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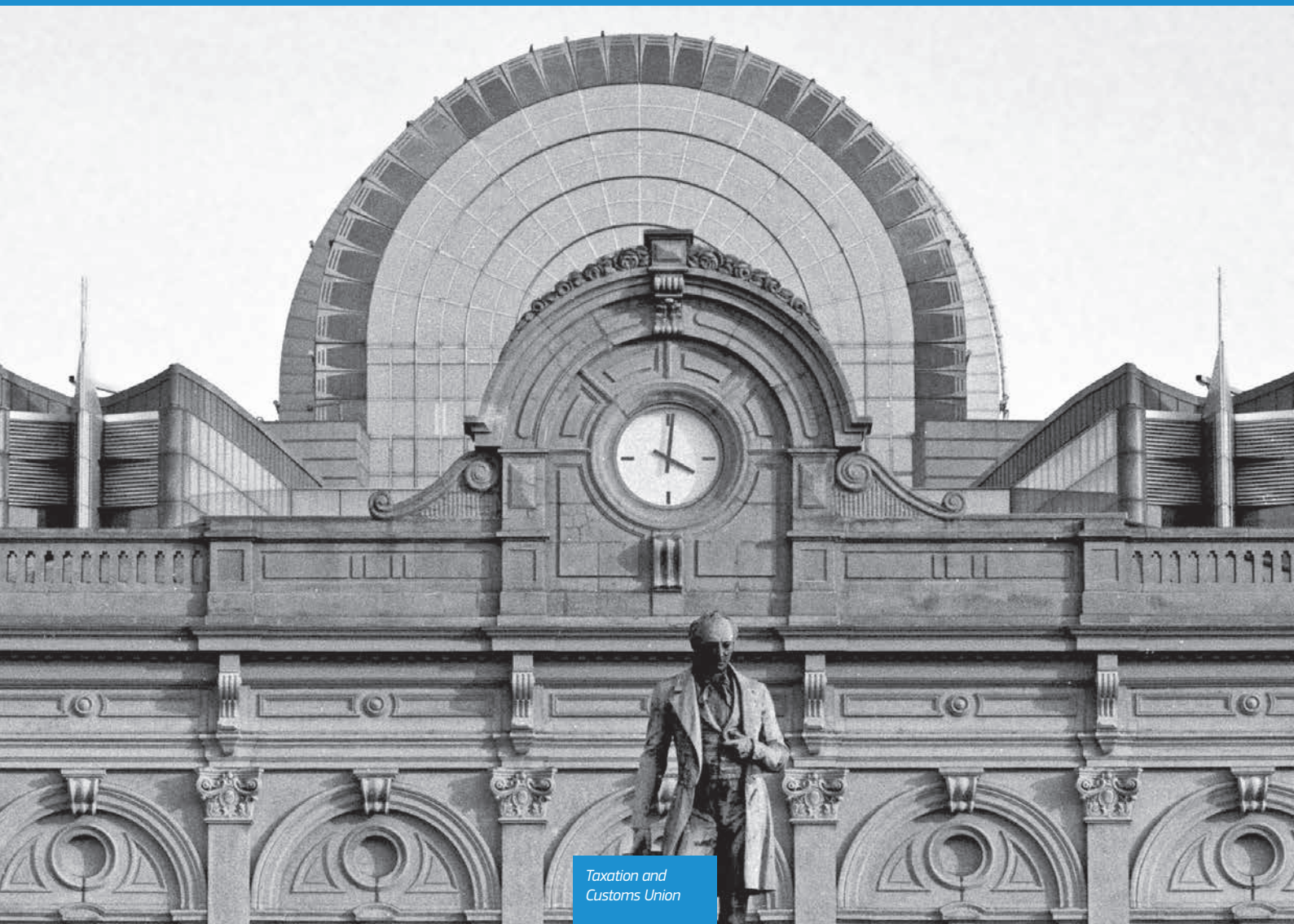
Final report



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European Commission

Study on the effects and incidence of labour taxation

Final Report

TAXUD/2014/DE/313

FWC No. TAXUD/2010/CC/104

IHS Institute for Advances Studies (Project leader)

CPB Netherlands Bureau for Economic Policy Analysis (Consortium leader)

In consortium with:

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Preface

This report has been prepared for the project "Study on the effects and incidence of labour taxation", Specific Contract No. TAXUD/2014/DE/313 implementing the Framework Service Contract No. TAXUD/2010/CC/104 for the provision of economic analysis in the area of taxation. We are grateful for the valuable feedback of the steering group and the external reviewers.

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List of abbreviations

ACAS	Advisory, Conciliation and Arbitration Service
AETR	Average effective tax rate
CES	Constant elasticity of substitution
CGE	Computable general equilibrium
DiD	Difference-in-differences
ECHP	European Community Household Panel
EET	Exempt contributions, exempt accumulations, taxed withdrawals
EITC	Earned income tax credit
EU	European Union
EU-SILC	European Union Statistics on Income and Living Conditions
EMU	European monetary union
ETI	Elasticity of taxable income
ICT	Information and communications technology
ICTWSS	Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts
IIP	Invariance of incidence proposition
ILO	International labour organization
ISCED	International standard classification of education
ITR	Implicit tax rate
LAF	LIME assessment framework
LIME	Lisbon Methodology Working Group
LIS	Luxembourg Income Study
LFS	Labour force survey
METR	Marginal effective tax rate
NAWRU	Non-accelerating wage rate of unemployment
NDC	Notional defined contribution
NEET rate	Neither in employment nor in education and training rate
OLG	Overlapping generations
PAYG	Pay-as-you-go
PIT	Personal income tax
SSC	Social security contributions
UI	Unemployment insurance
TEE	Taxed contributions, exempt accumulations, exempt withdrawals
VAT	Value added tax
WFTC	Working families' tax credit

Executive Summary

In the aftermath of the financial crisis most European countries are continuing to face employment problems. In a number of Member States government intervention has further resulted in increasing debt levels and high tax burdens overall and in particular on labour. Therefore well-targeted tax reforms seem to be in order to improve the labour market outcomes. It is often implicitly assumed that a decrease on the employee side, i.e. in the personal income tax rate or the employee part of social security contribution, leads to a higher labour supply. Similarly, a decrease in the employer labour taxes is often assumed to raise the demand of labour. However, the economic literature argues that in the presence of labour market imperfection economic incidence of a tax change is often different from the legal incidence. In this case the impact of a tax change on labour market outcomes depends on the interaction of the demand and the supply side of the market. This interaction is determined by the behavioural responses of economic operators, measured by elasticities. Higher (demand or supply) elasticities will cause larger responses to tax changes, with the relatively less elastic side bearing a higher tax burden. Against this background four main goals of this study emerge. First, is to identify from the literature which labour market imperfections result in employment problems and to attribute them to the labour supply or on the labour demand side. Given the heterogeneity in the labour market situation of different groups, we also set out to identify which socioeconomic groups are most vulnerable to employment problems. The next step is to review the literature which assesses the short-run and long-run economic incidence of labour taxation. To further break down the incidence into its underlying determinants we also review the literature on the (tax) elasticities of labour supply and labour demand. Then the literature on the influence of the economic environment on the tax incidence outcome, most notably the wage setting mechanisms and the institutional background, is reviewed. Finally the findings of the literature review are brought together in a framework of indicators to identify the potential of tax reforms to reduce tax related employment problems.

Labour demand and supply side reasons for unemployment

The study starts with a breakdown of employment problems into unemployment and non-employment. We argue that unemployment is more originating from the labour demand side and non-employment is more a labour supply side issue. This implies that cyclical unemployment can be attributed to the labour demand side, albeit only indirectly through the lack of aggregate demand which results in a lack of labour demand. It proves to be difficult to draw a clear line between cyclical and structural unemployment since unwinding of previously unsustainable situations, like necessary fiscal consolidation because of excessive public debt, can also result in longer term lack of aggregate demand.

A key part of structural unemployment is due to mismatches between labour demand and labour supply and therefore inherently difficult to attribute to one of the two labour market sides. We investigate how recent socio-economic changes like population ageing, falling fertility levels, increasing female labour force participation and increasing migration contribute to a change in labour supply and the composition

of the workforce. At the same time a probably even larger share of short to medium term unemployment can be attributed to broad changes in labour demand as a result of occupational and sectoral changes and structural changes in the workplace. These shifts increase the labour demand for certain skills while others become obsolete. This highlights to the necessity of indicators looking into changes in labour supply as well as labour demand and how these coincide. Such indicators can help to allocate the source of employment problems to either side of the labour market. At the same time, it is noteworthy that these indicators are also highlighting more fundamental structural problems in the labour market, which are not the result of labour taxation. Therefore tax reforms may not be the best way to address these issues.

The broad characterisation of employment problems further highlights the impact of wage rigidities in the labour market contributing to a labour demand problem. Also, incentive problems because of the tax and transfer system and the opportunity costs are key determinants of labour supply side problems.

Vulnerable groups in the labour market

Changes both in labour demand and labour supply leave some socio-economic groups at a vulnerable position in the labour market. First and foremost the low-skilled workers are facing a labour demand problem as a result of the sectoral shifts which substantially reduced the need for low-skilled workforce. Additionally the low-skilled are among those most affected by rigidities which prevent wages to adjust downwards. For example, binding minimum wages can result in a lack of labour demand for low-productivity low-skilled workforce. Given the relatively low wages of low-skilled people adverse incentives of the tax and transfer system can also result in a labour supply problem further adding to the employment problem.

Another vulnerable group in the labour market are the young people. Their perception as unstable employees who would leave an employer in order to gain more experience before they settle into a permanent role contributes to this problem. In addition, they usually have temporary, flexible contracts that do not secure their employment. Due to their lack of experience, they are also seen as less productive than the rest of the workforce. Consequently, youth unemployment can be largely attributed to a labour demand problem. Migrants, in particular those from non-European countries, face a similar situation in the labour market. Often their previous work experience and foreign education is not adequately valued by employers and therefore they are facing a labour demand problem. Furthermore, while the increase in migration can help to mitigate geographical mismatches, it also contributes to a relative fast change in labour supply. As a result there can be an oversupply of specific types of workers. While the situation of the elderly has been steadily improving during the last decade, they are still facing relevant employment problems. Due to population ageing the labour supply of elderly people is increasing. At the same time the labour demand is not keeping up, because the elderly are often perceived as people of lower productivity, who are not keen on investing in themselves, and who are unable to acquire new skills and adapt to rapid changes in the market. Currently, permanent contracts, which protect them from instant loss of employment, help them to maintain their employment level. However, once they lose their employment, it is difficult for them to become employed again, often due to a shrinking labour demand for their specific skills.

The role of women in the labour market has undergone a profound change, not least due to decades of initiatives and debates on this issue. The gender employment gap decreased significantly during the last decade and the labour market participation of women increased. Despite the achievements relevant disparities between the labour market attachment of women and men remain. To a large extent these differences are related to labour supply issues since women are still largely responsible for child care, care of elderly relatives and other non-market household activities. As a result the reconciliation between work and household activities often results in weaker labour market attachment for women. In terms of indicators this section suggests that the first step should be to break down the employment problems into its category. Separately looking at unemployment and non-employment will give a first impression as to on which side of the labour market the problems are located.

Survey of the labour tax incidence literature

A review of the literature on tax incidence of labour taxation shows that there is no clear consensus on who ultimately bears the burden of labour taxes. In a recent meta-analysis Melguizo and González-Páramo (2013) find that on average about two thirds of the incidence of labour taxes falls on workers. However, there is too much variation across different countries to view this result as a precise estimate. There are however a number of intermediate results which can be taken away from the survey of the literature.

Despite the absence of a clear answer to the tax incidence question, the literature still does indicate that there is some degree of sharing even in the long run. The second key finding is that the estimation of the long run tax incidence is struggling with identification issues. Further, up to our knowledge, there are no convincing studies available so far looking at medium-term effects or adjustment processes. Whether the legal incidence matters is also empirically unanswered, but the lack of clear evidence on the *invariance of incidence proposition* allows the tentative conclusion that the legal incidence matters at least in the short run.

There are differences in the tax incidence results across countries which can be at least partly attributed to the non-trivial role of centralisation of bargaining. The evidence is relatively robust that more centralised bargaining shifts the tax burden towards labour, while intermediate levels of coordination result in a partial shift of the tax incidence on employers.

Review of labour supply and labour demand elasticities literature

Following the argumentation of Metcalf (2002) the question of tax incidence can also be seen as a question of the relative elasticity of labour demand and labour supply. The review of these two strands of the literature allows some tentative conclusions. First, labour supply elasticities appear to be falling over time and recent meta-analyses place them around 0.4 to 0.3. The overall elasticity is driven to a very large extent through the extensive margin, whereas the elasticities at the intensive margin are close to zero. Furthermore recent studies, as discussed in Saez et al. (2012b), exploiting tax return data find that the elasticities at the intensive margin can mostly be attributed to reporting effects. The literature is also relatively clear as to how the elasticity at the extensive margin varies across different socioeconomic groups. Women and in particular single mothers have a more elastic labour supply. Men

typically have a higher labour supply elasticity at the extensive margin at the beginning or the end of the career when they face trade-offs with further education respectively early retirement.

Concerning the labour demand elasticities a recent meta-analysis by Lichter et al. (2014) suggests that the elasticities are increasing over time with a best guess of -0.3 as the average labour demand elasticity. The long-run elasticity is found to be higher, as well as higher labour demand elasticities are observable for fixed term contracts and low-skilled workers.

Framework of indicators

The review of the different strands of literature guides the development of a framework of 25 data indicators. These indicators are then evaluated in a simple framework to break down the employment problems and to gain further understanding which tax reform have the potential to improve the labour market outcome.

From the initial classification of employment problem we derive the first set of indicators which breaks down the employment problem into non-employment, unemployment and structural unemployment. Following the discussion about the vulnerable groups we dissect the unemployment and non-participation among socio-economic groups. The contribution of labour supply and demand mismatches is taken into account through skill and sectoral mismatch indicators. The labour supply side contribution to the mismatches is additionally accounted for through sectoral and skill change indicators.

The most important conclusion from survey of the tax incidence literature is that legal tax incidence likely to matter. This demands a more detailed look at the composition of the tax burden on labour. To this end we include measures of the implicit tax burden as well as statutory tax measures for personal income tax, social security contributions of both employers and employees

The review of the labour supply literature reinforced the importance of distinguishing between different socio-economic groups. Additionally, labour supply is more responsive at the extensive margin, especially for the young who face a trade-off between work and education and for mothers who face a trade-off between work and child care and home production. This highlights that aspects of the welfare state can alter the work incentives.

Among the wage settings institutions the role of wage bargaining is once more stressed, with a more centralised bargaining resulting in more incidence on workers than bargaining at the industry level. Furthermore minimum wages will affect the labour market outcome. In case they are binding the incidence result is clear, with the incidence fully falling on the employers. However, even in the case of non-binding minimum wages the literature suggests that they contribute to labour tax induced employment problems.

Theoretical results suggest that the progressivity of the personal income tax affects the labour market outcome in the presence of matching inefficiencies. For a given tax burden a more progressive tax system will reduce the search effort of unemployed people because a higher part of the additional match-specific rent will be taxed away.

Similarly the incentive to pay efficiency wages above the market clearing wage rate is reduced in progressive tax system. Despite the lack of conclusive evidence for these theories so far, we therefore will also include progressivity measures in our framework of indicators.

A review of the impact of welfare state on labour supply stresses the importance of measures of unemployment or participation trap. The withdrawal of cash benefits or transfers in-kind can create adverse incentive problems which can translate into employment problems through the labour supply side. Another important aspect affecting especially female labour supply is the availability of part-time work and possibility of parental or maternity leave.

Country examples for Austria, Italy and Spain

The last section uses the developed framework of indicators for Austria, Spain and Italy. Despite the common feature of a comparatively high tax burden on labour, the labour market outcomes in these three countries differ widely. Austria has a low level of unemployment and a slightly above average participation rate. Italy has an unemployment rate somewhat above average but also one of the lowest participation rates. Spain in contrast has a very high unemployment rate but an above average participation rate.

Broadly speaking our framework of indicators suggest that there seems to be a strong labour demand problem in Spain and a moderate labour demand and labour supply problem in Italy. Taking into account cyclical aspects of the unemployment rate confirms that at least part of the labour demand problem in Spain and Italy is due to business cycle reasons.

Despite an increase in female labour force participation Italy still faces a labour supply problem here. The participation rate of elderly has been increasing steadily in all three countries, but while in Austria this did not increase the unemployment rate, the unemployment rate rose since 2007 in Italy and Spain. Especially for the latter this indicates a labour demand problem for the elderly. We find high youth unemployment in both Italy and Spain. The constantly dropping participation rate in Italy points in addition to the apparent labour demand problem also to a labour supply issue. Unemployment rates for foreigners and low-skilled workers have increased dramatically in Spain since the crisis in 2007. This indicates a labour demand problem for these groups.

The mismatch and change indicators identify a strong sectoral change and an increasing skill mismatch as labour demand side sources of the employment problems for Spain. For Austria and Italy there seems to be relevant regional variation in the level of unemployment, but the development is not clearly identifying whether the regional mismatch is contributing to the employment problems.

The general fiscal situation in all three countries is such that all of them are struggling with increasing debt levels and persistent deficits. Further all three countries have a high implicit tax rate on labour relative to the implicit tax rate on consumption. Dissecting the tax burden of labour into its components one finds that social security contributions of employees make up a large part of the tax burden on labour in Austria. In Spain and Italy the social security contributions of employers make up a bigger share of the tax burden. This is also reflected in a high statutory total tax

wedge for an average workers income. Contrasting this with our measure of the statutory progressivity one finds that Austria and Spain have clearly regressive SSC for both employers and employees. According to predictions from the theoretical literature a less progressive tax burden should - for a given tax burden – result in more unemployment. This argument should be even strong since the tax burden in question is levied on the employers' side. Hence the statutory structure of the tax burden indicates a contribution of labour taxation to demand side problems, especially for Austria and Spain. The high statutory tax burden in Italy will also contribute to the labour demand problem.

In Italy the wage bargaining at the industry level is expected to result in shifting the tax incidence only partially to labour further contributing to the labour demand problem. A more – but not fully – centralized wage bargaining in Austria and Spain should result in more tax burden shifted to workers and therefore reduce the labour employment effects of the high tax labour burden. Additionally the link between the social security contributions should contribute to the tax incidence of employees' social security contribution falling on labour. Hence a tentative conclusion from our country examples could be that Italy should envisage a reform which reduces the employers' social security contributions. For Austria and Spain the prediction from the tax incidence literature indicates that the tax burden of either side of the social security contributions should fall on the workers, at least in the longer run. Therefore a planned reduction in the tax burden could be directed to either side. Any reform of the social security contributions should maintain the link between the contributions and the entitlements which further strengthens the shift of the incidence on labour. With the incidence more likely to fall on labour in Austria or Spain, tax reforms have less scope to reduce the labour demand problems, such as the one cause through the sectoral shift in Spain. Nevertheless, the increase in net disposable income should at least help to reduce the cyclical component of the employment problem in Spain.

Résumé

Bien après la crise financière, la plupart des pays européens continuent d'être confrontés à des problèmes sur le marché de l'emploi. Dans un certain nombre de pays membres de l'Union Européenne, les interventions de l'Etat ont par ailleurs mené à une hausse de la dette publique et à des taux d'impositions globalement élevés, en particulier sur le facteur travail. Des réformes fiscales ciblées peuvent en conséquence être appropriées pour améliorer le fonctionnement et les performances du marché du travail. Une hypothèse fréquente est qu'une baisse de l'imposition du côté des employés, c'est-à-dire une baisse des impôts sur le revenu ou des cotisations sociales payées par les ménages, engendre une hausse de l'offre sur le marché du travail. De manière symétrique, une baisse de la charge fiscale et des charges sociales sur les entreprises est censée augmenter la demande sur ce marché. Cependant, la littérature économique scientifique attire l'attention sur le fait que l'incidence économique d'une charge fiscale est souvent différente de son incidence juridique, en présence d'imperfections sur le marché du travail. Dans ce cas, l'impact d'une réforme fiscale sur les performances du marché du travail dépend des interactions entre offre et demande sur ce marché. Ces interactions sont déterminées par les changements de comportement des agents économiques et mesurées par des élasticités. Une plus grande élasticité, du côté de la demande ou de l'offre, donne un impact plus fort aux réformes fiscales, le côté le moins élastique du marché portant une plus grande part de la charge fiscale. Etant donné ce contexte, cette étude comporte quatre objectifs principaux. Le premier est l'identification des imperfections du marché du travail qui mènent à des problèmes d'emploi et leur attribution soit à l'offre soit à la demande de travail, basée sur une analyse de la littérature scientifique. Comme la situation des différentes catégories de personnes sur le marché du travail est hétérogène, nous identifions par ailleurs les catégories socio-professionnelles les plus vulnérables aux problèmes sur ce marché. La deuxième étape est une revue de la littérature qui évalue l'incidence économique de la fiscalité du travail à court et long terme. Pour connaître les déterminants de l'incidence de la fiscalité du travail, nous réalisons également une revue de la littérature qui s'attèle aux élasticités (fiscales) de l'offre et la demande de travail. En troisième lieu, nous passons en revue la littérature qui étudie l'influence de l'environnement économique sur l'incidence de la fiscalité, en particulier les mécanismes de fixation des salaires et l'environnement institutionnel. Pour finir, les conclusions que nous dérivons de la revue de la littérature sont amalgamées en un cadre d'analyse basé sur des indicateurs, qui permet d'identifier le potentiel des réformes fiscales pour réduire les problèmes du marché de l'emploi liés à la fiscalité.

Facteurs de chômage liés à l'offre et la demande de travail

L'étude commence par séparer les problèmes du marché du travail entre chômage et non-emploi. Nous présentons l'argumentation selon laquelle le chômage tient en majeure partie sa source du côté de la demande sur le marché du travail tandis que le non-emploi est principalement une question d'offre sur ce marché. A titre de conséquence, le chômage conjoncturel peut être attribué à un problème de demande sur le marché du travail, même si cela se produit de manière indirecte par l'intermédiaire d'une faiblesse de la demande globale et, partant, de la demande de

main-d'œuvre. Dans ce contexte, il s'avère difficile de séparer clairement chômage conjoncturel et chômage structurel, dans la mesure où les conséquences d'une situation fiscale intenable, nécessitant par exemple un programme d'austérité, peuvent également comprendre une baisse de la demande globale sur le long terme.

Un élément clef du chômage structurel est la présence d'inadéquations entre demande et offre de travail. Il est par conséquent difficile d'attribuer le chômage structurel à l'une ou l'autre des parties prenantes sur le marché du travail. Nous analysons de quelle façon des changements socio-économiques récents – comme le vieillissement de la population, le déclin de la fertilité, l'accroissement de la participation des femmes sur le marché du travail ou encore l'augmentation de l'immigration – influencent les changements d'offre et de composition de la main-d'œuvre. Dans le même temps, une proportion probablement plus large du chômage de moyen et long terme peut être attribuée à des changements d'envergure dans la demande de main-d'œuvre, résultants d'évolutions au niveau des occupations et des secteurs ainsi que de changements structurels du milieu de travail. Ces évolutions augmentent la demande pour certaines compétences, tandis que d'autres compétences deviennent obsolètes. Cela souligne l'importance d'indicateurs qui prennent en compte tant les changements de l'offre que de la demande de travail, et la manière dont ces changements coïncident. De tels indicateurs aident à l'attribution des causes des problèmes du marché du travail à l'une ou l'autre des parties prenantes sur ce marché. Ces indicateurs soulignent par ailleurs des problèmes structurels fondamentaux du marché du travail qui ne sont pas la conséquence de la fiscalité du travail. Les réformes fiscales ne sont par conséquent pas forcément la meilleure façon de résorber les problèmes du marché de l'emploi.

L'analyse générale des problématiques de marché de l'emploi souligne par ailleurs l'impact de la rigidité des salaires et leur contribution à un problème de demande sur le marché du travail. Finalement, les problèmes d'incitations que génère le système fiscal et de transfert, ainsi que les coûts d'opportunités, sont des déterminants importants des problèmes d'offre de main-d'œuvre.

Groupes vulnérables sur le marché du travail

Les changements à la fois dans la demande et l'offre de travail laissent certaines catégories socio-économiques dans une position vulnérable sur le marché du travail. D'abord et avant tout les travailleurs à faible niveau de qualification sont confrontés à des problèmes de faible demande, des transformations sectorielles réduisant la demande pour la main-d'œuvre à faible qualification. Cette même catégorie de travailleurs est par ailleurs celle qui est parmi la plus affectée par les rigidités qui empêchent les ajustements par le bas des salaires. Par exemple, un salaire minimal contraignant peut aboutir à une absence de demande pour de la main-d'œuvre à faible productivité nécessitant un faible niveau de qualification. Etant donné les salaires relativement peu élevés de cette main-d'œuvre, les impacts incitatifs négatifs du système de transferts et d'impôts peuvent par ailleurs conduire à un problème d'offre de main-d'œuvre, ce qui ajoute une dimension au problème de faible emploi de cette catégorie de socio-économiques.

Les jeunes sont un autre groupe vulnérable sur le marché du travail. Un problème est le fait qu'ils soient perçus comme étant instables, prêts à quitter leur employeur dès qu'une opportunité de gagner plus d'expérience se manifeste, avant de se stabiliser

dans une occupation permanente. Ils ont par ailleurs souvent des contrats flexibles et temporaires qui ne leur garantit pas une activité professionnelle sur la durée. En raison de leur manque d'expérience, ils sont également vus comme étant moins productifs que le reste de la main-d'œuvre. Le problème du chômage des jeunes peut par conséquent être largement attribué à un problème de demande sur le marché du travail. Les immigrants, en particulier ceux venant de pays non-européens, sont confrontés à une situation similaire sur le marché du travail. Leur éducation et expérience professionnelle préalable, acquises à l'étranger, n'est souvent pas reconnue de manière adéquate par les employeurs, de sorte que les immigrants soient confrontés à un problème de demande sur le marché du travail. De plus, si l'augmentation des flux d'immigration permet de réduire les problèmes de disparités géographiques, elle contribue également à un changement relativement rapide de l'offre de main-d'œuvre. Une résultante potentielle est un excédent de certains types de travailleurs. Bien que la situation des personnes âgées se soit améliorée de manière régulière durant la dernière décennie, elles sont toujours confrontées à certaines difficultés sur le marché de l'emploi. En raison du vieillissement de la population, l'offre de travailleurs âgés est croissante. Dans le même temps, la demande pour ces travailleurs ne suit pas, en raison de la perception fréquente que ces travailleurs sont de plus faible productivité, qu'ils sont peu intéressés à investir dans leur développement et incapables d'acquérir de nouvelles compétences ni de suivre les changements rapides du marché. A l'heure actuelle, les contrats à durée indéterminée, qui les protègent contre les pertes immédiates d'emplois, contribuent à maintenir leur taux d'emploi. Cependant, il leur est difficile de retrouver un emploi s'ils se trouvent au chômage, souvent en raison d'une baisse de la demande pour leurs compétences.

Le rôle des femmes sur le marché du travail s'est transformé de manière profonde, en particulier en raison des initiatives et des débats sur ce sujet qui ont eu lieu sur plusieurs décennies. L'écart entre taux d'emploi des femmes et des hommes s'est encore réduit de manière significative ces dix dernières années et le taux de participation des femmes sur le marché du travail a encore augmenté. Malgré ces accomplissements, il reste une disparité entre participation des femmes et des hommes. Pour une grande part, cette disparité est due à des problématiques d'offre de main-d'œuvre, dans la mesure où les femmes restent largement en charge de la garde des enfants, de celles des personnes âgées de la famille ou d'autres activités non marchandes du ménage. L'équilibre entre activité professionnelle et activités du ménage débouche donc souvent sur une participation au marché du travail plus faible pour les femmes. En termes d'indicateurs, cette section suggère que la première étape soit une séparation des problématiques du marché de l'emploi. Considérer de manière séparée chômage et non-emploi doit fournir une première impression sur la partie du marché du travail, offre ou demande, qui recèle les plus grands problèmes.

Revue de la littérature sur l'incidence de la fiscalité du travail

L'analyse de la littérature sur l'incidence de la fiscalité du travail révèle une absence de consensus sur qui, de l'employé ou de l'employeur, porte la charge fiscale. Dans une méta-analyse récente, Melguizo et González-Páramo (2013) parviennent à la conclusion qu'en moyenne deux tiers de la charge fiscale liée au travail est portée par les employés. Cependant, la variation d'un pays à l'autre est trop grande pour que

cette estimation soit considérée comme précise. Il est néanmoins possible de dériver un certain nombre de résultats intermédiaires de la revue de la littérature.

Malgré l'absence d'une réponse claire sur la question de l'incidence fiscale, la littérature indique toutefois qu'il y a un degré de partage de la charge fiscale, sur le court et le long terme. La deuxième conclusion majeure est que l'estimation de l'incidence fiscale sur le long terme n'arrive pas à traiter facilement les problématiques d'identification statistique. A notre connaissance, il n'existe pas à l'heure actuelle d'étude convaincante sur les effets à moyen terme ni sur les processus d'ajustements. La question de savoir si l'incidence juridique joue un rôle ou non demeure également sans véritable réponse empirique. L'absence de preuve empirique ferme sur la proposition d'invariance de l'incidence fournit une conclusion provisoire, à savoir que l'incidence juridique joue un rôle, au moins sur le court terme.

Les résultats sur l'incidence fiscale varient d'un pays à l'autre. Une partie de la différence de ces résultats peut être attribuée au rôle non-négligeable de la centralisation dans le processus de négociation entre acteurs du marché du travail. Les analyses empiriques montrent de manière relativement robuste qu'un plus grand degré de centralisation fait porter une plus grande partie de la charge fiscale sur l'employé, tandis que des niveaux intermédiaires de coordination mènent à faire porter une plus grande partie de la charge fiscale sur l'employeur.

Revue de la littérature sur les élasticités de l'offre et de la demande de travail

En suivant l'argumentation de Metcalf (2002), la question de l'incidence fiscale peut aussi être vue comme la question des élasticités relatives de l'offre et de la demande sur le marché du travail. L'analyse des deux parties correspondantes de la littérature permet de former quelques conclusions provisoires. Premièrement, les élasticités concernant l'offre de main-d'œuvre apparaissent déclinantes au cours du temps. Des méta-analyses récentes les situent aux alentours de 0.3 à 0.4. L'élasticité totale est définie pour une large part par la marge extensive, tandis que les élasticités à la marge intensive sont proches de zéro. De plus, les études récentes analysées par Saez et al. (2012b) et qui exploitent des données de déclaration fiscale parviennent à la conclusion que les élasticités à la marge intensive sont surtout dues à des effets de déclaration. La littérature est également assez claire sur les différences d'élasticités à la marge extensive d'un groupe socio-économique à l'autre. Les femmes, et en particulier les mères élevant leurs enfants seules, offrent leur travail de manière plus élastique. Les hommes offrent en général leur travail de manière plus élastique à la marge extensive au début et à la fin de leur carrière, périodes de leur vie pendant lesquelles ils sont confrontés à un choix entre travail et éducation, respectivement retraite précoce.

En ce qui concerne les élasticités de demande de main-d'œuvre, une méta-analyse récente réalisée par Lichter et al. (2014) suggère que les élasticités augmentent au cours du temps, une élasticité moyenne de -0.3 représentant la valeur la plus probable pour les auteurs de l'analyse. Des valeurs plus élevées sont trouvées pour l'élasticité sur le long terme, les contrats à durée déterminée ainsi que pour la main-d'œuvre faiblement qualifiée.

Cadre d'analyse à base d'indicateurs

La revue des différentes branches de la littérature fournit un guide pour le développement d'un cadre de 25 indicateurs basés sur des données. Ces indicateurs sont rassemblés dans un cadre simple et utilisés pour différencier les problèmes rencontrés sur le marché de l'emploi et pour développer notre compréhension sur la capacité des réformes fiscales à améliorer le fonctionnement du marché de l'emploi.

A partir de la classification initiale des problèmes du marché de l'emploi, nous dérivons un premier ensemble d'indicateurs pour établir une séparation de ces problèmes entre non-emploi, chômage et chômage structurel. En nous basant sur la discussion des groupes vulnérables sur le marché du travail, nous établissons une séparation entre chômage et non-participation pour chaque catégorie socio-économique. L'impact des inadéquations entre demande et offre de travail est pris en compte par des indicateurs sur les inadéquations de compétence et de secteur. La responsabilité de l'offre de main-d'œuvre dans les inadéquations est de plus prise en compte par des indicateurs de changements dans les secteurs et les compétences.

La conclusion la plus importante d'une revue de la littérature sur l'incidence fiscale est que l'incidence juridique joue un rôle probable. Cela requiert un examen plus détaillé de la composition de la charge fiscale liée au travail. A cette fin nous incluons des mesures de la charge fiscale implicite, des mesures sur les taux d'imposition légaux pour l'imposition des personnes et pour les contributions sociales tant des employeurs que des employés.

L'analyse de la littérature sur l'offre de main-d'œuvre renforce l'importance d'indicateurs qui fassent une distinction entre groupes socio-économiques. Par ailleurs, l'offre de main-d'œuvre est plus élastique à la marge extensive, en particulier pour les jeunes qui sont confrontés à un choix entre travail et éducation ainsi que pour les mères, confrontées à un choix entre travail et production domestique. Cela souligne le rôle des politiques publiques de l'état, qui peuvent modifier les incitations à travailler.

Parmi les institutions qui influencent la fixation des salaires, le rôle de la négociation salariale est encore une fois souligné, un mécanisme centralisé conduisant à une charge fiscale plus forte pour les employés qu'avec des négociations au niveau des secteurs. Des salaires minimaux vont par ailleurs influencer les résultats sur le marché du travail. Dans le cas où ils sont contraignants, l'incidence fiscale est claire et repose uniquement sur l'employeur. Même dans le cas où ils ne sont pas contraignants, la littérature suggère de plus que les salaires minimaux contribuent aux problèmes sur le marché du travail dus à la fiscalité du travail.

Les résultats théoriques suggèrent que l'imposition progressive des revenus des personnes a un impact sur le marché du travail, lorsque l'efficacité de celui-ci est pénalisée par la présence d'inadéquations. Pour un niveau de charge fiscale donné, un système fiscal plus progressif diminue les efforts de recherche de travail des personnes au chômage parce qu'une plus grande part du gain monétaire généré en cas d'obtention d'un emploi est perdue sous forme d'impôts. De manière similaire, les incitations à payer des salaires d'efficiences supérieurs au seuil d'équilibre entre offre et demande sont diminuées en présence d'un système fiscal progressif. Malgré l'absence de validation empirique robuste de ces théories, nous incluons tout de même des mesures de progressivité du système fiscal parmi les indicateurs.

Une analyse de la littérature sur l'impact des systèmes de sécurité sociale sur l'offre de main-d'œuvre souligne l'importance de mesures liées au chômage et au « piège de participation ». La réception d'allocations sociales en espèces ou en nature peut créer des incitations négatives, lesquelles peuvent se transformer en problèmes d'offre de main-d'œuvre et au final, d'emploi. Un autre aspect particulièrement important pour l'offre de main-d'œuvre des femmes est la disponibilité d'emplois à temps partiel et la possibilité de congés de maternité ou de congés parentaux.

L'exemple de l'Autriche, de l'Espagne et de l'Italie

Cette dernière section utilise les indicateurs du cadre d'analyse pour l'Autriche, l'Espagne et l'Italie. Malgré le fait que ces pays aient tous une charge fiscale sur le travail comparativement élevée, l'état du marché du travail dans ces trois pays diffère fortement. L'Autriche a un taux de chômage bas et le taux de participation est légèrement au-dessus de la moyenne. L'Italie a un taux de chômage quelque peu au-dessus de la moyenne mais également un des taux de participation les plus faibles. L'Espagne, par contraste, a un taux de chômage très élevé ainsi qu'un taux de participation plus large que la moyenne.

En termes généraux, notre cadre d'analyse suggère un problème important de demande de main-d'œuvre en Espagne ainsi que des problèmes modérés d'offre et de demande de travail en Italie. Tenir compte des aspects cycliques du taux de chômage confirme l'hypothèse qu'une partie des problèmes de demande de main-d'œuvre en Italie et en Espagne soit conjoncturelle.

Malgré l'augmentation de la participation des femmes sur le marché du travail en Italie, le pays continue d'être confronté à des problèmes d'offre de main-d'œuvre. Le taux de participation des personnes âgées s'est élevé de manière continue dans les trois pays. Alors que cette augmentation n'a pas été accompagnée d'une augmentation du taux de chômage en Autriche, ce n'est pas le cas pour l'Espagne et l'Italie, où le taux de chômage s'est accru depuis 2007. En particulier pour l'Espagne, ces transformations mettent en évidence un problème de demande de main-d'œuvre pour les travailleurs âgés. Le problème du chômage des jeunes se retrouve aussi bien en Espagne qu'en Italie. En plus d'un problème de demande de main-d'œuvre, la diminution régulière du taux de participation des jeunes en Italie suggère la présence d'un problème d'offre pour cette catégorie de la population. Le taux de chômage des étrangers et des personnes à faible qualification s'est accru de manière dramatique en Espagne depuis la crise de 2007, ce qui indique un problème de demande sur le marché du travail pour ces groupes.

Les indicateurs d'inadéquations de compétence, secteur et de changement permettent d'identifier en Espagne de forts changements sectoriels ainsi qu'une augmentation des inadéquations de compétences, tous deux attribuant à la demande de main-d'œuvre la source des problèmes sur le marché de l'emploi. Aussi bien en Autriche qu'en Italie, on observe une variation du niveau de chômage d'une région à une autre, mais leur développement ne permet pas de conclure clairement que la disparité régionale contribue aux problèmes du marché de l'emploi.

La situation fiscale générale dans chacun des trois pays est difficile, tous étant confrontés à des dettes publiques croissantes et des déficits persistants. Les trois pays ont par ailleurs un taux implicite d'imposition du travail qui est supérieur aux taux

implicite sur la consommation. Décomposant la charge fiscale sur le travail en Autriche montre que les cotisations sociales des employés constituent une grande part de la charge totale. En Espagne et en Italie, les cotisations sociales des employeurs représentent la plus grande part de la charge fiscale. Ces conclusions sont également reflétées par des hautes valeurs des taux d'impositions légaux totaux pour un revenu de travailler moyen. Par contraste, utilisant notre mesure de progressivité de l'imposition légale, il s'avère que le système de cotisations sociales est clairement régressif en Autriche et en Espagne, aussi bien pour les cotisations des employés que pour celles des employeurs. Selon la littérature théorique, un système de taxation moins progressif doit, à charge fiscale équivalente, résulter en un taux de chômage plus élevé. Ces prédictions sont encore renforcées par le fait que la charge fiscale est collectée du côté des employeurs. Il apparaît ainsi de la structure légale de l'imposition que la fiscalité du travail contribue aux problèmes de demande de main-d'œuvre, en particulier pour l'Autriche et pour l'Espagne. Le taux d'imposition légal élevé en Italie doit par ailleurs également contribuer aux problèmes de demande de main-d'œuvre.

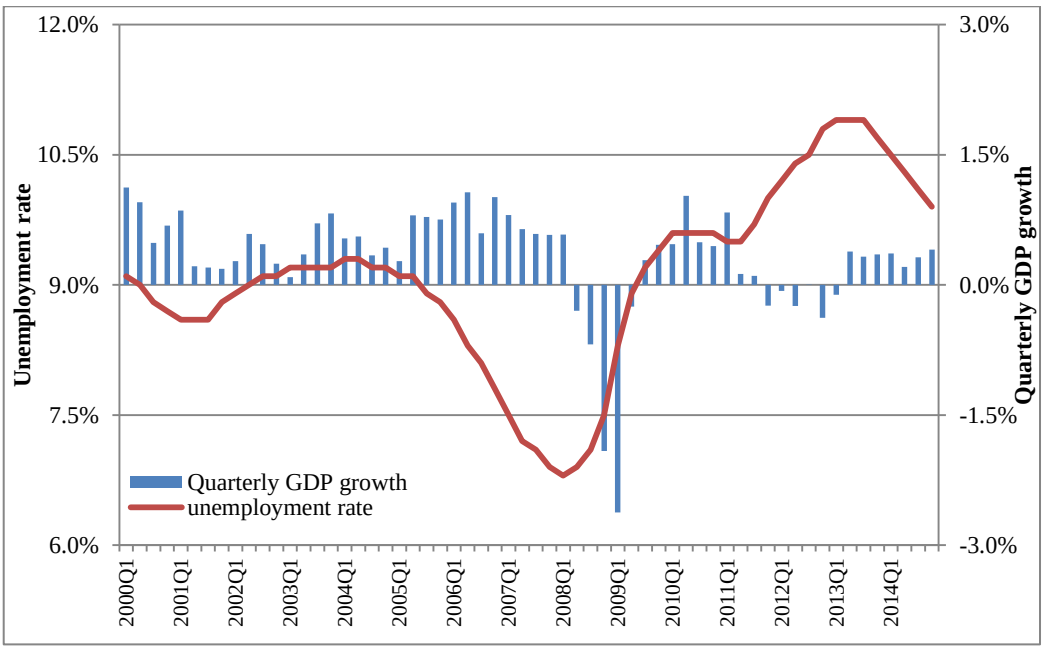
En Italie, le fait que la négociation salariale se situe au niveau des secteurs doit placer une plus grande partie de l'incidence fiscale sur les employeurs, ce qui doit contribuer aux problèmes de demande de main-d'œuvre. Un mécanisme de négociation plus centralisé en Autriche et en Espagne, sans toutefois être complètement central, doit conduire à placer une plus grande partie de la charge fiscale sur les employés, réduisant les effets d'une taxation élevée sur l'emploi. De plus, le lien entre cotisations sociales devrait aussi contribuer à ce que la charge des cotisations sociales des employés soit portée par le travail. Une conclusion possible de notre analyse de ces trois pays est que l'Italie pourrait faire une réforme visant à réduire les cotisations sociales des employeurs. Pour l'Autriche et l'Espagne, les prévisions de la littérature sur l'incidence fiscale suggèrent que la charge fiscale émanant des cotisations sociales à la fois des employés et des employeurs repose sur les épaules des employés, du moins sur le long terme. Une réduction planifiée de la charge fiscale de l'une ou l'autre des parties pourrait par conséquent être envisagée. Toute réforme du système de cotisations sociales doit maintenir le lien entre contributions et prestations, ce qui affermit le transfert de la charge sur le travail. L'incidence fiscale reposant moins sur les épaules des employés en Autriche et en Espagne, les réformes fiscales dans ces pays ont moins de chance de réduire les problèmes de demande de main-d'œuvre, tel que celui qui est créé par les changements sectoriels en Espagne. Toutefois, l'accroissement du revenu disponible net devrait aider à la réduction des problèmes conjoncturels d'emploi en Espagne.

1. Introduction

1.1. Background

The sharp recession as a result of the financial crisis in 2008 and the sluggish recovery has strongly increased the level of unemployment in the European Union. Figure 1 highlights the development and the relationship between the quarterly GDP growth and the unemployment rate in the EU 28 countries. Following a period of solid growth in 2006 and 2007 the unemployment rate sunk to 6.8 % in the first quarter of 2008. The sharp recession caused an increase of the unemployment rate up to 9.6 % in the first quarter of 2010.

Figure 1: GDP growth and unemployment in the EU 28, 2000-2014

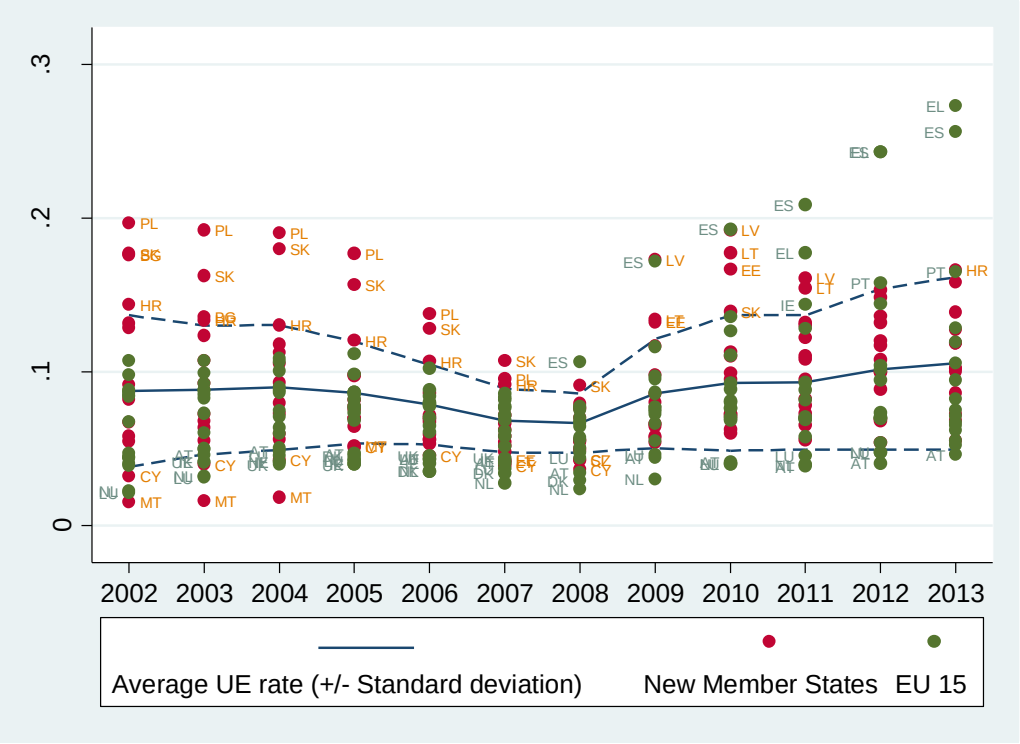


Source: AMECO and Eurostat, own illustration.

However, the economic recovery in 2010 was not strong enough to reduce the level of unemployment and the next recession in 2012 and 2013 further increased the unemployment rate to 10.9 % in the third quarter of 2013. Only over the course the last year there has been a slow improvement in the European labour market.

Figure 2 goes beyond the weighted average of the unemployment rate and highlights the fact that the labour markets in the Member States have been affected by the recession to a varying degree. In 2002 it was the new Member States who had high unemployment rates, most notably Poland and the Slovak Republic. Until the 2008 the unemployment rates in the EU converged, owed to a large degree of a much better labour market outcome in the new Member States. Starting with the recession in 2008 the unemployment rate increased in most countries, but while the increase was moderate for some countries, in Spain and Greece the unemployment rate continued to rise at a fast pace. In 2013 the unemployment rate in Greece was at 27.3 % and in Spain a 25.6 %. At the other end of the spectrum the unemployment rate in 2013 was still only at 4.6 % in Austria and at 5.2 % in Germany.

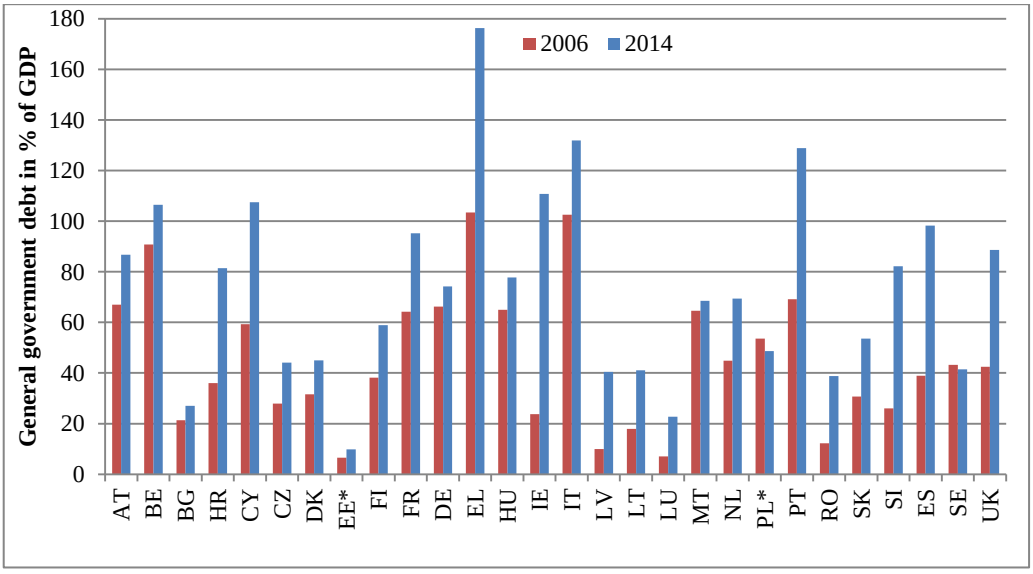
Figure 2: Unemployment rates in EU 28 Member States 2002-2013



Source: Labour force survey, own illustration.

The sharp recession has not only left its mark on the labour market, but also significantly increased the debt level in most European countries. Figure 3 compares the pre-financial crisis debt level in 2006 to the current debt level in 2014. With the exception of Sweden all countries have now a higher debt level than before the crisis. The increase is most dramatic for countries which were hardest hit by the recession, i.e. Ireland, Cyprus and for the countries in southern Europe which continue to struggle with the aftermath of the crisis like Italy, Spain, Greece and Portugal. In sum the figures illustrate the difficult situation in Europe with most European countries struggling with historically high levels of unemployment and large public debts. The currently fragile economic recovery makes the challenge for fiscal consolidation particularly difficult and highlights the necessity of well-targeted reforms even more. In that context the European Semester (European Commission, 2013a) has amongst others identified the tax system as an important area for growth promoting reforms. Following the ranking of growth-friendly tax structures by the OECD (see Johansson et al., 2008) the broad consensus is on a shift from labour taxation towards consumption taxation and recurrent taxes on immovable property. Using an indicator based approach a tax reform report by the European Commission (2013b) finds that around a third of the Member States have a potential need for reducing labour taxation. The European Semester translates this into country specific recommendations to cut labour taxation for nine Member States. However, until now the recommendation is not specific as to whether the cuts shall be on the employee or firm side.

Figure 3: Debt levels in the EU 28 Member States 2006 and 2014



Notes: * For Estonia and Poland the value for the debt level in 2006 is not available, instead the value of 2010 is used.

Source: AMECO database, own illustration.

It is often implicitly assumed that a decrease on the employee side, i.e. in the personal income tax rate or the employee part of social security contribution, leads to a higher labour supply. Similarly, a decrease in the employer labour taxes is often assumed to raise the demand of labour. In both cases, the goal of such policies is generally to improve labour market outcomes and reduce unemployment. However, it is well established in the literature that the economic incidence of a tax change is often different from the legal incidence. Fullerton and Metcalf (2002) review the literature on the incidence of different aspects of taxation and Metcalf (2006) summarises that the impact of a tax change on labour market outcomes depends on the interaction of the demand and the supply side of the market. This interaction is determined by the behavioural responses of economic operators, measured by elasticities. Higher (demand or supply) elasticities will cause larger responses to tax changes, with the relatively less elastic side bearing a higher tax burden.

While in the absence of labour market imperfections the legal incidence has no long run influence on labour market outcomes, it has been highlighted by Symons and Robertson (1990) that short-run effects might differ substantially. Furthermore wage rigidities due to minimum wages and institutional settings will affect both the incidence and the employment outcome of social security contributions and labour taxation.[1] For example, Gruber (1997) shows, that the strength of the link between the labour taxes (social security contributions) and the benefits received by the workers, strongly affects the incidence both in the short run and in the long run.

Against this background the four tasks below emerge. First, it is important to identify **employment problems** due to labour market imperfections, and whether these

[1] See e.g. Picard and Toulemonde (1999) and Econpubblica (2011).

problems originate more on the **labour supply** or on the **labour demand side**. The next step is to review the literature which assesses the **short-run and long-run economic incidence** of labour taxation. To further break down the incidence into its underlying determinants we also review the literature on the (tax) elasticities of labour supply and labour demand. Then the literature on the influence of the economic environment on the tax incidence outcome, most notably the **wage setting mechanisms and the institutional background**, is reviewed. Finally the findings of the literature review are brought together in a **framework to identify the potential of tax reforms to reduce tax related employment problems**.

1.2. Objective and tasks

The specific tasks of the study are structured along the tasks stated in the terms of reference and include:

- a review of the economic literature on the identification of labour demand and labour supply as source of employment problems;
- a review of the economic literature on short-term and long-term tax incidence on labour;
- a review of the economic literature on how the different labour market institutions/regulations (employment protection legislation, unemployment benefits, minimum wage, wage setting institutions and trade unions etc.) influence the incidence and effects of labour taxation on employment outcomes, also across various categories of workers such as e.g. the low-skilled, women the young and older workers;
- from the above analysis a framework to identify when employment problems are tax-related and the estimated efficiency of tax measures to fix these problems.

2. Review of the sources of employment problems

It is beyond the scope of this study to exhaustively cover all the literature on employment problems.[2] Rather than trying to do so, we aim for a general overview, which will guide us in the development of indicators. Based on the idea, that in the presence of labour market imperfections, the effectiveness of labour tax cuts in increasing employment could be improved by directing reductions towards the side of the market which is the source of employment problems, the focus of this overview is therefore the question whether the sources of the employment problems can be attributed to mainly the labour demand or the labour supply side.

2.1. A broad characterisation of employment problems

Before we set out to review the literature on the sources of employment problems, it is useful to broadly classify and describe what we intend to capture with the term employment problems. Table 1 provides a summary of our classification of employment problems and their main sources. We broadly distinguish between unemployment, and under- and non-employment, also referred to as out of the workforce. While the necessity and usefulness of this distinction was debated in the earlier literature, it was stressed prominently by Flinn and Heckman (1983) analysing the transition between the different employment states. Similarly, Murphy and Topel (1997) show that focusing exclusively on unemployment may increasingly fall short of capturing the full extent of employment problems, as many workers may decide to stop looking for a job and leave the workforce if their job prospects are bleak.[3]

Therefore we subsume under the term employment problems unemployment, under-employment and a large part of non-employment. The most obvious aspect and most visible part of the employment problem consists of **unemployment**, defined as the share of the workforce who wants to work and does not find employment. Hence the defining feature of unemployment is that it is involuntary and that those afflicted actively search for a job. There are various different definitions for unemployment which vary mostly along the criteria of active job search. For example Eurostat – in line with the International Labour Organization (ILO) - defines unemployed persons as *someone aged 15 to 74 without work during the reference week who is available to start work within the next two weeks and who has actively sought employment at some time during the last four weeks*.[4] Unless otherwise specified we follow this definition of unemployment throughout this study. However, the ILO definition of unemployment is rather narrow, since it excludes everyone, who stopped actively searching for a job, is not immediately available for work or has a temporary employment during the observation period. Therefore simply looking at unemployment would fall short of covering the full extent of the employment problems. Therefore we also include **under- and non-employment**, defined as the share of the population

[2] The broader overview can be found in three partly complementing books on unemployment: Layard et al. (2005), Pissarides (2000) and Phelps (1994). See also Blanchard (2007) for a discussion about the relative strength and weaknesses of the respective books.

[3] For a more recent discussion see also Jones and Riddell (2006).

[4] For the exact definition see the glossary for *unemployment* on the Eurostat webpage: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary.

who (apparently) voluntarily stays away from the workforce in our definition of employment problems. Again following Eurostat and the ILO definition, this group includes *underemployed part-time workers, jobless persons seeking a job but not immediately available for work and jobless persons available for work but not seeking it*.[5]

Table 1: Broad classification of employment problems

<table>
<tr><th>Employment problem</th><th>Unemployment</th><th colspan="2">Under- and Non-employment</th></tr>
<tr><td>Distinctive feature</td><td>Non-voluntary out of employment and (actively) looking for employment</td><td colspan="2">Voluntarily out of employment and not (actively) looking for employment</td></tr>
<tr><td rowspan="3">Reasons for employment problems</td><td colspan="2">Business cycle reasons
(short term lack of aggregate demand)</td><td rowspan="3">Reasons for non-employment outside the labour market</td></tr>
<tr><td colspan="2">Structural reasons
• Unwinding of unsustainable developments
(long term lack of aggregate demand)
• Mismatch between labour demand and supply
○ Skill-mismatch (including experience)
○ Geographical mismatch
• Rigidities at the labour market
○ Wage rigidities
○ Other labour market regulations</td></tr>
<tr><td></td><td>Incentive problems
• Opportunity cost
• Poverty trap</td></tr>
</table>

Source: Own classification based on the literature review.

Table 1 provides a broad categorisation of the causes of employment problems. Note that there are numerous different approaches to label and characterise sources of employment problems and labour market imperfections. In the spirit of Manning (2011), who characterises labour market imperfections around the rents accruing to employers and employees, we also chose not to investigate the literature along the canonical models.[6] In contrast, in a first step, we organise our classification along the distinction between cyclical and structural unemployment. In a second step we split

[5] Eurostat groups together *underemployment* and *potentially active*. See http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary.

[6] For a recent survey of models explaining unemployment with search models see also Rogerson et al. (2005).

the reasons for structural unemployment into problems resulting from a mismatch between labour supply and demand and problems resulting from rigidities in the labour market. Additionally there are specific incentive problems that only contribute to under- and non-employment.

One needs to bear in mind that not all persons voluntarily staying away from the workforce are effectively contributing to an employment problem. Ideally, we would only want to include those who are interested to participate (more) in the workforce, but choose not to actively seek (more) work, because of discouraging circumstances at the labour market. In our classification in Table 1 the share of non-employment which is not caused by adverse labour market conditions is represented by the shaded area. This part of non-employment includes for example women preferring to care for their children at home despite the sufficiently profitable opportunities to go back to work, young people choosing to travel, or older people choosing early retirement despite the availability of suitable positions.

In terms of the distinction between labour demand and labour supply as the source of the employment problems, one can start from the broad categorisation that unemployment is the result of a labour demand problem and under- or non-employment stems from a labour supply problem. This relationship only partly holds, since the underlying reason for persons not seeking employment can be the lack of suitable positions because of a labour demand problem. Similarly the reason for firms not hiring available workforce could ultimately be due to inadequate quality of the labour supplied or other underlying causes. Nevertheless it can be useful as a starting point to attribute unemployment more to the labour demand side and non-employment more to the labour supply side. In the following we will briefly discuss where this generalisation appropriate and where caution is in order.

2.1.1. Cyclical and structural employment problems

It is useful to first distinguish short-term and demand-driven problems from longer term structural problems. In recessionary times the aggregate demand falls and in consequence the labour demand is also subdued. While this also creates an employment problem which is due to labour demand problems, this is not the type of labour demand problems, which should primarily be addressed by directed labour taxation reforms. In practice it is however difficult to separate short-term cyclical from structural long-term employment problems. One concept of the structural unemployment rate is the non-accelerating wage rate of unemployment (NAWRU), the level of unemployment the economy would settle into in the absence of shocks (see e.g. Orlandi, 2012). The remaining part of unemployment is then solely due to business cycle effects, the short term lack of aggregate demand resulting in higher unemployment. For the purpose of this report we are less interested in business cycle effects, but rather in the structural unemployment resulting from labour market imperfections. However, the distinction is not as clear as it appears, since large shocks in aggregate demand can result in an increase in the structural unemployment. For example, Orlandi (2012) mentions the bust of the housing price bubble, which can result in a long term reduction of demand to unwind a previously unsustainable

development.[7] Similarly, the necessary longer-term fiscal consolidation to reduce excessive public debt can be seen as a situation where the previously unsustainably high level of public consumption needs to be corrected. Therefore, some of the previously cyclical employment problems can manifest themselves in structural unemployment problems if a long term adjustment is necessary.

In particular the concurrence of the strict fiscal consolidation, also debated as **austerity programs**, and the continuing employment problems in Europe have provoked an emotional debate, whether and to which the sudden withdrawal of public expenditure is contributing to the employment problems. The economic literature has largely focussed on the growth effects of government consumption and only recently addressed the employment effects of government consumption. Using a structural VAR approach Brückner and Pappa (2012) find that government spending can increase both unemployment and employment as a result of an increased participation rate. Dallari (2014) relies also on a structural VAR approach to directly address how recent cuts in government expenditures have affected unemployment in a number of European countries and find very heterogeneous results among countries. In contrast, Turrini (2013) analyses the same question using a narrative approach, i.e. he identifies episodes of discretionary fiscal consolidation, and finds a negative employment effect overall. However, at closer inspection fiscal consolidation result affects job separation and job finding rates differently depending on the strength of employment protection measures. In consequence the impact of fiscal consolidation may well be different in the longer run, depending on the labour market institutions. The tentative conclusion from the existing literature therefore is that necessary austerity programs are likely to contribute to short term cyclical unemployment. Whether this unemployment manifest itself in longer term structural unemployment depends on other aspects of the labour market.

2.1.2. Mismatch between labour supply and labour demand

Structural unemployment because of a **mismatch** between the labour supplied by the workforce and the labour demanded has per definition both a labour supply and a labour demand dimension. The underlying assumption that employment problem can be reduced by a labour tax reduction on the appropriate side might be less applicable here, since labour taxation only affects the incentives to overcome the mismatch. The mismatch itself cannot be directly addressed by labour taxation reforms.

The mismatch between labour demand and can have different causes. The jobs offered might require specific **qualifications** and **skills** which are not sufficiently offered by the available workforce because they lack the necessary education or experience. From the outset, it seems somewhat puzzling that in times with high unemployment and the easy dissemination of information via the internet, firms struggle to find the matching employees. However, as Manning (2011) highlights, job and employee specific idiosyncrasies can create a match-specific rents, resulting in frictions in the matching function. Therefore even with an apparent abundance of adequate work force it can be difficult to find the worker which is suitable for the

[7] Orlandi (2012) refers to evidence for US states provided by Estevão and Tsounta (2011), but the results are easily transferable to Europe for countries like Spain and to a somewhat lesser extent Ireland.

vacancy. Another aspect of these idiosyncrasies implies that even workers with sufficient formal education may fall short of the necessary job related skills. Chevalier (2003) also points out skill heterogeneity within the same educational group. Thus, in the more recent literature there has been a clearer focus on the distinction between the level of education and the skill level (see for example Quintini, 2011).[8]

While the discussion about search and matching problems in the labour market has seen a strong increase following the seminal contribution by Mortenson and Pissarides (1994), the consensus at the moment appears to be that these mismatches are insufficient to fully explain patterns in cyclical unemployment (for an overview see Rogerson and Shimer, 2011) and structural unemployment (see Barlevy, 2011, for an application to the US labour market).

A further reason for matching problems can be **geographical distance** between the residence of the employees and the work place. Whereas migration caused by the pursuit of employment opportunities has been of longstanding interest in countries with high labour mobility like the United States (see e.g. Pissarides and Wadworth, 1989), the view that the low geographical mobility of the workforce in continental Europe creates employment problems is somewhat newer.[9]

Irrespective of the kind of mismatch, there is always a labour demand and labour supply side aspect to the disparity. While it is not always straightforward to attribute the cause of the mismatch to one side only, section 2.2 sets out to classify the most important aspects of changes and trends contributing to mismatches in the labour market.

2.1.3. Rigidities in wages and the labour market

Rigidities in the labour market can cause employment problems if they result in a **wage rate above the market clearing rate**. Standard reasoning sees a high wage rate as a labour demand problem since employers are not willing to hire sufficient people at this wage rate. An alternative view would be to treat a high wage as a labour supply problem if the workforce is not sufficiently productive for the going wage rate. For the purpose of this study, however, we will stick to the standard interpretation and see employment problems due to wage rigidities as primarily labour demand problems.

The economic literature offers a number of reasons for why wages do not sufficiently adjust downwards to enable market clearing in the labour market. For example, Manning (2011) distinguishes between *collusion and institutional reasons*. The most obvious form of collusion is *collective bargaining* of the workforce organised in unions. The role of collective bargaining in creating unemployment has for example been addressed by Blanchard (1991). A different aspect of collusion is, when firms pay *efficiency wages*, i.e. wages above the market clearing rate to maintain

[8] See also McGuiness (2006) for a survey of overeducation in the labour market, which constitutes yet another aspect of skill mismatch.

[9] See for example Tatsiramos (2009) for a recent analysis how unemployment benefits interact with labour mobility in a number of European countries.

unemployment in order to keep employees motivated (see Shapiro and Stiglitz, 1984).[10]

On the institutional side, the most obvious **labour market regulation** is a binding *minimum wage*. Although, the clear-cut economic prediction of Stigler (1946) that the introduction of a minimum wage would result in more unemployment, was challenged by Card and Krueger (1994) using a quasi-experimental approach, the recent evidence indicates that binding minimum wages increase unemployment.[11] More generally, the institutional setting, such as employment protection legislation, unemployment benefits, active labour market policies, and taxation of labour has a large influence on the labour market, as recently surveyed by Boeri (2011). Overly generous labour market protection legislation can result in a *dual labour market*, if firms become reluctant to hire new employees on fixed contracts.[12] In a dual labour market one part of the workforce is in relatively well paid and stable jobs, while the other part of the workforce is in unstable jobs with lower wages. Boeri (2011) points out that the share of temporary workers exhibits a strong positive correlation (0.73) with employment protection legislation. Hence, strong employment protection seems to lead to more temporary contracts, which can lead to large increases in unemployment during economic downturns, because firms find it easy to lay off these workers, just as it has happened in some southern Member States in the wake of the recent economic crises. Young workers and workers in the construction sector in countries with a housing bubble such as Spain were particularly hit.[13] While the earlier literature based on cross-country comparison struggled to differentiate the effects of the institutions from other country characteristic, the more recent literature learns primarily from within country variation through reforms.

Given the importance of these different labour market institutions, and the complex interaction between them and with labour taxation, Section 4 will be devoted to these potential sources of employment problems.

2.1.4. Incentive problems

Adverse incentives of the tax-benefit systems can also cause non-employment or under-employment. Of all the mentioned reasons for employment problems, the assignment to labour supply is the clearest here. The incentives directly affect labour supply and have no connection to the labour demand.

There is a longstanding debate about **poverty** or **unemployment traps**, where income related benefits create situations for unemployed people where they are better off staying outside the workforce.[14] For example, Pedersen and Smith (2002) use detailed data from Denmark and show that especially for women, the disincentives for work (i.e. the unemployment benefit is higher than the disposable income under full-

[10] See also Yellen (1984) for a broader discussion of the different efficiency wage theories, some of which see the efficiency wages as a motivational device and unemployment as a side effect.

[11] See Neumark et al. (2014) for a recent survey of this strand of the literature.

[12] The term dual labour markets stems back to at least Bulow and Summers (1986).

[13] See Bentolila et al. (2010) for a discussion about the effects of the crisis in countries with dual labour market.

[14] See Havemann (1996) for a discussion of these problems and some potential approaches to mitigate them.

time work) dominate other considerations and lead to a significant increase in non-participation in the labour force. Similarly, progressive tax systems can create incentives for secondary earners to reduce their work effort or to decide to opt for part-time employment. Even stronger disincentives for secondary earners can result from joint filing for couples, because the marginal tax rate depends on the joint income and as a result can be very even for high low income levels of the secondary earner.[15]

One final aspect we want to cover with the term incentive problems is the concept of **opportunity costs** of work. We interpret this term rather broadly and also include the costs which arise to the household through labour force participation. A prominent example is the cost of child care. That the rise in female labour force participation was in part driven by the falling cost of child care was already pointed out by Connelly (1992). More recently, Compton and Pollak (2014) find that geographical proximity to grandparents significantly increases the labour force participation of married women with young children. This allows the conclusion that there are still relevant opportunity costs for those mothers without family support. Therefore section 4.2 will be devoted to analyse the impact of family policies on the employment outcome.

2.2. Changes in Labour supply and demand as sources of employment problems

There are several ongoing socio-economic trends which already have affected both labour demand and supply, and even more importantly are expected to have a lasting impact on employment in Europe. Two main research projects have identified and summarised the key challenges lying ahead.[16] For example NeuJobs (2014), sees the main challenges ahead in natural megatrends such as energy transition and climate change as well as in societal megatrends as population dynamics and changes in the way work is organised. The adaptation to the current employment problems and raising challenges in Europe result in innovative agricultural, industrial and service activities that will shape the skills, jobs and work organization.

Table 2 classifies the socio-economic trends in factors affecting labour demand and labour supply. Changes in demography and educational attainment will influence the workforce available and their attachment to the labour market. While population ageing will reduce the workforce available, lower fertility rates and changing family structures contribute to raising female labour force participation. Together with migration these trends can significantly alter the workforce available. On the labour demand side the occupational shifts between sectors and other structural changes will affect the extent and quality of labour input required.

[15] For a recent discussion about labour force participation of secondary workers in the US see McClelland et al. (2014).

[16] The European Commission (2009) analyses the general outlook for the world in 2025, whereas NeuJobs (2014) directly investigates the future for work in Europe.

Table 2: Socio-economic trends affecting labour market outcomes

Sources influencing employment	Trends	Characteristics
Labour supply sources	Demography	Population ageing; Low fertility rates; Changing family structures; Growing female employment; Migration patterns
	Changes in educational attainment	Higher share of people with higher education, Polarisation of labour force
Labour demand sources	Occupational shifts	Development of green economies; Development of ICT tools; Increased demand in care sector and personal services, retail, tourism
	Structural changes	Change in the patterns of market organization and culture; Changes in production and consumption

Source: Own elaboration based on Neujobs (2014) and Styczyńska et al. (2013)

2.2.1. Factors affecting labour supply

The current demographic trends affecting labour supply include population ageing, low/falling fertility rate, changing family structures (increase of non-marital unions, patchwork families and single parents), growing female employment and the increase in migration. These trends generate new social risks and challenges for welfare systems and challenges in increasing the participation and employability of these groups in the labour market. As a result of these socio-demographic trends, potential labour market composition has notably changed and this change is expected to continue. The transition involves increasing share of elderly in the economically active population and women in the working population, as well as increasing emphasis on migration and employment of frequently marginalised groups (e.g. migrants including 2nd generation migrants and the Roma).

Table 3 summarises how these changes affect the characteristics of labour supply. This will in turn determine labour market outcomes and can result in increases employment problems. The full extent of the potential employment problems, however, will only become apparent once the changes in the labour supply are seen in connection with the changes in labour demand in the next subsection.

Table 3: Labour supply characteristics affecting labour market outcomes

Factors	Labour supply effect
Population ageing	People aged 50 + have lower chances of being employed Large share of population potentially decreases link between contributions and pension entitlements
Falling fertility levels	Having children has ambiguous effects on employment. While it increases the probability of men to be employed, the chances of being employed decreases for women.
Changing family structures	Being married has ambiguous effects on employment, for men there is a positive correlation, while for women it is negative. However, most likely also a reverse causality
Female labour participation	Women still have a lower labour force attachment
Changes in educational attainment	Lower educated people are less probable to find employment
Increasing migration	Migrants have lower chances of finding employment

Source: Own elaboration

The currently ongoing **population ageing** results in the ageing of the workforce and an increasing number of retired people. Between 2002 and 2012 the share of the population between 15 and 64 years has slightly decreased from 67.2 % to 66.4 %, while at the same time the share of over 65 year old has increased from 16.0 % to 17.9 %.[17] The different age composition of the labour force has a direct effect on the labour supply, while the increasing number of retired people can have an additional indirect effect via an altered link between the contributions and the pension entitlements in pay-as-you go systems. Despite the fact that the participation of the elderly is increasing, their employment rate is still much lower compared to the prime-aged workforce (Styczyńska et al., 2013).[18] Significant country differences are observed at the European level with employment ranging from 74.8 % in Sweden to 40.3 % in Malta (Eurostat, 2013). There are several reasons behind that phenomenon. There are the retirement preferences of workers, their health status, the (dis)incentives to work provided by labour market institutions, the perception about the lower productivity of older worker, or employer's decision about hiring older worker (Ruzik-Sierdzinska, 2013).

Related to the population ageing and in line with the trend in a number of developed countries the **fertility levels** in the EU-28 have decreased significantly in the last decades. After only a small recovery in the last decade the fertility rate in 2012 is at

[17] See population age statistics from Eurostat: http://ec.europa.eu/eurostat/statistics-explained/index.php/Population_structure_and_ageing.

[18] Through this report we define the elderly as persons aged between 55 and 64 years. The prime-aged workforce in comparison is aged between 20 and 52 years.

1.58 live births per women in the EU-28 countries.[19] This downward trend in the fertility rates is associated with numerous social and economic factors, but the causality of the relationship is unclear. A strong negative relationship between the increased participation level of women in the labour market and fertility rates has been observed in a large number of countries since 1960, (e.g. see Becker and Lewis, 1973 and Butz and Ward, 1979, for the US). In addition, the opportunity costs of childbearing, the individualisation and changes in the family structures are the other social aspects affecting women's decisions on motherhood. Additionally, participating in higher education also plays a role in women's postponing their decision. The economic factors discouraging the parenthood decisions are economic uncertainty and drops in the household income as a result of labour market and financial instabilities.[20]

Changing family structures have an ambiguous effect on the labour force attachment of individuals. A study conducted by US Urban Institute shows that the unemployment level of married men and women is significantly lower than that of unmarried, and labour force participation rates are much higher among married people (Lerman and Schmidt, 1999). The study also finds higher unemployment rates in the never-married group and that the labour market outcomes of men living with at least one of their own children are better than those of with no children. On the other hand, it has been shown that unemployment affects the individuals' decision on marriage. Ackers (2002) collects several case studies of European countries to find that the impact of changing family structures on employment is strongly affected by the cultural background, which is also reflected in the resulting public policies. For example, Iza and de la Rica, (2005) find for Spain that holding unstable contracts or being unemployed strongly negatively affects the individuals' decision on getting married in comparison with that of holding permanent contracts In contrast, for women fixed term contracts are a less strong determinant in their marriage decision. This trend might be explained by Becker's theory of marriage, based on rational choice, which suggests that since men are more likely to specialise in the labour market than women, i.e. from the traditional perspective still being affective on the individuals' view that "men are the main breadwinner", the worsening of the labour market conditions for men reduces the gain of marriage, as a result the incidence of marriage among young people decreases (see Becker, 1973).

Moving to **employment of women**, the last decade saw a gradual rise in labour market participation of women, and their employment rate. Despite recent improvements, a gender employment gap is still observed in all European countries. Women continue to deal with the challenges keeping them away from or limiting their participation in the labour market (e.g. see Tembon and Fort, 2008). Two aspects are crucial for the improved position of women on the labour market: the processes of school-to-work transitions and reconciling motherhood and work, through their relative importance and performance. Understanding these processes and their contribution to the overall improvement of female labour market participation is necessary to make policy recommendations for the employment strategy and to make predictions about the potential changes in the future.

[19] Eurostat, Fertility Statistics, 2014.

[20] Tausig and Fenwick, 1999, Neels and de Wachter, 2010, Van Bavel 2001 for Belgium; Yule 1906, Teitelbaum 1984, for Great Britain and Bengtsson, and Lee 2004 for the Eurasian region.

Changes in educational attainment can also play an important role for the composition of workforce. Education plays a major role in the probability of finding a job (see Ridell and Song, 2011). Data from the Labour Force Survey (LFS) in Europe show that highly educated have higher chances of being employed than their lower-educated counterparts. This is common for all EU countries (Nunez and Livanos, 2010). Low skilled make up 34 % of the EU population and their labour market attachment is significantly lower than for their more skilled counterparts.[21] The European Strategy for Employment and Growth 2020 estimates that just over a quarter of the population in Europe, about 80 million people, has low or basic skills and therefore are less likely to benefit from life-long learning. In contrast, additional education improves the ability of the labour force to adjust to economic shocks, enhances adaptability to change and in consequence increase the probability of being employed. Low-skilled workers encounter increasing difficulties to find a job, face lower job stability and are out-competed by medium-skilled workers even in elementary occupations (European Commission, 2014a)

Europe has a history of **migration**. And the removal of internal barriers further contributed to the strong increase in migration in all EU countries. In 2012, about 1.7 million people migrated to the EU from a non-EU country and 1.7 million previously residing in one of the EU-27 Member States migrated to another one.[22] The unemployment level of migrants in the EU is significantly increasing since 2007 and remaining much higher than that of the total population. 2013 Eurostat data show that the unemployment level of the migrants in EU-28 is 18 % in comparison to 10.4 % for the native population (Eurostat, Indicators of Immigrant Integration, 2013). This level substantially differs across the population depending on the citizenship of the migrant. The largest difference is observed in Belgium, as non-EU born unemployment level is 14 percentage points higher than that of total population, while for EU-born migrants this difference is only 2 percentage points. Studies suggest that migrants arriving to EU may suffer in the labour market of the host country for several reasons. First, the educational qualifications provided by the country of origin might not provide the necessary qualifications in the host country and put migrants in a position where their competencies are much lower than the native workers in the country. Second, because the human-capital has a limited level of mobility, and therefore is mostly country specific, most migrants find it hard to translate their knowledge and adapt the system and qualifications in the host country (Chiswick, 1978, Borjas, 1994, Friedberg, 2000). In addition, if the employer perceives that the migrant is not willing to work permanently, then both parties refrain from investing in human-capital since it is not likely that it will pay off in the future (Dustman, 2000). Similarly, if the job search costs are so high for the migrants or if they are unlikely to become a resident in the host country, they may refrain from undertaking long searches for a better job and prefer the one immediately available even if it is low-status, therefore they are overqualified for the job (Kalter and Kogan, 2006; Dustman, 2000).

[21] Low skilled adults are defined as people over 25 with lower secondary education at most, which includes International Standard Classification of Education (ISCED) categories 0 to 2.
[22] Eurostat, Migration and Migrant Population Statistics, 2014.

2.2.2. Factor affecting labour demand

When considering the demand side of the labour market, we should ask the questions of how many jobs will be created, or destroyed on the market, in what sectors, and what would be the reason of such a change. During the last decade we observe a relatively fast evolution in the consumption of goods and services, changes in the structure of products demanded, introduction of modern technologies, changes in the lifestyle of people. All these evolutions, which are broadly called in the literature socio-ecological transformation, result in changes in the labour market demand for specific skills, education, or abilities. Changes in the demand for labour can be characterised by two phenomena: *occupational shifts* in labour demand, and *structural changes in labour market organization* and working conditions due to the introduction of information and communications technology (ICT) measures. These changes will significantly affect the creation of jobs, and employment overall in the medium- and long-run.

There is a longstanding debate over the impact of **occupational shifts** on labour market outcomes. On the one hand, the sectoral shifts hypothesis developed by Lilien (1982) states that occupational shifts tend to be slow and typically involve significant unemployment before labour fully adjusts to new patterns of labour demand. This can generate considerable fluctuations in the unemployment rate that are not directly related to the fluctuations in aggregate demand. On the other hand, some studies tend to reject the hypothesis, showing that it has small and insignificant impact on aggregate unemployment rate (Abraham-Katz, 1986).

Empirical studies - at least superficially - seem support both hypotheses. Van Ours and Van der Tak (1992) show that sectoral shifts do not have a substantial influence on the unemployment rate in the Netherlands. Fluctuations of unemployment rate are mainly due to aggregate demand factors. Similarly, Sakata and McKenzie (2001) find no relation between sectoral shifts and the unemployment rate in the long run in Japan. When analysing the same hypothesis for different groups of workers, Sakata and McKenzie (2004) confirm that sectoral shifts do not have any long-term impacts on unemployment. They contribute, however, to the unemployment of old males in the short-run.

In contrast, Pelloni and Polasek (2003) show that sectoral re-allocations in Germany, UK, and the US account for a substantial share of aggregate employment variation, while the effects of aggregate shocks for sectoral shares are of smaller magnitude. In contrast Also, Grubb (2002) finds that due to the rapid increase in the information society, communication revolution, or the hi-tech revolution the nature of work has changed. It shifts from occupations rooted in industrial production to occupations associated with knowledge and information. In order to moderate the negative effect of occupational shifts the idea of career information and career guidance is supported. Due to these rapid changes the more recent European studies point to a problem of skill shortages, when higher demand than supply exist for certain occupations, such as ICT professionals, nurses, or engineers. They also highlight the problem of skill obsolescence related to the risk of losing acquired skills and abilities, due to the rapid introduction of new technologies and innovation in the market.

Summing up, the empirical results confirm that occupational shifts are likely to increase the unemployment rate, but mostly in the short- to medium-run. When

considering the problem in the long-run, occupational shifts are insignificant for (un)employment level of individuals. In terms of shifting sectoral structure of employment, several studies document the structural shift from manufacturing to services in developed countries (Schettkat and Yocarini, 2006). The service sector has become the most important sector in all OECD economies. It is, however, composed of a wide variety of different activities ranging from fast food to brain surgery. An increase in the demand for social services, healthcare, and education is observed. The most recent data on occupational shortages show that in Austria in 2014 registered nurses, data processing technicians, and technicians in engineering were highly demanded. Other more recent studies (Beblavy et al., 2013) confirm that due to the technological and ecological transformation, we observe the decrease of employment demand in agriculture, non-market services, and the increase in employment demand in transport, energy, construction, and private services. The projections of the future labour market show that employment growth will be mainly driven by job creations in private services sector. The same changes will be observed in transport. The industry sector and agriculture will lose around 30 % of their jobs in 2030 (Boitier et al., 2013).

In Employment in Europe 2009, the European Commission clearly summarises the state of the art on the impact on employment of the socio-ecological transition to a low carbon economy. Sectors directly involved in the adaptation are those especially related to (i) the efforts to increase energy efficiency and (ii) renewable energies. In the long run the net effect on employment is expected to be neutral or slightly positive. The main impact will occur on redistribution across sectors and regions. Intra-sectors redistribution is deemed smoother since it is easier for a worker to change company within the same sector rather than to find an entirely different job.

Structural changes in the labour market are characterised by several factors affecting the workplace. Prominent examples are the as the introduction of ICT tools in the workplace, which fundamentally alter the tasks of jobs. Modern communication has further allowed work reorganisation through international division of labour. This often leads to highly specialised jobs in Europe, while simple mechanical tasks are either substituted by technology or outsourced to low-income countries. The remaining and newly emerging jobs in Europe often require a very different skill set, which in conjunction with a slowly adjusting workforce results in skills gaps, characterised through the fact that workers' skills are not up to requirements of the jobs. These were highlighted by a recent study on adult skills revealing proficiency problems in basic literacy, numeracy and ICT skills (OECD, 2013a). Despite the fact that measuring the impact of technological change on labour market has proved difficult, there is agreed consensus that the world is changing faster and more severe consequences are expected in the labour market (OECD, 2012a). There is a general agreement that the long-term trend has been toward jobs requiring more education and cognitive skills, but the level and types of skills in demand, and the drivers of change are matters of debate and are difficult to understand. Growing development of ICT tools and increasing use of ICT and knowledge-sharing in the workplace might be assumed as significant determinant of unemployment increase. OECD (2012b) shows the demand for educational, cognitive and interpersonal skill increases, while craft skills, physical demands and the frequency of repetitive physical tasks declined. This is related to the facilitation of handling of complex systems, speeding up the process of

knowledge-sharing worldwide and across all areas, and creating a cheap communications space for new world views and lifestyles (NeuJobs, 2014).

Table 4 summarises the changes in labour demand and how they will contribute to the skill mismatch. While the findings in the literature and consequently this short survey here suggest that the skill mismatch is primarily a short run problem, the speed of adjustment will crucially depend on the labour supply side as well. Higher education and increasing mobility of the workforce positively contributes and reduces the length and the extent of the mismatch resulting from changes in labour demand.

Table 4: Labour demand characteristics affecting labour market outcomes

Factors	Labour demand
Occupational shifts	Shifts of production between occupations/sectors cause increased demand for one type of skills, and decreasing demand for different type of skills. In the short- to medium-run such shifts can results in a skill-mismatch, i.e. mismatch between skills that are demanded on the labour market and skills that are available. It causes the increase of unemployment and the increase in vacancies at the same time. In the long run the market should adjust and the unemployment should decrease and employment increase.
Structural changes in labour market	Introduction of innovative tools in the workplace, changing nature of the workplace induce demand for different types of skills, often unavailable on the labour market. Again, we observe a skill shortage, which creates unemployment and lower employment.

Source: Own elaboration

Given the differences between different socio-economic groups with respect to their ability to adapt to changes in labour demand, the respective labour market outcome will be different. Therefore the next subsection will shed some light on how this manifests into employment problems for different vulnerable groups of the population.[23]

2.3. Groups vulnerable to employment problems

The interplay of changes in labour demand and labour supply can create labour market outcome which are less favourable for specific socio-economic groups. Both, a strongly increasing labour supply or a sharply falling labour demand can put a socio-economic group into a vulnerable position. Therefore we review the situation of some groups to highlight their relative exposure to employment problems. Specifically we look at the low-skilled, the youth, the elderly, women and migrants.

[23] Note that the matching problems in the labour market are an inherently two-sided problem, but it is beyond the scope of this particular project to also investigate the role of employers in detail.

2.3.1. Low-skilled

The level of education and the resulting skill level of the workforce is a key determinant of the labour market outcome. Despite this importance there is an ongoing debate how to adequate measure the skill-level. There are several schools explaining how the concept should be defined and measured (CEDEFOP, 2010). Therefore, before proceeding, we outline the problem of the definition and the challenges that this entails for policy makers and analysts. There is a tendency to define low-skilled adults on the basis of their prior qualification attainment, in comparison to that of the population as a whole. This is driven largely by the fact that comprehensive data on the labour forces of individual Member States is not readily available. Nevertheless, measurement by educational attainment alone sterilises the concept of low-skilled adults and obscures it from the sources of the low-skilled that are important for a better understanding of the heterogeneity of low-skilled workers within and across countries. Rather, factors such as the characteristics of individuals, which relate more to their employability (i.e. how they are regarded by employers in terms of being work-ready, trainable, and having the appropriate attitudes and aptitudes), should be taken into account. At the same time, it is important to recognise that qualifications (and other characteristics or factors on which employer hiring decisions are based) tend to operate as proxies for these wider attributes that are sought by employers. Nevertheless, the lack of data prevents researchers from providing such analyses.

To proceed, we follow Eurostat and define low-skilled adults as people over 25 with lower secondary education at most, including ISCED 0 to 2. Therefore, due to data availability and in order to maintain comparability with the majority of studies at the European level, we use Eurostat's definition for measuring low-skilled workers.

Since 2002, the ratio of employment rate of the low-skilled has constantly decreased to a level of 60 % of the employment rate of the rest of the working population in 2013. This trend has been fuelled by the fact that low-skilled workers were the ones mostly affected by the crisis, also mirrored in the continuously increasing unemployment rate of the low-skilled. At the end of 2013, the unemployment rate of low-skilled workers was over 2 times higher than the unemployment rate of the rest of the workforce. The participation rate of low-skilled workers is much more responsive to business cycles than for the rest of the population, suggesting that they are easier discouraged to participate in the labour market and seek employment.

Low-skilled adults constitute a significant proportion of the workforce: in 2013, around 25 % of the EU-28 population aged 25 to 64 had an education level of ISCED of 2 or less (Eurostat, 2014). Low-skilled workers encounter increasing difficulties finding a job, face lower job stability, and are out-competed by medium-skilled workers even in elementary occupations (European Commission, 2014a). The need for (continuous) upgrading of the skill level in most occupational fields threatens the labour market position of low-skilled workers who are crowded out of their traditional occupational domains (Borghans and Groot, 1999; Jacobebbinghaus and Zwick, 2002). Low-skilled workers are often either locked up in poorly paid elementary jobs with flexible contracts that further weaken their labour market position. Furthermore, low-skilled are increasing crowded out of employment, by better skilled people taking jobs for which they are over-qualified because of a lack of jobs for which their qualification and

skill level are commensurate. A further problem constitutes the increasing number of people at high risk of becoming low-skilled workers. Fast sectoral structural change in economies and globalization, which result in a shift towards a service-sector economy and away from the primary sector and select manufacturing activities in Europe, imposes the risk of increased number of low-skilled people in society. Since the issue of inadequate skill levels can not sufficiently be addressed through tax reforms, further policy measures are necessary. Box 1 describes a few approaches.

Box 1: Examples for policy measure for low-skilled workforce

Low-skilled make up an especially vulnerable group since they are confronted with a lack of labour demand which cannot be easily addressed through labour cost reduction because of tax reforms. Therefore *additional policy measures* are necessary to improve the labour market situation of the low-skilled. To this end the OECD (2014c) indicates several policy measures to adapt individuals' level of specialised skills to the changing nature of jobs and the changing demand for skills.

One of the measures mentioned includes full involvement of employers in designing and delivering training. Employers themselves are asking for a more active role in designing and delivering training programs to ensure that programs provide skills they need in their workforce.

A stronger network between small and medium enterprises, collaboration between public employment services and companies is recommended. In Sweden, for example, every higher vocational education and training programme has a steering group involving employers that advise on provision and ensure programmes and qualifications that are in line with the needs of labour markets. In the USA Community colleges can rapidly develop courses demanded by employers, as they use industry representatives as trainers. The increase in funding for firms, that see the need of upskilling, or re-skilling of their low-skilled employers should be made available.

Other measures proposed for upskilling are related to flexible lifelong learning opportunities for individuals. Flexible training systems can build the skills necessary to activate and connect unemployed individuals, especially low-skilled individuals, to the labour market during the life course at different stages of the employment path. For employed individuals, the opportunities to further develop skills are an important condition in preventing unemployment and building career progression.

To decrease the risk of falling in low-skilled employment traps further measures are proposed. They include helping employers to upgrade their management practices and introduce practices that enable skill improvement (like shifting employees into different jobs and positions within the company in order to facilitate the learning of news skills, employee participation in discussion on business strategies, knowledge transfer and several others). Policy makers should also provide guidance, and incentives in order to increase the collaboration and networking across firms, universities and colleges to help them share knowledge, new technologies and innovation. In addition, the public sector should give an example and should also implement human resource management, and incentivise the collaboration between different stakeholders on the labour market.

2.3.2. Youth

The unemployment rates of young people have reached alarmingly high rates in some European countries. The scale of the problem is exemplified by Eurostat statistics which show that in August 2013 more than half of young workforce in Greece (57.9 %) and Spain (55.2 %) were unemployed. Only Germany (7.9 %) and Austria (8.7 %) had levels below ten per cent. More widely, the International Labour Organization (ILO, 2013, p. 3) stated that "since 2009, little progress has been made in reducing youth unemployment in the advanced economies", with both the level and duration of unemployment increasingly significantly. There are a number of causes of youth unemployment. Apart from poor macroeconomic performance, which affects all groups of workers, young people face higher barriers to entry into the labour market due to their lack of job-specific experience relative to adult experienced workers. Youth are also perceived to be more likely than adult workers to resign voluntarily because they are more likely to explore different opportunities before they settle (Görlich et al., 2013).

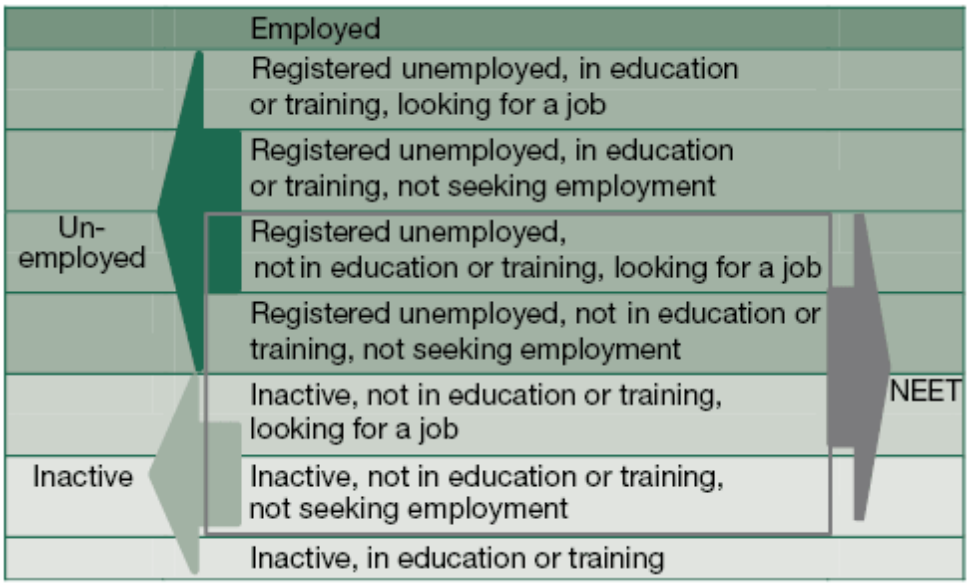
The youth labour force is further characterised by flexible contracts. Given the common practice to offer temporary contracts to young people, the recession hit this group particularly hard. Among the first one to lose their jobs, the unemployed youth population is also finding it particularly difficult to find a new one (OECD, 2009). This effect is again aggravated by lower levels of education. While the unemployment level among the youth with tertiary education is 19 %, this level reaches 34 % in the lower education group.

Contrary to the overall labour market, there no is significant difference between the unemployment rates of young men and women; this holds both in lower and higher education groups. However, in the labour market participation the difference reappears. Young female activity rate between the ages of 20 and 24 is 56.8 % while this rate among young males is 65.6 %.[24] This difference is most pronounced in the lower education group, decreases with an increased level of education and completely disappears in the tertiary education group. Hence the lack of a gender gap in youth unemployment is primarily driven by less educated young women staying away from the labour market.

Therefore, the European Commission clearly states that it is important to measure the situation of young people that are out of the labour market as well. The European 2020 flagship initiative "Youth on the Move" aims at "unleashing all young people's potential" and clearly emphasises the importance of focusing on youth, in general, and on young people who are neither in employment or in education or training (NEETs), in particular (European Commission, 2010). Figure 4 places the NEET category in the general labour market classification. NEETs includes young people aged 15-29 discouraged from seeking employment and unwilling to take up any kind of training. This includes a variety of subgroups that have very different personal experiences, characteristics, education levels, and attitudes toward job seeking.

[24] Eurostat, 2014.

Figure 4: NEETs position within the labour market classification



Source: Styczyńska (2013)

The NEET rate for the young people aged 15 to 24 has been increasing since 2008 and reaches 13 % in 2013 in the EU-28, while their unemployment rate is at 23.5 %. NEET rate for people aged 25-29 is even higher and reached the level of 20.9 % in the EU-28 in 2013.[25] Eurofound (2012) studies the NEET and suggests that the main reason for not seeking employment is the belief that there is no work available. Other studies find that strict employment protection regulations for adults are the main reasons of higher unemployment rates among young people (Breen, 2005; Esping-Andersen, 2000), lower youth employment rates (Bassanini and Duval, 2006), longer job search periods (Wolbers, 2007), and lower chances of getting reemployed (Russell and O'Connell, 2001); hence, pushing them towards NEET. In addition, the youth labour force is characterised by flexible contracts as compared to the type of contracts of the rest of the population (Eurostat, 2014). During crises, it is more difficult for an employer to dismiss a permanent worker than the temporary employee on a zero-hours contract.[26] Therefore, young people are the first to lose employment in the case of the reduction of short-term adjustments (OECD, 2009).

Consequently, young people have a much weaker labour force attachment with an employment rate of only 43 % of the employment rate of the adult population. Their unemployment rate is constantly around 2.4 times higher than the unemployment rate of their older counterparts.

While some young people withdrawing from the labour market choose to stay in the education system, many young people end up in inactivity because of discouragement and marginalisation of the labour market. This position of the youth in the labour

[25] See Eurostat (2014) for the latest data on the NEET rate.

[26] The term zero-hours contract is not legally defined, but usually refers to very flexible contracts, where the employer has the option to offer any number of hours between zero and full time, but has no obligation to offer any. At the same time the employee does have no obligation to accept any work hours. See also the website of ACAS (Advisory, Conciliation and Arbitration Service) for a more thorough discussion.

market can result in multiple disadvantages such as the lack of qualifications, health problems, poverty and other type of social exclusions. For example, Bell and Blanchflower (2010) estimate that a 6-month unemployment spell of young workers aged 22 results in an 8 % decrease in wage preference. At the age of 30, the wage is expected to be lower by 2-3 percentage points than it would have been otherwise. Moreover, some young people who are NEET for a long period of time are trapped into a vicious cycle hard to escape, and, as a result, they quit the labour market entirely (Quintini and Manfredi, 2009).

2.3.3. Elderly

The labour market situation of the elderly has been steadily improving since 2002. Both the employment rate of the elderly and their activity rate have been increasing steadily. At the same time the unemployment rate of the elderly was significantly lower than the unemployment rate of their younger counterparts during the whole period. It fluctuated around the level of 65-70 % of the unemployment rate of their younger counterparts. Despite the fact that the situation of the elderly is improving, several issues are masked by these data.

First of all, it is important to note that the positive change in the employment rate of the elderly was supported by enormous policy efforts, numerous initiatives and monetary subsidies, which have been undertaken in order to encourage and improve the labour market activity and employability of the elderly.

We should also note that the ratio of activity rate of the elderly has been increasing, but to a very limited extent (by 1.5 percentage points during last 10 years). The elderly still do prefer to leave the labour market when they have the possibility and to stop participating in the workforce (Styczyńska, 2013).

Further, it is noteworthy that the elderly are very strongly protected by their permanent contracts and labour code and they cannot be dismissed instantly. Nevertheless, once they are dismissed, their probability of finding employment decreases significantly. Therefore, their long-term unemployment rate as a percentage of total unemployment remains substantially higher among older workers than any other group in the labour market. With an increasing trend after the crisis, the long-term unemployment rates as a percentage of the total unemployment among the elderly reached its highest level in 2013 at 59 % (Eurostat, 2014). The data implies that more than half of the unemployed elderly could not find a job for over one year from when they became unemployed. There are several reasons behind this fact. First, the elderly are perceived as people less productive and unwilling to undertake any type of training (Ruzik- Sierdzinska, 2014). Gelderblom et al. (2011) also find that after the age of 55 workers' own human capital investment declines sharply.

Additionally, the elderly are perceived as people with inadequate IT and ICT skills (Arias et al., 2014). In addition to the perceptions of older workers, the high long-term unemployment level is also a result of job immobility. A study in Netherlands finds that starting with the age of 45, the level of job mobility declines sharply, and by the age of 55, it drops even to a level that is less than 1 % (INSPIRES, 2014). In line with expectation, the unemployment rate among the elderly with the lowest level of education is substantially higher than in the rest of the better-educated population (Eurostat, 2014).

Looking at within-group differences reveals that the activity rate of the female elderly aged 50-64 is 12 percentage points lower than that of male elderly (Eurostat, 2014). Still, in several European countries, gender stereotyping continues to be an issue despite the majority of people accepting gender equality in the labour market (ISTAT, 2011). Older women tend to be the main providers of care for their family members, namely grandchildren and the elderly.

2.3.4. Women

The ratio of the employment rate for women has been increasing from 77 % of the employment rate of men in 2002 to 87 % in 2013. This is a result of a faster increase in the employment rate of women than men. In addition, during the crisis, women's employment was affected to a lesser extent than men's. Moreover, women managed to recover much quicker after the crisis while men are still struggling with decreasing employment rates. Similar to the improvement in the employment ratio, the ratio for the unemployment rate has also improved. While in 2002, the unemployment rate of women was 1.2 times higher than that of men, it is at a comparable level since 2009. In addition, a constant increase in the activity rate of women is observed. In 2013, the activity rate of women was at 85 % of the activity rate of men.

Nevertheless, the cultural expectation of women remains one of the biggest challenges. In many European countries, women are expected to take care of the children and the elderly as well as doing the housework. These views on the traditional role of women appear to be still present among young people (Vella, 1994; Guiso et.al, 2003; Algan and Cahuc, 2004)[27]. As a result, women experience more difficulties in reconciling their career with their non-market household activities. When they are employed, they tend to spend less time in the workplace as compared to their male counterparts, since they are more likely to work part-time (Bardasi and Gornick, 2000; Jacobs and Gornick, 2002). Consequently, their salary and pensions are lower than that of men.

Furthermore, for women having young child(ren) has a negative impact on finding employment, their employment duration, and their employability (see e.g. Wolff, 1990; Phipps, 1990; Knudsen and Peters, 1994; Gornick et al. 1996; Pettit and Hook, 2002). The opposite holds for men in that fatherhood increases the labour force participation of men (Gornick, 1999). Working mothers report a higher level of stress in their lives than other workers. To overcome this, jobs may allow workers to work flexible hours to allow them to manage family responsibilities during normal work hours. The longer women stay outside the labour market as a result of child or elderly care duties, the harder it is for them to become reemployed again, which further deteriorates the gender gap in the labour market and creates serious consequences in women's lives.

The other factor shaping the labour market position of women is the level of education. While the employment rate is only 36.5 % among women with primary education, this level increases to 78 % among the women with tertiary education. Similarly, in line with the well-established view on the effect of education, unemployment rates are much lower in the tertiary education group than in the

[27] Thornton et al. (1983) also find an profound impact of fundamental religious beliefs on the role of women in the society.

primary education group, at 6.9 % and 18.7 % respectively (Eurostat, 2014). Women's employment rate and working hours increase with their educational level; this suggests that earnings capacity affects the labour market behaviour of women (Phipps, 1990; Knudsen and Peters, 1994; Gornick et al. 1996; Pettit and Hook, 2002). This relationship is observed in the available data for the female labour force in the EU.

Additionally, due to changes in family structures, the number of single mothers has increased over the last 50 years. The labour force participation rates of mothers with partners are significantly higher when compared to lone mothers. With some exceptions (i.e. Luxembourg and the Netherlands), younger single mothers are less likely to fully participate in the labour market (RAND Europe, 2014). In addition, single mothers working part-time are more likely to be in low-skilled jobs.

2.3.5. Migrants

Eurostat defines a migrant as a person [who] *establishes his or her usual residence in the territory of a Member State for a period that is, or is expected to be, of at least twelve months, having previously been usually resident in another Member State or a third country* (Poulain, 2008). Here, a distinction between migrant groups is necessary since the groups are too heterogeneous in terms of their labour market characteristics. The first group are European migrants who migrate between Member States while the second group are non-European or third country migrants who migrate to the EU from a non-Member State.

The employment patterns of migrants show a high degree of cyclical sensitivity. Since 2002, the employment rate of migrants (both European and non-European migrants) had been increasing. However, the financial and economic crisis particularly affected the non-EU migrants. Their employment rate decreased by over 4 percentage points right after the crisis in 2009 and in contrast to EU migrants and natives has not yet fully recovered after the crisis. This suggests that in times of economic difficulties, non-EU migrants are the ones who lose their jobs first and are struggle to get back into employment.

This is even more visible in the unemployment rates, which remain substantially higher for the migrants in comparison to the natives. However, this still hides the real picture of the labour market problems that third country migrants experience. A recent study presenting multi-level analysis of migrant unemployment rates finds that migrants coming from Islamic countries have higher rates of unemployment than those who originate from Western Europe (Fleischmann and Dronkers, 2010).

Kogan (2007) suggests that labour market regulations which are aimed at employment protection impose high firing costs on the employer. This can result in employers being reluctant to hire migrants as they are considered riskier and making a mistake in the hiring process is costly. This tendency results in discrimination, therefore resulting in hiring natives over migrants. In addition, the motivation to avoid the costs of job search causes migrants to end up in poor jobs. In the long run, this aversion might trap them in low status, badly paid, and unpleasant jobs (Reyneri and Fullin, 2011). According to a study by the European Commission (2011) based on 2009 data, while the over-qualification rate for the total population is 21 %, the rate is 33 % for foreign-born persons. The over-qualification rate was even higher among

people born outside the EU, at 36 % (European Commission, 2011). This difference holds for both women and men, but women suffer at a higher level than men, as they do almost in every other position.

Gender studies confirm the disadvantaged situation of female third country migrants as well. A recent study focusing on migrant women in the EU (RAND Europe, 2008) finds that non-EU migrant women are much more intensely concentrated in a few low-skilled jobs than that the EU-born group. The study also finds that having a child under five years old decreases the labour force participation of migrant women further than it does for native women. Considering the fact that third-country migrant women are much more likely to have younger children compared to native-born women, this finding is particularly important in explaining the differences in the labour force participation of women. The study also suggests that how the recently arrived migrant woman determines the labour market achievements of migrant women. The differences between the labour market achievements of women in old and new migrant-receiving countries are mostly a result of the fact that the migrant women in the new migrant-receiving countries are, on average, younger. The study on migrant women also finds that in the new migrant-receiving countries, when differences in education, marital, and family status are controlled for, the results show no significant difference between native-born and migrant women.[28] On the other hand, the same methodology results in only minor changes in the labour-force participation of migrant women in the old migrant-receiving and Nordic countries. Therefore, this might imply a potential negative discrimination towards non-EU migrants.

Even though the data and literature show that the integration of migrants is not well achieved yet, and there still are labour market penalties for migrants, when education is introduced to the estimation models, the penalty in terms of the probability of entering the white-collar class increases instead of decreasing, unlike the situation in the past (Reyneri and Fullin, 2011). Although, in the EU-28, there is no substantial difference between the tertiary education achievement rate of the total population and foreign-born persons (28 % and 32 %, respectively), the significant difference is mostly pronounced in the lower level of education. There is a 10 % difference between the share of foreign-born people with low education attainment and that of total population. This is the result of the migration of a large number of people from outside the EU with a low level of education. While the share of population with primary or less education is lower in the total population and not significantly different for the EU-born migrants, this share is significantly higher for third country migrants (27 %, 28 %, and 40 %, respectively, Eurostat, 2014).

Considering the future path of the European labour market, where unemployment among the low-skilled is likely increase while there will be excess demand for skilled workers (Constant and Zimmermann, 2005), as a result of the large numbers of non-EU born persons having the lowest level of education, their level of vulnerability will become much more noticeable.

[28] RAND Europe (2008) defines Belgium, France, Luxembourg, the Netherlands, the United Kingdom and, to a lesser extent, Austria, as the old migrant receiving countries, while Spain, Greece and Portugal are defined as the new migrant receiving countries.

2.4. Summary

The aim of this section was to gain an understanding whether the observed employment problems in Europe are mainly due to a labour demand or a labour supply problem. Starting with the observation that unemployment is more originating from the labour demand side and non-employment is more a labour supply side issue, cyclical unemployment can be attributed to the labour demand side, albeit only indirectly through the lack of aggregate demand which results in a lack of labour demand. It is difficult to draw a clear line between cyclical and structural unemployment since unwinding of previously unsustainable situations, like necessary fiscal consolidation because of excessive public debt, can result in longer term lack of aggregate demand.

A key part of structural unemployment is due to mismatches between labour demand and labour supply and therefore inherently difficult to attribute to one of the two labour market sides. Looking at recent trends one can make progress in attributing the employment problems to the labour supply side where socio-economic changes like population ageing, falling fertility levels, increasing female labour force participation and increasing migration change the composition of the workforce. At the same time a probably even larger share of short to medium term unemployment can be attributed to broad changes in labour demand as a result of occupational and sectoral changes and structural changes in the workplace. These shifts increase the labour demand for certain skills while others become obsolete.

Changes both in labour demand and labour supply leave some socio-economic groups at a vulnerable position in the labour market. First and foremost the **low-skilled** part of the population is facing a labour demand problem as a result of the sectoral shifts which substantially reduced the need for low-skilled workforce. Additionally the low-skilled are among those most affected by rigidities which prevent wages to adjust downwards. For example, binding minimum wages can result in a lack of labour demand for low-productivity low-skilled workforce. Given the relatively low wages of low-skilled people adverse incentives of the tax and transfer system can also result in a labour supply problem further adding to the employment problem.

Another vulnerable group in the labour market are the **young people**. There are several reasons behind this phenomenon. Young people are usually perceived as unstable employees who would leave an employer in order to gain more experience before they settle into a permanent role. In addition, they usually have temporary, flexible contracts that do not secure their employment. Due to their lack of experience, they are also perceived as less productive than the rest of the workforce. Consequently, youth unemployment can be largely attributed to a labour demand problem. **Migrants**, in particular those from non-European countries, face a similar situation in the labour market. Often their previous work experience and foreign education is not adequately valued by employers and therefore they are facing a labour demand problem. Furthermore, while the increase in migration can help to mitigate geographical mismatches, it also contributes to a relative fast change in labour supply. As a result there can be an oversupply of specific types of workers. While the situation of the **elderly** has been steadily improving during the last decade, they are still facing relevant employment problems. Due to population ageing the labour supply of elderly people is increasing. At the same time the labour demand is

not keeping up, because the elderly are often perceived as people of lower productivity, who are not keen on investing in themselves, and who are unable to acquire new skills and adapt to rapid changes in the market. Currently, permanent contracts, which protect them from instant loss of employment, help them to maintain their employment level. However, once they lose their employment, it is difficult for them to become employed again, often due to a shrinking labour demand for their specific skills.

The role of **women** in the labour market has undergone a profound change, not least due to decades of initiatives and debates on this issue. The gender employment gap decreased significantly during the last decade and the labour market participation of women increased. Despite the achievements there relevant disparities between the labour market attachment of women and men remain. To a large extent these differences are related to labour supply issues since women are still largely responsible for child care, care of elderly relatives and other non-market household activities. As a result the reconciliation between work and household activities often results in weaker labour market attachment for women.

In terms of indicators this section suggests that the first step should be to break down the employment problems into its category. Separately looking at unemployment and non-employment will give a first impression as to on which side of the labour market the problems are located. Furthermore distinguishing between structural and cyclical aspects of unemployment will give an indication on the part of unemployment which can be traced back to a lack of aggregate demand and is therefore not the result of a labour supply problem. The discussion of the vulnerable groups further highlights that the overall employment situation can hide labour market problems of specific groups.

The above discussed socio-economic trends can result in a mismatch between labour supply and labour demand. This highlights to the necessity of indicators looking into changes in labour supply as well as labour demand and how these coincide. Such indicators can help to allocate the source of employment problems to either side of the labour market. At the same time, it is noteworthy that these indicators are also highlighting more fundamental structural problems in the labour market, which are not the result of labour taxation. Therefore tax reforms may not be the best way to address these issues.

The broad characterisation of employment problems also revealed that rigidities in the labour market and incentive problems because of the tax and transfer system are key determinants of the labour market outcomes. These will be picked up in Section 4 to further refine the need for appropriate indicators.

3. Review of the tax incidence on labour

In this section of the report, we provide an overview of what is known about the short- and long- run economic incidence of labour taxation. In doing this we first examine the literature that directly assesses the incidence of taxation, utilisation both cross-country and within-country variation in labour taxation. In a second step, we make use of the much broader economic literature that examines labour demand, and particularly labour supply: as highlighted in Fullerton and Metcalf (2002), in the classical model of the labour market, incidence is determined by the relative responsiveness of labour demand and labour supply. Finally, we move beyond reduced-form and partial-equilibrium models to consider incidence in a general equilibrium framework.

We begin, however, with a discussion of the conceptual and empirical difficulties that arise in identifying the incidence of labour taxation.

3.1. How can one identify the incidence of a tax?

The extent to which workers or employers bear the burden of labour taxation is intimately linked to the relative degree of responsiveness of each to the financial (dis)incentives created by the tax: that is, to the relative elasticities of labour supply and labour demand.[29] This is most clearly seen in a simple representation of a classical perfectly competitive labour market.

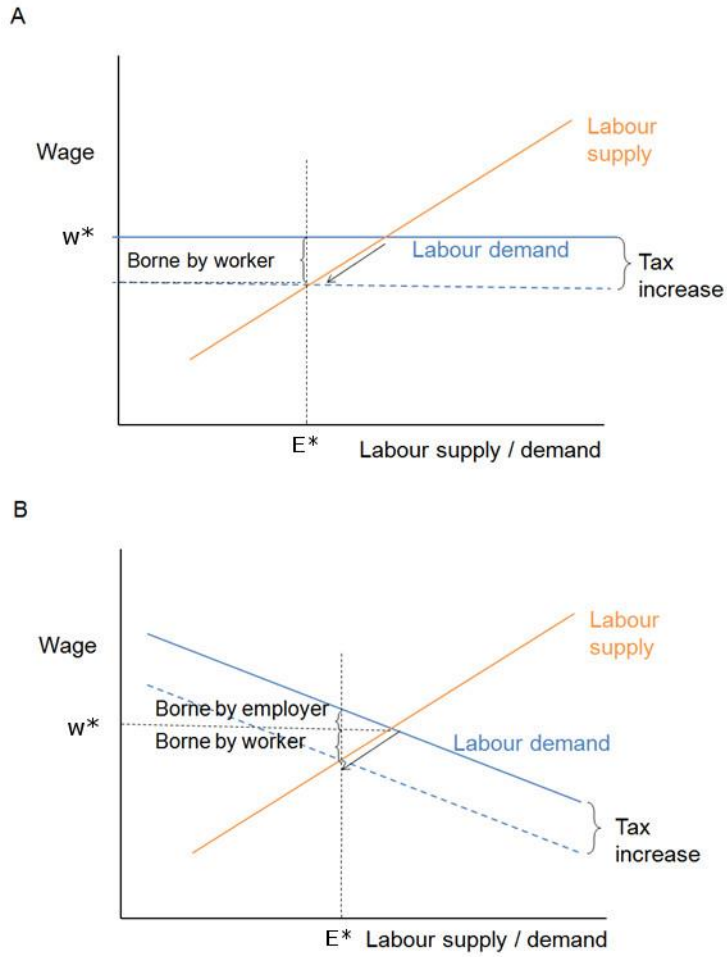
Figure 5 shows the situation where labour supply is somewhat elastic, and: in panel (A) when labour demand is completely elastic; and in panel (B) when labour demand is incompletely elastic. The labour supply curve is shown in orange, and the labour demand curve shown in blue.

Initially, no taxes are levied. Market equilibrium is at the point at which labour demand and labour supply are equal: let's call the resulting level of employment "E*", and the resulting wage rate "w*". Now let's introduce a tax, in this case, formally levied on workers, so, that for a given gross wage paid by employers, workers receive a lower net wage. But who bears the economic burden of this tax? In the case of completely elastic labour demand, panel (A) shows that the incidence is fully on the worker: the gross wage remains unchanged, and the worker bears the full burden of the tax in the form of a lower net wage. However, in the case of incompletely elastic labour demand, panel (B) shows that the incidence of the tax is split between the worker and the employer. Intuitively, as the workers reduce the amount they are willing to work because of the lower net wage they receive when the tax is in place, the employers are willing to pay a higher gross wage to help maintain supply of (the now more scarce) labour. Thus the burden of taxation is split between employers who

[29] An elasticity is a measure of the degree of responsiveness. In this context, for instance, an elasticity of labour supply of 1 means that the amount of labour supplied increases by 1 % when the net wage increases by 1 % (or in the case of labour demand falls by 1 % when the cost to the employer increases by 1 %). If labour supply or demand is completely unresponsive to changes in wages, this report terms it "completely inelastic". If labour supply or demand responds infinitely to a small change in wages, we describe it as "completely elastic". See also Section 3.3 for a distinction of the different types of elasticities.

pay somewhat higher gross wages than in the absence of the tax, and workers, who none-the-less still receive a lower net wage than in the absence of the tax.

Figure 5: The relationship between behavioural response to taxation and tax incidence



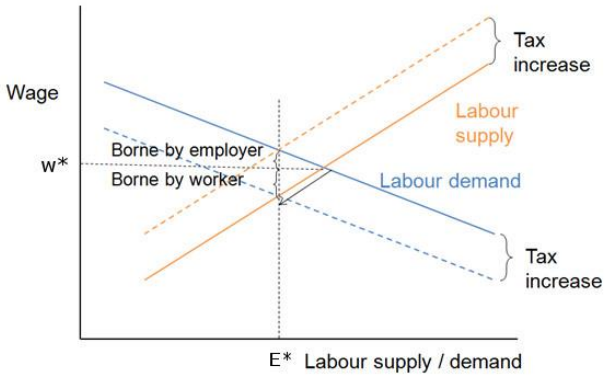
Source: Own illustration

This illustrates a more general pattern. Holding the elasticity of labour supply fixed, the more elastic is labour demand, the larger the share of the burden of tax that is borne by the worker, and vice versa. Intuitively, as employers become more responsive to the price of labour, they are less willing to bid up wages when a tax is imposed, and therefore more of the burden falls on workers. And holding the elasticity of labour demand fixed, the more elastic labour supply is, the lower the share of the burden of tax that is borne by the worker. Intuitively, as workers become more responsive to the price of labour, taxes reduce their labour supply more, and therefore employers have to bid up wages more to keep them working; therefore more or the burden falls on employers, and less on workers. As already mentioned, the incidence of tax is therefore a function of the relative responsiveness of labour demand and labour supply.

Figure 6 shows another feature of classical models of the labour market: the side of the market on which a tax is legally (or statutorily) levied does not affect its economic

incidence – which is a function of labour supply and demand elasticities. The Figure shows two scenarios. First, as in Figure 5, the case when the tax is legally levied on the employee so that the net wage they receive (the dashed blue line) is lower than the gross wage paid by the employer (the solid blue line). Second, is the case when the tax is legally levied on the employer, so that the cost of employing the worker (the dashed orange line) exceeds the gross (and net) wage the employee receives (the solid orange line). In both cases the tax is of the same magnitude; just its legal incidence differs. Figure 6 shows that the economic incidence is the same though – the cost to the employer, and the net wage received by the employee adjust in exactly the same way, irrespective of which side of the market the tax is legally levied. This is the "invariance of incidence" proposition (IIP).

Figure 6: The invariance of incidence proposition (IIP)



Source: Own illustration

Of course, even in this simple model, it may take time for wages to adjust. In the short run then, the legal incidence of a tax may matter for its economic incidence. And in different models of the labour market – for instance, bargaining models where workers and employers bargain over the gross wage –, perhaps formal incidence matters in the long as well as short run. Testing whether the IIP holds is therefore key to understanding the incidence of taxation, and the effects of employer versus employee taxes on the labour market and economy more generally. It is perhaps surprising therefore, that only a relatively small number of papers actually test this proposition. However, rather than a lack of interest, this may reflect the fact that changes in employer and employee social security contributions (SSCs) often occur in conjunction, rather than separately, which presents problems for econometric identification.

More generally, identifying the incidence of taxes from observable data is problematic. Whilst the relationship between behavioural responses to taxation and the incidence of taxation is relatively simple in theory, separately identifying behavioural effects from the incidence of taxation is often more difficult in practise.

If one observed both gross earnings, and the amount of labour utilised, one could calculate the wage rate paid. In this case, one could calculate everything that one needs to separately identify labour supply, labour demand, and tax incidence:

- The overall change in labour utilised would reflect the combined absolute effect of the responsiveness of labour supply and labour demand;
- The change in the wage rate would reflect the incidence of the tax, which reflects the relative responsiveness of labour supply and demand;
- This could then be used to work out how much of the overall responsiveness of labour utilised reflects labour supply and labour demand responsiveness.

However, in practise, one does not observe the amount of labour utilised, nor the true underlying wage rate. Instead, one typically observes hours of work – which omits important margins on which people can respond to taxation, such as the effort exerted per hour of work. To see the problems this can cause, again consider a tax increase. Individuals respond by reducing how much labour they supply, not by working fewer hours, but by exerting less effort per person. Because workers are putting in less effort, all else equal, employers would be willing to pay them less per hour. But if labour demand is incompletely elastic, employers will bid up the underlying wage per unit of effort in order to encourage more labour effort to be supplied. This would tend to push wages per hour back up. The change in the hourly wage paid therefore reflects a mix of changes in effort, and the partial incidence of the tax on employers. One therefore cannot separately identify incidence from the underlying behavioural effects that drive incidence.

This problem plagues the literature that examines tax incidence and the larger literature examining behavioural responses to taxation. Much of the classical labour supply literature, for instance, estimates how responsive hours of work or employment are to the incentives created by the tax and benefit system. But in doing this it omits responses on other margins, including effort (Meghir and Phillips, 2010). The literature examining the elasticity of income that developed following the work of Feldstein (1995, 1999), looks at how responsive taxable or total income is to changes in tax systems, precisely to account for responses by variables other than hours – effort, compensation form, tax evasion etc..[30] However, implicitly the analysis is built on the foundation of perfectly elastic labour demand where incidence of a tax is fully on workers. If taxes are not fully borne by workers, change in income may not only capture broader behavioural responses, but also be "contaminated" by changes in underlying wage rates due to the sharing of the burden of taxation between workers and employers.

This means that certain forms of behavioural responses to taxes need to be ruled out by assumption to make progress.

One option is to rule out non-hours responses to taxation. This is the implicit assumption utilised in studies of incidence that use measures of hourly pay, or unit labour costs, to examine the incidence of taxation. This includes influential papers in both the macro- and micro- incidence literatures (see below).

A second option is based on the observation that behavioural response to taxation can be split into substitution effects (related to the marginal tax rate), and income effects (related to the average tax rate). If one defines the incidence of a tax based on the overall proportion of a tax that is borne by workers vis-à-vis employers, it is also

[30] See also section 3.3.5 for a short review of the literature using tax return data to learn about the elasticity of taxable income.

related to the average tax rate. If one is therefore willing to rule out income effects, one can therefore interpret the relationship between average tax rates and individual total or taxable earnings as providing information on the incidence of the tax. This approach has been used in a single paper in the micro- literature (Lehmann et al., 2013).

More novel identification techniques also exist – exploiting differences between intra-firm and inter-firm differences in tax rates, for instance, as in Bingley and Lanot (2002). However, as their approach relies on variation in the tax rate at the local level and very detailed information it may only be applicable to a few countries.

3.2. Direct estimates of the incidence of labour taxation

There are two broad strands in the literature that attempts to directly estimate the incidence of labour taxation. The first makes use of the non-linear structure of tax and social security contributions – arising from tax-free allowances, contributions ceilings, and multiple rates –, or differences in tax and social security contribution schedules for different individuals or employers, to investigate the incidence of labour taxation using **within-country** variation. Analyses using this **micro-econometric** approach have found a range of results – with no real consensus as to whether employees or employers bear the burden; or whether the formal legal incidence of a tax (i.e. whether the employer or employee formally pay the tax) matters for its economic incidence.

The **macro-econometric** literature makes use of cross-country and/or time-series variation in labour taxation and aggregate measures of the compensation of employees (such as labour income shares) to uncover the incidence of labour taxation.[31] In contrast to the mixed findings from the micro-econometric literature, the macro-econometric approach has often been interpreted as finding that the burden of labour taxation is largely borne by workers. In particular, analysis in Symons and Robertson (1990) is often cited as evidence that the burden of employers' social security contributions is largely shifted on to workers. However, as we discuss below, there are a number of problems with this analysis, and later macro-econometric studies have actually found more mixed results.

3.2.1. Meta-analysis of results

Before discussing these literatures in more detail, we summarise the findings of a recent meta-analysis of papers estimating the incidence of labour taxation.

[31] Calling the cross-country time-series literature macro-econometric is actually somewhat of a misnomer: rather than using the tools of macro-econometrics, such as time series econometrics, most empirical studies actually utilise panel models, usually more associated with micro-econometrics. But because the literature makes use of aggregate ("macro") employment, wage, and tax data, it seems more natural to think of it as macro-economic, rather than micro-economic. The use of panel models in many of these studies could be problematic though – it is a method designed for analyses where the number of observations (n, for instance, the number of countries) is relatively high, and the number of periods of observation (t, for instance, the number of years) is relatively low (see e.g. Greene, 2003, p. 283.). In contrast, in some studies, the number of countries included is relatively small compared to the number of years of data available. This means results may not be as robust as we would like, since the standard fixed effects approach uses only the variation over time.

Melguizo and González-Páramo (2013) include results from 52 empirical studies from both the **micro**- and **macro**- literature. In a first stage, they provide some descriptive statistics of the results of these papers. The mean proportion of the burden of labour taxation borne by employees in the included studies is 66 %.[32] However the standard deviation is very high (51 %), reflecting the fact that different studies find everything from labour taxes being more than fully borne by employees, through to them being more than fully borne by employers. In other words, there is little consensus in the literature.

In the meta-analysis itself they estimate that 66 % of the burden of labour taxation is borne by employees in the form of lower wages; the standard error of this estimate is actually quite low (4 %). This reflects the large sample sizes of many of the underlying studies. When including controls for the institutional features of the countries included in a study, or the methodology of a study, they find that:

- Workers bear less of the burden of tax in the short run (43 %) than in the long run (74 %).[33]
- Workers bear a greater share of the burden of taxation (79-88 %) in "Nordic economies" (with a highly centralised bargaining), than in "Continental-Mediterranean economies", with an intermediate degree of centralisation, (59-70 %). In contrast, there is little difference in incidence between "Continental-Mediterranean economies" and "Anglo-Saxon economies" (which have a low degree of centralisation).
- Different taxes have different effects on net real wages. In studies looking at income tax, payroll tax and social security contributions only, employees are found to bear 59 % of the burden of taxes. But in studies that look at the overall fiscal or salary wedge (including indirect taxes, or in the latter instance, all factors that contribute to wedge between producer and consumer purchasing power), employees are found to bear 79 % of the total burden. It is not clear whether these differences are a short- or long-run phenomenon.
- The degree of linkage between social security contributions and benefits does not have a statistically significant effect on the proportion of labour taxation borne by employees.
- Unfortunately, they do not test for whether the invariance of incidence proposition (IIP) holds – perhaps reflecting the fact that very few papers have explicitly tested this, as our literature review will show.

[32] As discussed above, while the remaining share of taxes is naturally thought of as being borne by employers, of course this is true only in the first instance: ultimately the burden of the taxes may be shifted to consumers or suppliers via prices, or shareholders via dividends.

[33] This is interpreted as evidence of "nominal rigidities", but it is not clear that this interpretation is correct, as "nominal rigidities" lead to economic incidence being affected by statutory incidence. A lower share being borne by workers in the short run does not necessarily mean that incidence is closer to statutory incidence – this is only the case where incidence is being identified primarily variation in employer social contributions (where statutory incidence is on the employer). If, instead, identification comes primarily from variation in taxes statutorily incident on the employee (such as employee contributions, or income tax), the fact that incidence is less on the worker in the short run, would actually count against "nominal rigidities" being important in the short run.

In this report, we utilise a narrative approach to reviewing the literature. While this may seem less objective and rigorous than a meta-analysis approach it does have some benefits. It allows a more nuanced evaluation of the quality of particular analyses, and can help avoid the risk of drawing too strong conclusions from a literature that actually finds a wide range of results. Our reading of the literature suggests that some of the results suggested by Melguizo and González-Páramo (2013) do seem relatively robust – in particular, a number of papers find that the degree of centralisation of wage bargaining, and/or of the degree of labour market coordination, matters for the incidence of labour taxation.[34] And there is some evidence that nominal wage rigidities mean that statutory incidence may matter more in the short term than in the longer term, as one might expect (it takes time to re-negotiate wages). On the other hand, we would caution against placing too much emphasis on the central estimate that employees bear two-thirds of the burden of labour taxation. The wide range of estimates obtained in different studies, in different countries, and using different methodologies, mean that we believe that no strong conclusions on the average proportion borne by workers can be drawn from the available evidence. And, from a policy point of view, it is important to distinguish between shorter- and longer-run effects, between the effects of different forms of taxation, and between different countries and institutional contexts, meaning that such an average measure is of only limited practical use.

3.2.2. Macro-studies

The OECD (1990) study

The seminal macro analysis was undertaken in Symons and Robertson (1990).[35] Two approaches were used: The first, and most widely known, utilised data from 16 OECD countries in 1974 and 1986. Incidence of employer and employee social security contributions was estimated by looking at the link between changes in real average gross wages and average indirect tax, income tax, and employee and employer social security contribution rates (measured as aggregate revenues divided by GDP) between 1974 and 1986. In particular, the following equation was estimated:

$$\mathrm{dln(w)} = \beta_0 + \beta_1 \mathrm{dt_r} + \beta_2 \mathrm{dt_e} + \beta_3 \mathrm{dt_c} + \beta_4 \mathrm{dln}\left(\frac{\mathrm{y}}{\mathrm{e}}\right) + \mathrm{d}\varepsilon \; dln(w) = \beta_0 + \beta_1 dt_r + \beta_2 dt_e + \beta_3 dt_c + \beta_4 dln\left(\frac{y}{e}\right) + d\varepsilon \mathrm{dln(w)} = \beta_0 + \beta_1 \mathrm{dt_r} + \beta_2 \mathrm{dt_e} + \beta_3 \mathrm{dt_c} + \beta_4 \mathrm{dln}\left(\frac{\mathrm{y}}{\mathrm{e}}\right) + \mathrm{d}\varepsilon \quad (1)$$

where w is the gross wage; t_r is the employer's SSC rate, t_e is the sum of the employee's SSC rate and personal income tax rate; t_c is the indirect tax rate; $\frac{y}{e}$ is average labour productivity, calculated as output divided by employment; and ε is the error term. In such a framework, a coefficient of 0 is interpreted as indicating that full incidence of employer's SSCs is on **employers**, and full incidence of other taxes is on **employees** (because the gross wage paid to employees in unaffected by taxes formally levied on employers or employees). A coefficient of -1 on dt_r would instead

[34] Section 4 of this report provides further discussion on how labour market institutions affect the incidence and behavioural effects of taxes. In this section, we focus largely on empirical results.

[35] The study formed chapter 6 of the economic outlook and is therefore also commonly referred to as OECD (1990). We also use OECD (1990) for the ease of exposition.

indicate full incidence of employer's SSCs on **employees** (and a coefficient of +1 on dt_e and dt_c is interpreted as indicating full incidence of these taxes on **employers**). Equation (2) shows the results of this regression:

$$dln(w) = -0.05 - 0.91^{**}dt_r + 0.33dt_e + 0.68dt_c + 0.97^{**}dln\left(\frac{y}{e}\right) \quad (2)$$

where ** indicates statistical significance. The results suggest that a 1 percentage point increase in the rate of employer social security contribution rate reduces the rate of growth of real wages by 0.9 %, on average. This is statistically significantly different from 0 %, but not from 1 %: the result has therefore been interpreted as indicating that employer social security contributions are fully incident on **employees**. In contrast, the coefficients on employee contributions and income tax, and on indirect taxes, are not statistically significantly different from 0, which is again interpreted as indicating full incidence on employees. An f-test that tests whether the incidence of each tax is the same (i.e. on employees) cannot be rejected – that is, the IIP cannot be rejected.[36] But nor are the coefficients for employee and indirect taxes statistically significant from +1 meaning that we cannot reject that employers ultimately bear the full incidence of these, – and indeed, for indirect taxes, the coefficient is closer to 1 than to 0, and the central estimate is that employers bear two thirds of the burden. This indicates the weak statistical power of this particular analysis, based as it is on only 16 pair-wise observations.

Given that it is based on 12-year difference, some have argued that these results are likely to pick up the longer-run incidence of tax changes.[37] This is not necessarily the case though, and depends upon the exact pattern of tax changes that took place.[38] A second approach based on individual time series for each of the 16 countries, and covering the period from 1955 to 1986, attempts to estimate long-run effects more directly by estimating the following auto-regressive equation:

$$\ln(RPW)_t = \beta_1 \ln(RPW)_{t-1} + \beta_2(lnk - lnl) + \beta_3 TT + \beta_4 X + d\varepsilon \quad (3)$$

where RPW is the real product wage, defined as the gross wage plus employer social security contributions, all deflated by the producer price index; k is the capital stock; l is the labour force; X is a dummy for the period 1970 to 1976 to account for a "wage explosion" during that period; and TT is the total tax wedge calculated as:

$$TT = t_r + t_e + t_c + t_m \quad (4)$$

[36] The F-test performed tests whether $\beta_1 = (\beta_2 - 1) = (\beta_3 - 1)$.

[37] Intuitively, this argument relies on the fact that the measured tax changes that occurred between 1974 and 1986 are more likely to have taken place at some point prior to 1985, say, than in 1985. Thus taking differences over longer periods (e.g. a 12 year period) is more likely to pick up longer term effects that taking differences over shorter periods (e.g. a 1 year period).

[38] Tax changes could have taken place between 1985 and 1986, for instance; or, perhaps, tax changes later in the period reversed tax changes earlier in the period, so that the 12-year difference picks up the shorter-term impact of a later tax **cut**, say, and the longer term impact of an earlier tax **rise**.

where the additional term t_m reflects the difference between the pre-tax price of consumption goods compared to produced output (which OECD (1990) terms an "import tax", as one reason a difference in these two price indices is difference between the price of produced goods and consumed imports). Equation (5) shows the result of averaging the coefficients from regression in each of the 16 countries:

$$\ln(RPW)_{\mathrm{t}} = \underset{(8.4)}{0.8}\ln(RPW)_{\mathrm{t-1}} + \underset{(1.7)}{0.15}(lnk - lnl) + \underset{(0.5)}{0.08}TT + \underset{(2.1)}{0.03}X + \mathrm{d}\varepsilon \qquad (5)$$

where average t-statistics are in parentheses. Because coefficients from 16 individual regressions have been averaged to obtain these results, under the assumption of independence, an average t-statistic of 0.5 is "on the borderline of significance", which means that the results may indicate that employers bear a small positive fraction of the tax burden in the first instance. A further regression is estimated to test for the IIP by in addition including the term t_r- t_e in equation (5). The average coefficient on this difference is -0.05, and the average t statistic is 0.1: this is far from significant, meaning that the IIP cannot be rejected. But as the OECD (1990) points out "the coefficient on t_r- t_e is not well determined". Once the feedback effects of $\ln(RPW)_{\mathrm{t}}$ on $\ln(RPW)_{\mathrm{t-1}}$ ... in such an auto-regressive framework are taken into account, the 95 % confidence of the effect of a 1 percentage point increase in employer SSCs combined with a 1 percentage point reduction in employee taxes is a change in the real product wage of between -1.6 % and +1.2 %. In other words, while the IIP cannot be rejected, neither can the proposition that employer taxes are borne by the employer, and employee taxes by the employee (or indeed, the reverse!).

Lastly, OECD (1990) undertakes a shorter-run analysis:

$$\ln(RPW)_{\mathrm{t}} = \beta_1\ln(RPW)_{\mathrm{t-1}} + \beta_2(lnk - lnl) + \beta_3 TT + \beta_4 dTT + \beta_5 X + d\varepsilon \qquad (6)$$

where the change in the tax wedge (dTT) is also included, either with, or instead of the level of the tax wedge (TT). This finds a β_4 coefficient of approximately 0.5, suggesting that in the short run, around half the burden of taxes are borne by employers in the form of a higher real product wage. This coefficient is very highly significantly different from both 0 and 1. They also test whether the incidence of employer's SSCs differs from that of employee taxes and indirect taxes. They find that

- Employers bear a relatively lower share of employee taxes than employer taxes, meaning that the IIP can be rejected. However they also reject statutory incidence as well, suggesting that even in the short term, some shifting may occur;
- Employers bear more of the burden of indirect taxes than labour taxes, perhaps reflecting the fact that employees and employers pay significant attention to inflation (which will be affected by indirect tax changes) when negotiating pay.

The discussion so far has generated two findings from the OECD (1990) study. First, is that the statistical power of its "longer run" analyses is weak. In the analysis making use of 12-year differences in gross wages and tax rates, one can reject neither the hypothesis that the full incidence of employee taxes and indirect taxes is on **employees**, nor that it is fully incident on **employers**. In the long-run auto-regressive model, one can reject neither statutory incidence nor the IIP. Second, in

the "shorter run" analysis, where statistical power is stronger, taxes are found to be partly incident on employers, and the IIP can be rejected. This latter finding is something we will find further support for in other studies.

The OECD (1990) study has also been subject to a recent critique. In a forthcoming review Geibel et al., look at the empirical methodology and data utilised in the study. They highlight a number of problems with both. For instance, they criticise the use of the following type of approximation $\ln(1+t_r) \sim t_r$ when deriving equation (1), pointing out that it does not hold particularly well for large values of t_r.[39] They also find problems with the tax revenue data utilised by the OECD (1990) – and subsequently by a number of other studies –, which differs from measures constructed directly from published National Accounts data. Although unable to replicate the OECD (1990)'s results using published OECD data, the results that are obtained are shown to be highly sensitive to the choice of years and countries used (excluding Sweden, for instance). For instance, if 6-year (rather than 12-year) differences are used, the coefficient on dt_r is found to vary between 0.119 and -3.622, depending on which 6-year pairs are used.

OECD (1990) – a seminal study which has done much to influence subsequent thinking on labour taxation (see for instance, Saez et al. 2012a, and CPB and CAPP, 2013) – is therefore not a valid basis for concluding that the incidence of labour taxation is shared in the short term, but borne fully by employees in the long term. We now review other papers in the macro- literature, and find some support for differences between short- and long- run incidence, but no firm consensus on whether taxes are fully borne by workers in the long run. A summary of the papers and their results can be found in Appendix Table 1. In what follows, we draw out the implications of the literature, rather than assess each paper on a case-by-case basis.

Other macro studies

We have identified seven other studies that directly estimate the incidence of taxes using macro cross-country data: Alesina and Perotti (1997); Arpaia and Carone (2004); Azemar and Desbordes (2010); Daveri and Tabellini (2000); Nunziata (2005); Ooghe et al. (2003); and Tyrvainen (1995). In general, these studies have improved upon the methodology used in the OECD (1990) study – for instance, including $\ln(1+t_r)$ rather than making use of the aforementioned approximation –, although two of the most cited studies use the same problematic OECD revenue statistics to derive their measures of taxation (Alesina and Perotti, 1997, Daveri and Tabellini, 2000). Measurement error in these tax variables may bias results.

As Appendix Table 1 shows, the studies find a range of results – with some suggesting that labour taxes are borne almost entirely by workers, even in the short run (Arpaia and Carone, 2004), whilst others find that a substantial degree of taxes are borne by employers, even in the long run (for instance, Azemar and Desbordes, 2010), in some contexts. There is also a significant degree of heterogeneity across countries (Tyrvainen, 1995), which, as we discuss below, seems to be linked to wage bargaining

[39] The regression model is derived from the first order condition of a profit maximising firm, which includes the term $\ln(1+t_r)$. They also point out the regression model includes average labour productivity, whereas the underlying model of profit maximisation is based on marginal labour productivity.

regimes. This means that no strong conclusions can be drawn about the incidence of taxation in general. But what patterns emerge from the literature?

We first examine whether there are systematic differences between short- and long-run tax incidence. The dynamic effects of labour taxation are accounted for in most of the papers. Tyrvainen (1995) applies a vector auto-regressive model to look at the long-term effects of taxation on wages. Arpaia and Carone (2004), Azemar and Desbordes (2010), and Nunziata (2005) all include an auto-regressive component: by modelling the persistence of wages, one can differentiate between short- and long-term effects (as in the OECD study). And within the studies applying static panel models, perhaps the most cited paper (Alesina and Perotti, 1997), examines whether calculating changes in wages and taxes over 1-year or 2-year periods affects results.

Alesina and Perotti (1997), in fact, find little difference between such estimates: and if anything, their results that employers bear part of the burden of labour taxation, and the wage bargaining regime is important for tax incidence are stronger (rather than weaker), for 2-year as opposed to 1-year differences. In addition, in Arpaia and Carone (2004), Nunziata (2005), and Azemar and Desbordes (2010), the high degree of persistence of labour costs implies that the long-run effects of taxes on labour costs are larger than the short-run effects. Given that each of these studies finds that a part of the burden of taxation is borne by employers in the short-run; the implication is that employers bear more in the long term.

However, these results should be treated very cautiously. First, as in OECD (1990), the longer-run models have weak statistical power: in Arpaia and Carone (2004), for instance, the long-run effects of taxation on labour costs are statistically insignificant, meaning that it cannot be rejected that the employee bears the entire burden, whereas the (smaller) short-run effects are statistically significant. Second, accounting for the persistence of employer costs is not a particularly convincing way of controlling for the longer-run effect of taxes: it may be better to include lagged values of taxes, or lagged values of changes in taxes. Unfortunately none of the studies examined does this. Third, Azemar and Desbordes (2010) suggest that one should account for feedback effects of the larger long-term effects of taxes on employer costs (on unemployment, say). Doing this they find that the rather than bearing around 90 % of the burden of taxation, falls in wages induced by higher unemployment, mean employers bear only around 55 % of the burden of taxation in the longer term, close to the share borne in the short term. We are less convinced by this argument (it could surely apply to short-term effects too), but it does highlight the difficulty in separately identifying the incidence of taxes from their behavioural effects, that we raised earlier.

Thus it seems difficult to conclude whether incidence differs between the long- and short- run from the macro- evidence.

Estimating separately the effects of different components of the tax wedge – such as employer SSCs, employee SSCs, income tax, and indirect taxes – allows one to test the IIP. Only one study we have found undertakes such a test. Arpaia and Carone (2004) find that employer SSCs and income taxes increase labour costs by a similar statistically significant (but economically very modest) amount, whereas employee SSCs are borne entirely by employees in the form of lower wages. However, in the longer run, the IIP may hold: Arpaia and Carone cannot reject the IIP in the longer run, although like their other long-term results, this may again reflect weak statistical power.

More studies examine whether social security contributions have different effects to income taxes. Alesina and Perotti (1997) finds evidence for differences in the incidence of income tax compared to SSCs (employer plus employee) in the short-term – with employers bearing more of the burden of income tax than SSCs in countries with highly centralised bargaining, and more of the burden of SSCs relative to income tax in countries with moderate or low degrees of centralisation (only the former result appears to be statistically significant though). The authors suggest this may reflect the link between SSCs and benefit entitlements (see also Summers, 1989) – which negotiators in more centralised wage bargaining systems are better able to take account of. In support of this, Ooghe et al. (2003) also find hints that the share of the burden of employer SSCs that is shifted to employees increases with the strength of the link between contributions paid and benefit entitlements. Again, in the long-term, these factors may matter less: Tyrvainen (1995) finds no difference between the incidence of employer SSCs and income tax in 8 out of 10 countries in his longer-run analysis.

Perhaps the most consistent result is that labour market institutions, and in particular, the degree to which the wage bargaining process is centralised, plays a role in determining the economic incidence of labour taxation. Following analyses of how wage bargaining processes affected the link between taxation and unemployment, Alesina and Perotti (1997) examined how they affected the link between taxation and labour costs. They find that in countries with highly centralised wage bargaining (between a general employers' confederation, and the confederation of trade unions, say), and in countries with strongly decentralised wage bargaining (such as between individual firms and its workers, or individual workers), taxes are borne almost entirely by workers. In contrast, in countries with an intermediate degree of centralisation (e.g. industry-level bargaining), around two-thirds of the burden of taxation is borne by employers. This is consistent with their theoretical model of the labour market where as unions gain market power they are able to shift more taxes on to employers but that when bargaining takes place at the economy-wide level, less shifting occurs as unions then have more of an incentive to take account of the negative effects of high labour costs on employment. This develops ideas from Olson (1982), Calmfors and Drifill (1988) and others.

Following this work, four of the other studies also examine the role wage bargaining plays in determining the incidence of taxation.[40] Daveri and Tabellini (2000) find similar (albeit less strong) effects, with employers bearing around 40 % of the burden of labour taxation in countries with an intermediate degree of centralisation, and relatively little elsewhere. Nunziata (2005) use a different measure of "labour market coordination" and find employers bear a slightly higher fraction of taxes in countries with a moderate degree of coordination, than in those with a lot or a little coordination. However, when using the same measure of "centralisation" as in earlier work, they find that employers bear part of the burden in countries with a moderate and low degree of centralisation: only in countries with a high degree of centralisation

[40] Tyrvainen (1995) find a significant degree of heterogeneity of incidence across countries. Although not explicitly linked to bargaining institutions, the pattern is suggestive. Incidence is more on workers in the US, UK and Sweden (highly centralised or decentralised countries), and more on employers in Germany and a number of other continental European countries (which have an intermediate degree of centralisation).

do workers bear the entire burden. Azemar and Desbordes (2010) also find this pattern: workers in countries with a high degree of centralisation, bear all of the tax, but less than half in decentralised countries. Finally, Arpaia and Carone (2004), find the opposite pattern – with countries with an intermediate degree of centralisation exhibiting full incidence on workers, but those with a high degree of centralisation or decentralisation showing some incidence on employers (albeit only a modest amount). Whilst consistently finding an effect of bargaining institutions on tax incidence, therefore, the literature does not provide a simple consensus on just what those effects are.[41]

Taken together, the picture from that emerges from the macro literature is therefore a little disappointing and more than a little confusing:

- It is not clear what fraction of the burden of tax is borne by workers or employers in either the short- or long-run, in part, reflecting the difficulty of estimating long-run incidence;
- Little work examines the IIP. More work examines differences between the incidence of SSCs and income tax, a comparison to which the IIP need not apply – because of the link between SSCs and benefit entitlements;
- It is clear that wage bargaining institutions matter and most papers suggest a high degree of centralisation is associated with a greater share of taxes being borne by workers than an intermediate degree of centralisation. Furthermore, papers tend to find that incidence under decentralised systems is closer to that under high degrees of centralisation.

We now examine studies making use of within-country changes to SSCs and taxes to see if stronger conclusions can be drawn from these.

3.2.3. Within-country studies

The literature that makes use of data from a single country, often in the form of micro (employer- or worker-level) data, is larger, and growing more rapidly than the macro-literature. It also differs in its scope: rather than examine how changes in the overall tax wedge (including SSCs, income tax, and sometimes indirect taxes), papers in the micro- literature typically examine the incidence of SSCs, or payroll taxes, only. Of the studies we have identified, only 2 examine the incidence of income tax (although rather more examine the incidence of tax **credits**, such as the Earned Income Tax Credit in the US, and similar schemes in Europe). We therefore organise this part of the review by **tax** rather than countries or econometric approach.

Studies of the incidence of SSCs

Turning first to SSCs and payroll taxes, the evidence does not support Fullerton's and Metcalf's (2002) claims that studies have "consistently" found that the incidence of such taxes is fully on workers. While three of the most influential studies find this to be the case (Gruber, 1997, Anderson and Meyer, 1997 and 2000), a number of other studies find incidence of the tax is shared between workers and employers, and that the splitting of the legal incidence of SSCs (Saez et al., 2012a) translates into economic incidence.

[41] The review of the wage settings institutions in section 4.1 will shed some more light on the differences in the results.

The majority of the studies adopt a panel, or difference-in-difference (DiD) style approach, making use of reforms to social security contributions that affect different workers or different employers in different ways. Gruber (1997) is typical. Gruber uses data from censuses (in 1979, 1980, 1984 and 1985) of all manufacturing plants in Chile with more than 10 employees. A major reform to the Chilean social security system in 1981 led to substantial changes in both employee and employer SSCs, which differed substantially across different manufacturing plants, because of the significant degree of heterogeneity in the amount of SSCs different employers were liable to for a given wage bill, both pre- and post- reform. This reflects the wide range of different social security institutions in Chile, with different tax rates, and features of the SSC regime such as tax rates depending on assessed risks, and the exemption of certain wage costs from SSCs. Gruber (1997) is only interested in estimating the incidence of employer contributions: changes in employee SSCs are a confounding factor in his model that he attempts to overcome. A number of different empirical approaches are used, to try to overcome this, and other confounding factors. This includes standard DiD (identifying from differential changes in wages between plants), and difference-in-difference-in-difference (identifying from differential changes in wages between blue and white collar workers within a plant). The results suggest that there is full shifting of employer contributions to employees in the form of lower wages. And for white collar workers in particular, there is evidence of more-than-full shifting (with wages falling by more than the cash value of contributions). Gruber interprets this as indicating that workers highly value the type of insurance provided by the SSC system (which is often poorly provided for in the private sector), and are therefore willing to pay a more than actuarially fair price for it. This suggests that the link between SSCs and benefits may matter for incidence.

Anderson and Meyer (1997, 2000) use similar variation in SSCs across employers in the United States to estimate the incidence of employer contributions there. In both papers they find evidence that, aggregate or industry-level changes in employer SSCs are borne to a significant extent by workers (point estimates from their 1997 paper suggest there is a little less than full shifting, but those from their 2000 paper suggests there may be more than full shifting to workers). However, two things are worth noting. First, the standard errors associated with the estimated coefficients are large – in a number of instances, the 95 % confidence intervals span the interval between no shifting, and far more than full shifting. Second, employers are much less able to shift firm-specific changes in employer SSCs to workers. This may reflect the fact that firms are competing with other firms in the same industries for workers (as well as for customers), and can therefore not pass on firm-specific costs, but only costs that are common across firms in the industry. This can lead to employment reallocation across firms, which the authors argue means the results confirm that "in some cases, differences in taxes across employers lead to large dead-weight losses". This difference between "firm" (or individual) and "market" level incidence is important and is something that the rest of the literature using micro- data has tended to not pay close enough attention to.

Murphy (2007) uses variation in unemployment insurance (UI) taxes and wages across US states in the period between 1992 and 2002 to look at the extent to which the incidence of tax differs for different types of workers. He notes that with variation in UI rates across states, workers (and employers) can respond by moving between

states: those workers who are most mobile across states would be more "responsive" to variation in UI rates and would therefore bear less of the burden of the tax than those who are less geographically mobile. Based on data on inter-state mobility, those aged 16-24 and working at least 20 hours a week, and married white women aged 25-54 working full time are defined as "less mobile"; married white men aged 25-54 working full time are the "more mobile" group. He finds evidence that the falls in wages when the UI base is extended or when there are unpredictable increases in UI rates42 take two years to materialise, and are larger for the "less mobile" workers. Depending on the method used, between one quarter and three quarters of UI appears to be borne by married male workers (and the rest by employers); for women, and youths, however, there is some evidence of more than full shifting of the burden.

The US has, on the whole, highly decentralised wage bargaining, as does Chile. Taken together, these papers therefore add to the impression that workers are likely to bear a substantial part of the burden of employer (and likely employee) SSCs in countries with decentralised bargaining. Within Europe, this includes countries like the UK and Ireland. But what do studies undertaken in European countries themselves suggest?

Bell et al. (2002) use a DiD approach and industry-level data to analyse the incidence of employer SSCs in the UK with identification provided by the differential impact across sectors of a 1999 reform. Changes in the average wage in each industry are related to the average change in employer SSCs paid by firms in that industry. Results suggest that employer SSCs are fully borne by workers – indeed, there is some evidence again, that workers bear more than the full burden, which is somewhat strange in the UK context given the very weak link between contributions and benefits (and the fact that the reform did not change benefits). However, estimates are imprecise (the 95 % confidence is that workers bear anything from about a quarter of the incidence, to more than two and a half times the incidence) and there is evidence of output prices also responding to the change in SSCs, which would seem strange SSCs if SSCs are quickly and fully reflected in changes in nominal wages. Results from this study (the only published study for the UK we have found), should be treated with caution.

Lehmann et al. (2013) look at the effect of changes in employer SSCs (and tax credits) on the employer cost of labour in France. They make use of reforms in the mid-2000s that differentially affected firms operating 35-hour and 39-hour contracts to identify the behavioural effects of SSCs (identification for the impact of tax credits comes from their differential affect according to income and number of children). A model of the following form is estimated:

$$\Delta \ln(\mathrm{z}) = \alpha + \beta_t^{SSC} \Delta \ln(1 - \mathrm{t}^{SSC}) + \beta_t^{it} \Delta \ln(1 - \mathrm{t}^{it}) + \beta_{\bar{\tau}}^{SSC} \Delta \ln(1 - \bar{\tau}^{SSC}) + \beta_{\bar{\tau}}^{it} \Delta \ln(1 - \bar{\tau}^{it}) + X\delta + \varepsilon \quad (7)$$

where z is employer cost, t^{SSC} and t^{it} are marginal SSC and tax credit tax rates, and $\bar{\tau}^{SSC}$ and $\bar{\tau}^{it}$ are the equivalent average tax rates. Coefficients on the marginal tax rates pick up substitution effects, whilst those on average tax rates pick up either income

[42] Murphy (2007) argues that many of the changes in UI rates are predictable based on the economic cycle.

effects, participation responses, or the incidence of a tax (the paper is agnostic about which of these phenomenon it is investigating). The results show that changes in employer payroll taxes are reflected almost one-for-one in employer cost (i.e. the hypothesis $\beta_t^{SSC} = -1$ cannot be rejected) indicating that employers bear almost the full incidence of employer contributions, at least in the short run. Note, that income effects and participation responses would tend to go in the opposite direction (i.e. have a positive effect on β_t^{SSC}) meaning this result cannot be explained by these effects confounding the effect of the incidence of employer SSCs. This result is in line with results from Aeberhardt and Sraer (2009), who find that the reduction in employers' payroll tax for low-wage workers did not generate wage moderation (see also Lhommeau and Remy, 2009 and Bunel and L'Horty, 2012).

Saez et al. (2012a) find similar results for Greece but plausibly argue that their method uncovers the long-term rather than short-term incidence of SSCs. They make use of a reform in 1993 which led to new entrants to the labour market after that date facing a permanently much higher earnings cap for payroll taxes than existing workers did. This increased the amount of employer and employee contributions levied on the earnings of those new workers who earned more than the initial cap. The analysis uses a regression discontinuity design approach, comparing the earnings of people entering the labour market just before and just after the reform took place. In their main specification, "just before" is interpreted as the 5 years prior to the reform; and "just after", the 5 years after. Because these 5-year bands may seem too wide, they also test the sensitivity of their results to using 2-year "before" and "after" bands.

Three measures of earnings are measured: the employer cost; the gross "posted" earnings; and the net earnings received by the worker. If employers were able to shift the burden of employer SSCs fully on to workers, the employer cost of people entering the market "just before" and "just after" the reform should be the same; the gross and net earnings would be lower though, reflecting the additional employee SSCs and shifted employer SSCs being borne by workers. On the other hand, if workers were able to fully shift the burden to employers, net earnings would remain unchanged and gross wages and employer cost would be higher for those entering the labour market after the reform.

In fact, it is gross earnings that are unchanged before and after the reform; employer cost jumps up, and net earnings jumps down. The size of the discontinuities mirrors the discontinuities in average employee and employer SSC rates caused by the reforms. Saez et al. argue that this means that statutory incidence matters for economic incidence: employers bear the cost of employer SSCs, and employees of employee SSCs. This is rationalised by long-lasting nominal wage rigidities associated with workers and employers bargaining over gross earnings, rather than net earnings and employer costs. In other words, employers find it difficult to offer different gross earnings to workers based only on the tax regime they face. However, this is not necessarily the case: it could just be that the economic incidence of both employee and employer contributions is the same and it just happens that the share formally borne by workers versus employers happens to align well with the sharing of the economic incidence of the tax. So Saez et al.'s approach – where the change in employee and employer contributions is co-linear – cannot really allow one to test whether the IIP holds or not. Nevertheless the results are fairly convincing indicative evidence that the IIP may not hold in the long run.

A number of studies look at the incidence of SSCs in Scandinavia.

Holmund (1983) is an early paper for Sweden, and uses a very simple time-series model relating changes in average SSC rates to changes in average hourly wages and prices in the mining and manufacturing sectors. The results suggest that around half of the burden of employer social security contributions is borne by employers, and the other half by employees, at least in the short term.

The more recent Scandinavian literature focuses on evaluating the impact on wages of reforms to SSCs that target particular regions or parts of the population. A number examine the effect of reductions in SSCs in so-called "regional support areas" in Finland and Sweden. Bennmarker et al. (2009) looks at the impact of a 10 percentage point reduction in employer SSCs in 2002 in northern Sweden. When looking at *existing* firms only, they find that workers saw a 0.25 % increase in wages for every 1 percentage point decrease in the employer SSC tax rate. This would suggest workers gained a little, but most of the gains from lower employer SSCs were retained by employers. Interestingly, when allowing for entry and exit of firms, the effect on wages becomes statistically insignificant (although this could relate to selection effects – those firms who enter to take advantage of labour costs could be lower-paying employers, for instance).[43]

Korkeamäki and Uusitalo (2009) and Korkeamäki (2011) look at the impact of similar policies in Finland using a DiD approach. The former paper finds that wage increases shifted about half of the gains from lower employer SSCs to workers in the form of higher wages, although the estimates are unfortunately not statistically significantly different from zero. However, the latter paper, which uses a larger sample of employers, finds little effect on wages (suggesting that employers kept all the gains). Delving deeper, Korkeamäki (2011) estimates the effect on wages to be positive and significant in one region (Lapland) but negative and significant in the other (Kainuu). It is possible that the results for Kainuu are impacted by a negative shock in that region (a violation of the common trends assumption required for DiD analysis), but equally, so could the results for Lapland.[44] These papers therefore highlight the difficulty in finding a plausible identification strategy.

Two other Swedish studies examine the impact of reforms to employers SSCs for young people in 2007 and 2009, which reduced contribution rates by a total of around 16 percentage points (11 percentage points in 2007, and a further 5 percentage points in 2009). Egebark and Kaunitz (2012) analyse the impact of the first round of cuts in 2007 across the economy as a whole. A DiD approach is used, where the treatment group are aged 21–24 (those benefiting from the first round of the reform), and the control group are those aged 25–26. The study finds a small positive effect on employment, and virtually no effect on wages, implying that the cuts in employer SSCs were incident on employers. Skedinger (2012) focuses on the impact of the reforms on workers in the retail sector. Again a DiD approach is used, and he finds that wages increased by between only 0.8 and 1.1 per cent as a result of the reforms, which would mean an overwhelming majority of the incidence of the cut in SSCs was enjoyed by employers in the form of lower labour costs.

[43] Selin (2012) investigates the role of taxation for the SSC for self-employed and finds at tax price elasticity of -0.5.

[44] See section 3.3.2 for a short discussion of the common trend assumption.

Along with the results for France and Greece, and those of Anderson and Meyer (1997, 2000), this Scandinavian literature highlights that the incidence of a change in labour taxes is likely to vary according to how broad a group of people or employers that change affects. For instance, in the US reforms, a large part of the change in employer SSCs that was common across employers in their sector was passed on to workers, but very little of the firm-specific change was. In France, 35-hour and 39-hour firms faced differential changes in employer SSCs, and could not pass these on to workers. And one interpretation of the results for Greece is that employers could not pass on a large increase in employer SSCs to workers who entered the labour market after reforms, but that workers did bear the effect of higher employee SSCs. Competition between similar employers for workers, and between similar workers for jobs, combined with firm-level bargaining over the nominal gross wage (rather than employer cost and net wage) could explain such a pattern. It could also mean that targeted reductions in employer SSCs are more likely to lead to reductions in employer costs, than more broad-based reductions in employer SSCs.

These findings also have methodological implications though. One reason why studies using micro- data may be more likely to find employers bear a substantial part of the burden of SSCs than macro- studies do is the type of variation in tax rates utilised. Micro- studies exploit variation **between workers and employers**, whereas macro-studies exploit variation **over time** or **between countries**. Employers may not be able to change gross wages for different employees, or offer different gross wages to other employers, in order to pass on idiosyncratic variation in their SSC bills. But it seems more likely that they can offer different wages over time, or compared to employers in other countries (due to limited labour mobility, for instance, as suggested by Murphy, 2007). And perhaps a note of caution should be sounded for the results more generally. If employers pass on changes in SSCs to workers not by changing individual wages, but by changing the average wage they pay across all workers (that is the burden of SSCs is shared across workers), identification based on comparing individuals directly affected by a reform with those not directly affected would be inappropriate. This means DiD analysis comparing workers (or employers) affected differentially by a reform may be drawing erroneous conclusions. Taxes may be shifted from employers to workers (or vice versa) not at the individual level, but at the employer or market level. This is a difficult issue to overcome, but has been utilised as an identification strategy in a novel analysis of the incidence of income tax.

Studies of the incidence of income tax or tax credits

Bingley and Lanot (2002) make use of the variation in local income tax rates across municipalities in Denmark to identify both the behavioural effects and incidence of income tax. Tax rates vary based upon where the employee lives, rather than where the employer is based. This means that a given employer (or establishment) will often employ people who face a range of different income tax rates. At the same time, the average tax rate faced by employees will differ across employers based on where they are located, as employees tend to be drawn from a fairly local pool. Bingley and Lanot assume that establishment- or employer- level wage setting means that employers cannot vary wage rates paid to employees based solely differences in the income tax rates they face. Any within-employer variation in the earnings of "similar employees" associated with differences in the income tax rates they face, are therefore assumed to be the result of behavioural response (e.g. working longer hours, or working harder

per hour). Information on the incidence the income tax is then backed out using information on between-employer variation in earnings and average income tax rates, and what is known about behavioural response from the within-employer variation. Results suggest there is partial shifting (40 %) of the burden of income tax from workers to employers.

Kubik (2004) looks at the incidence of income tax using the American 1986 income tax reforms. He looks at how hourly wages change for different occupations affected differently by these tax reforms, implicitly assuming that behavioural change is captured by hours of work and employment. The findings show that those occupations that saw relatively large falls in their marginal tax rates also saw their relative wages fall.[45]

A range of papers examine the incidence of tax credits. Azmat (2006), looks at the incidence of the Working Families Tax Credit (WFTC) in the UK. Using a DiD approach (comparing claimants with similarly skilled non-claimants), she finds that employers captured about 35 % of the value of the tax credits paid to men, on average, by reducing the gross hourly wage. Employers could not reduce wages below the National Minimum Wage, however, meaning less of the incidence of the tax credit was on employers for the lowest paid. This may be one reason why no robust effect of tax credit receipt on the wages of women can be found (women tend to have lower hourly wages). Azmat also finds evidence of spillover effects, with wages in industries and for education groups with high numbers of WFTC claimants seeing a slow-down in wage growth relative to other industries.

Leigh (2010) and Rothstein (2008) find similar results for the US Earned Income Tax Credit (EITC). Rothstein's identification is provided by the differential effect of the EITC on individuals with different skill levels and different family structures. He finds that for every $1 of EITC paid, recipients benefit by 70 cents, with reductions in their gross wage benefiting their employer by 30 cents. Again, there is strong evidence of spill-over effects on the wages of other ineligible low-skilled workers. Reductions in their wages benefit employers of low-skilled labour more generally by 42 cents for every $1 of EITC paid, increasing the overall benefit to employers to 72 cents.[46] These results therefore emphasise how different market-level and individual level incidence can be. It is a weakness of the incidence literature that most papers do not distinguish between these two phenomena.

3.2.4. Summary

A recent meta-analysis (Melguizo and González-Páramo, 2013) provides a relatively precise estimate of the fraction of labour taxes borne by workers in the form of lower wages: around two-thirds, on average. The narrative literature review undertaken here, however, finds that the range of estimates is too broad, and too contextually specific, to consider this to represent a consensus on how the incidence of labour taxes are shared between workers and employers. However, the review has suggested the following:

[45] Unfortunately, Kubik (2004) relates changes in hourly wages to changes in **marginal** (and not average) tax rates, meaning that results are not fully comparable to other studies.

[46] In a follow up paper Rothstein (2010) simulates the incidence of the EITC and finds that employers capture 0.36 cents from non-eligible low skilled workers.

- Although there is a wide-range of results, the balance of evidence suggests there is likely to be some degree of sharing of the incidence of labour taxation between workers and employers, possibly even in the long run. This includes income taxes as well as social security contributions.
- But the extent to which labour taxes are borne by workers or employers seems to differ between different countries. In particular, incidence appears to be related to the degree of centralisation in bargaining, in both theory and practise. There is some evidence that more of the incidence of such taxes are borne by employers in countries where bargaining takes place at the industry level (an "intermediate degree of centralisation"), than at the firm/worker level ("low centralisation") or at the multi-sector or economy-wide level ("high centralisation"). Support for this is strongest in the macro- as opposed to the micro- literature, perhaps reflecting that many of the micro- studies for countries with a high degree of centralisation (like Sweden) are based on reforms that affect only a subset of the labour market.
- Tests of whether the legal incidence matters for economic incidence (i.e. whether the IIP holds) are surprisingly few and far between. What evidence that does exist suggests that legal incidence is likely to matter in the short term; whether it matters in the long term is less clear, in part because standard errors are large in many long-run models.
- More generally, the literature examining long-run incidence is sparse and beset by identification problems. More research is needed, using consistent methods on both macro- and micro- data on a cross country basis. This includes application of true time-series econometrics, rather than simple autoregressive models.

3.3. Review of the literature on labour supply elasticities

Individuals can respond to changes in (real) wage rates along three margins: participation on the labour market (the **extensive margin**), hours worked (the **intensive margin**) and **taxable income** (Blundell, 2012). The last margin includes variations in work effort, as well as the shifting of wage income towards other forms of taxable income (such as capital or corporate income), towards activities that reduce the tax base (such as higher expenditures on housing or charitable giving), or towards tax evasion (Saez et al., 2012b). In this section, we will first discuss the pure labour supply response to changes in the real wage rate, starting with a brief description of the economic model of labour supply, and the empirical strategies that have been employed in the recent literature to estimate the size of responses, mentioning the key econometric issues with each approach. Then we will aim to give an overview over consensus estimates of labour supply elasticities for various socio-economic groups relying on other surveys and recently published studies. We then discuss recent efforts to incorporate family decision making into the standard labour supply model. In the final part of this section, we review what can be learned from the literature about the elasticity of taxable income from recently available tax return data.

3.3.1. Economic model and interpretation of the wage elasticity of labour supply

The Marshallian (uncompensated) wage elasticity of labour supply is defined as the percentage change in labour supply in response to a 1 percent change in the (net) wage rate (holding non-labour income constant). In contrast, the Hicksian

(compensated) elasticity holds utility constant, isolating the "pure price effect" of a change in the wage rate. More studies report the uncompensated (Marshallian) than the compensated wage elasticity, which is why we concentrate on this measure. In the theoretical model, the income effect of a change in the net wage rate has to be considered as well: as wages increase, budget sets expand, and individuals might want to substitute time towards leisure, counteracting the price effect of a wage increase. In the empirical literature, however, there is a consensus that the income elasticity of labour supply is zero, or very close to zero, to the extent that the literature on taxable income tends to assume income elasticities away (e.g. Bargain et al. 2014, Saez et al. 2012b).[47]

A typical static model of labour supply could take the form

$$\ln(h_{\mathrm{it}}) = \alpha \ln(w_{\mathrm{it}}) + \beta Y_{it} + \varepsilon_{it} \tag{8}$$

Where w_{it} is a measure of the after tax wage rate, Y_{it} is non-wage income, and ε_{it} is a random disturbance, including influences that are not observable to the researcher. If estimated correctly, α is the Marshallian wage elasticity in a static model of labour supply (holding non-wage income constant). As noted by Blundell and MaCurdy (1999), this static model assumes individuals to be either myopic (they only consider the present period when making their labour supply decisions) or credit constrained (they are unable to transfer income across periods). Furthermore, this model ignores the effect of current labour supply on future wages (Keane, 2011).

If individuals do shift income and consumption between periods (e.g. save income in anticipation of idle periods over the life cycle), this elasticity confounds two different labour supply adjustments: the labour supply response to anticipated wage movements over time (the intertemporal or Frisch elasticity), and the response to shifts in the entire wage profile (changes in the expected wage for each period over the lifecycle, e.g. due to a permanent shift in the demand function, or a tax reform). Blundell and MaCurdy (1999) call the first change an evolutionary change in the wage rate, because it constitutes a move along the same individual wage profile, and the second a parametric shift, because it alters the entire expected wage profile. To see the difference between these concepts, consider a temporary reduction in the tax rate that is expected to be rescinded in the future. Anticipating a lower after-tax wage rate in the next period, an individual could decide to work and save more in the current period, while reducing her labour supply in the future, when the tax reduction is abolished. Estimating a model such as (8) would yield an inflated Marshallian elasticity, since the individual plans to reduce her labour supply in the next period, merely shifting it through time.

The direct assessment of labour supply elasticities over the life-cycle is methodologically – and computationally – cumbersome, and the data requirements, most importantly regarding information on savings and public pension entitlements are difficult to meet in practice (Meghir and Phillips 2010).[48] Also, the static labour

[47] Blomquist and Selin (2010) estimate the taxable labour income elasticity at -0.07 for men, implying that the compensated is about 5 percentage points higher than the uncompensated one.

[48] Both types of elasticities stemming from a lifecycle model can in principle be estimated from cross sectional data using the appropriate specification (Blundell and MaCurdy, 1999). The wage

supply elasticity is the relevant concept for comparing steady state impacts of differences in tax rates across countries (Chetty et al., 2011).We will therefore concentrate on this literature.

3.3.2. Econometric issues and identification

A cross sectional analysis of labour supply usually estimates a (static) labour supply function such as (8), where hours of work are regressed on a constant, the net wage rate, a measure of non-wage income, the spouses' wage rate where applicable, and a vector of other individual characteristics that are thought to influence labour supply, for example the presence of young children, indicating fixed costs of work (Blau and Kahn, 2005).

Since wages are only observed for individuals with positive labour supply, they have to be imputed for those who do not work during the relevant time period. This is usually accomplished using wage information from those in the sample that do work, correcting for selection bias into work.[49]

One major issue with the estimation of a model such as (8) is the endogeneity of the wage rate. Hours worked can correlate with the wage rate not only because labour supply curves are upward sloping (that is, those with higher wage offers tend to work more hours) but also because wage rates and labour supply are both influenced by another, unobserved variable, such as motivation, that leads to both higher wage rates and more hours worked (Blau and Kahn, 2007). If this is the case, ε_it would be correlated with the wage rate in the empirical model (8), which would lead to a biased estimate of α. Willingness to work (or a low taste for leisure) could also be correlated with present asset income, because it implies high past earnings (Keane, 2011). Empirical models therefore often include taste-shifter variables assumed to be correlated with, and thus to a certain degree to control for, taste for work, such as education, number of children, marital status etc. Other empirical strategies to deal with omitted variable bias are instrumental variable techniques and differencing methods, discussed below.

Also, with a progressive tax schedule, hours worked directly influence the net-wage rate, as the individual determines his or her own marginal tax rate by his or her hours choice (Evers et al., 2008). An individual with weak preferences for leisure is likely to

elasticity corresponding to a move along the same wage profile can be estimated by regressing log hours on age, personal characteristics influencing the lifetime wage profile, preferences and permanent income, and the wage rate, which can be instrumented with higher order age variables. Intuitively, this holds the wage profile fixed on the individual level, while letting the wage rate and age vary across individuals. Regressing log wages on property income, higher order age variables, and the wage rate (instrumented by personal characteristics) on the other hand yields the response to a shift in the entire wage profile.

[49] Those who do not work either have higher fixed costs of work (or higher reservation wages), or are offered lower wages than those who do work. Therefore, predicting their wages from the sample of those who participate in the labour market, using their observed characteristics, would lead to an overestimation of their wage offers. The standard approach to deal with this selection into work effect is the Heckman correction. Following Heckman (1979) this involves first the estimation of a selection equation using a probit estimate to derive the probability of working. In the second stage regression the derived inverse mills ratio is used to control for the selection bias. An exception is Blau and Kahn (2007) who predict wages using the observable characteristics of those individuals with low working hours (below 20 hours). Löffler et al. (2014) have a critical discussion of the two-step approach and show that the results are sensitive to the treatment of wages.

work more, and thus face higher marginal tax rates, which can lead the researcher to underestimate the effect of tax rates on labour supply (Meghir and Phillips, 2010). Non-labour income is also likely to depend directly on the wage rate and hours worked since means-tested benefits are usually phased out as earnings rise. This will generate a negative correlation between hours worked and non-labour income (because means-tested benefits are withdrawn if total income rises) and hours worked and marginal, net-of tax wage rates (because of the progressive tax system) (Keane, 2011).

Another concern with the direct estimation of a model such as (8) is measurement error with regards to wages and hours worked (Blundell and MaCurdy, 1999). Even if the measurement error is completely random and unrelated to any other included variables it will bias the OLS estimator towards zero. Furthermore, the measurement error can be considerable, and because hourly wage rates are typically computed by dividing weekly, monthly or annual earnings by hours worked, Keane (2011) argues that measurement error in this context is not random: If hours worked are measured with error, and the error increases in absolute value with hours worked, reported wages for individuals with high labour supply will be consistently lower than they actually are ("denominator bias"), leading to deflated estimates of labour supply elasticities.

Moreover, a labour supply curve such as (8) treats the wage rate as fixed, while observed wage rates are equilibrium wage rates, determined by the interplay of supply and demand. This model assumes that as w_{it} varies across individuals, we are moving along the labour supply curve which enables us to calculate the labour supply elasticity, while in fact the demand curve might be shifting. One approach to deal with this type of endogeneity is controlling for factors that determine the wage rate, but do not influence the labour supply curve directly, e.g. through a correlation with preferences for work. For example, education and age have been put forward in the literature as instruments for labour demand. However, these controls are vulnerable to criticism: someone with a high preference for work might have acquired more education in the past, while preferences for leisure might well vary across the life-cycle (Keane, 2011).

Instrumental variable approaches

One way to address these biases is to use instrumental variable approaches. An instrument is a variable that is correlated with the independent variable of interest – in this case the net, hourly wage rate – but affects the dependent variable of interest (hours worked) only through the independent variable of interest. That is, an instrument can be excluded from the main equation or model of interest (this is an exclusion restriction). Intuitively, the instrumental variable approach looks for exogenous variation in the wage rate, so that any labour supply response can be thought of as being caused by exogenous factors. E.g. Keane (2011) suggests using demand shocks as sources of exogenous variation: businesses might want to increase production if the oil price falls, leading to a demand shock that increases wages. It is unlikely that oil price increases directly affect preferences for work. The instrumental variable approach is typically implemented by two-stage-least-squares: in a first stage, the independent variable of interest is regressed against the instrument or instruments, and against a vector of controls. The fitted values of this regression are then used in the main model (Angrist and Krueger, 1999). Finding good instruments that are both strongly correlated with the hourly net wage, and yet can be included

from the labour supply model can be a challenge. Instruments for the hourly wage rate that have been used in the literature include gross wage rates, deciles of the wage distribution, and education (Blau and Kahn, 2007). Education was often used as an instrument in earlier studies, but the assumption that education is not related to tastes for work is increasingly called into question (Meghir and Phillips, 2010). Therefore, estimates based on cross sectional studies can be viewed as somewhat less reliable as those based on natural experiments or other forms of exogenous variation in wages, such as changes in the wage structure over time.

Quasi Experiments

Quasi experiments are policy reforms that change the opportunities or incentives for one group of people (treatment group), while another group sharing many of the same characteristics remains unaffected (control group).[50] DiD estimators then compare the average change in the outcome of interest following the policy reform, e.g. hours of work, between the treatment and the control group (average treatment effect on the treated).

Fixed effects models that decompose the error term ε_{it} into an individual fixed effect, capturing unobserved factors such as motivation or taste for leisure, and a "true random effect", that is not correlated with wages or non-wage income in a specification such as (8), are computationally equivalent to DiD estimators (Blundell and MaCurdy, 1999). If unobserved individual characteristics, such as preferences for leisure, can be assumed to be time invariant, they can be differenced out using panel data.

Besides its simplicity, the quasi-experimental approach is appealing because it avoids many of the econometric issues discussed in this section. The drawback of this approach is that any results are confined to the specific treatment group and policy reform studied. Also, time effects must be the same for the treatment and control group so any difference in (average) outcomes can be attributed to the policy reform, and the composition of both the treatment and the control group must remain constant before and after the reform (Blundell, 2012).[51]

Discrete Choice Models

Rather than estimating a continuous labour supply function such as (8), discrete choice models assume that individuals (or households) choose from a set of discrete hours options, such as non-participation, part-time, or full time work. For couple households, the discrete options are husband-wife hours combinations. The advantage of discrete choice models is that they directly account for the fact that observed hours of work cluster around zero and full-time hours and incorporate both the intensive and extensive margin of labour supply (Bargain et al., 2014). Furthermore, the use of a maximum likelihood approach implies that the theoretical framework of the random

[50] Blundell et al. (1998) and Burns and Zilliak (forthcoming) use tax reforms which affected people differently as instruments to identify the labour supply elasticity, respectively the elasticity of taxable income. In a sense they are exploiting quasi experimental information, but use an IV approach.

[51] This is also commonly known as the "common trend assumption". Based on the seminal work by Ashenfelter (1978) and Ashenfelter and Card (1985) is well established that a DiD approach can only consistently identify the treatment effect if there is neither selection into the treatment, nor a different trend in the treatment group. See also Imbens and Wooldridge (2009) for further potentially confounding e.g. serial correlation) problems in DiD estimators.

utility model coincides with the empirical approach.[52] Also, the discrete choice approach is well suited to the incorporation of the complexities of the tax benefit system, and its interplay with means tested benefits given the labour supply of different members of one household, because it is not necessary to specify the entire budget constraint. For each hours choice, transfer entitlements and take home pay are directly evaluated, typically using a micro-simulation model with tax benefit calculation capabilities for the relevant country.[53] Fixed costs of work, such as childcare costs, transportation or work attire, can also be included in the model specification (Blundell et al., 2000).[54]

These models allow the exploitation of the discontinuities and nonlinearities of tax systems for identification: because they lead to individuals with the same gross wage rates receiving different net wages, they provide exogenous variation (Bargain et al., 2014).[55]

Discrete choice models require the specification of utility functions of individuals or households including the parameterisation of preferences for leisure and consumption. This involves making strong assumptions regarding preferences, which is the major drawback of this approach (Blundell, 2012). While tastes for leisure and consumption, as well as fixed costs of work are allowed to vary both with observed and unobserved characteristics, this approach necessitates strong assumptions on the distribution of unobserved heterogeneity, on budget constraints and fixed costs of work (Blundell, 2012).

3.3.3. Empirical evidence on labour supply elasticities

In this section, we aim to summarise the consensus on the absolute size of labour supply elasticities as it emerges from recent surveys of the extensive literature on this topic. We will add to this by citing examples of some recent studies.

Labour supply elasticities have been shown to vary significantly across demographic groups and over the life cycle. It therefore makes sense to consider the labour supply responses of men and women separately. Moreover, the response at the extensive margin (participation elasticity) is generally found to be more important for the overall response than adjustments in hours worked for those already employed (e.g. Blundell, 2012). For example, looking at 18 different countries, Bargain et al. (2014) find that the intensive margin elasticity is very close to zero even for those socio-economic groups that are expected to be most responsive to changes in the wage rate, such as married women (see below). We therefore distinguish these two margins where possible.

[52] See for example Dagvik (1994) or Aaberge et al. (1999).

[53] The take-up of benefits can be directly incorporated in such models, by allowing for disutility due to the stigmatisation of welfare claimants, or because of time costs involved in applying for certain benefits (hassle-costs, Blundell and MaCurdy, 1999, Blundell and Shepard, 2011).

[54] The omission of fixed costs of work might have led to an overestimation of the elasticity of married women's labour supply in earlier studies (Blundell et al., 2013). Fixed costs of work explain why small positive hours of work are rarely observed – once the offered wage rate exceeds the fixed cost of work, the labour supply jumps, leading the researcher to overestimate the effect of a marginal increase in the wage rate.

[55] Structural models do not directly estimate elasticities, but preference parameters. Elasticities are then calculated by marginally increasing net wage rates, and comparing the labour supply before and after the increase.

Women's labour supply elasticities are generally found to be considerably higher than men's, especially those of married women (the group most frequently studied in the labour supply literature) and of women with young children. Generally, on the country level, participation rates are negatively related to estimated wage elasticities, which is consistent with the extensive margin of labour supply quantitatively dominating the intensive margin (e.g. Evers et al., 2008). Women's overall participation rate is still below men's. This is particularly true for married women and those with young children who not only face a work – leisure, but a work – leisure – home production trade off: they perform tasks that would otherwise have to be delegated to the market at a cost, most prominently child care. Therefore, it is not surprising that their labour supply elasticities exceed those of men (Blau and Kahn, 2007).

Estimates of female labour supply elasticities in the literature vary widely but tend to be positive and below or close to 1. Overall, annual wage elasticities tend to be larger than weekly or monthly elasticities, which is to be expected since longer terms allow more time for labour supply adjustments that can include both adjustments at the extensive and intensive margin. In their survey, Meghir and Phillips (2010) report a "consensus estimate" for married women's labour supply of close to 1, but warn that these estimates should be regarded with caution, since most of these estimates rely on cross sectional comparisons. Estimates of weekly elasticities, in contrast, vary between zero and 0.3, which implies a quite inelastic labour supply, also for women. Indeed, more recent reviews that concentrate on studies that do not rely on cross sectional comparisons find lower mean values for married women's labour supply elasticities. Evers at al. (2008) construct a sample of 209 elasticities from 30 empirical studies, excluding studies based on (cross sectional) OLS estimates because of the endogeneity and consistency problems detailed above. They report a mean elasticity for women of 0.43, with a wide range of estimates between 0.03 and 2.79. Similarly, Bargain and Peichl (2013) collect 90 estimates from recent studies (mainly from the 1990's and the 2000's), also reporting a mean elasticity of 0.43, with estimates clustering in the 0 to 0.5 interval.[56] They find that elasticities decrease over time, and that studies based on cross sectional-data tend to result in higher estimates of married women's labour supply, although this last result is more clear-cut for the US than for Europe.[57]

In a recent study, Bargain et al. (2014) estimate the same discrete choice model for 17 European countries and the United States using a data set with comparable variable definitions, covering the period 1998-2005. For married women, wage elasticities are estimated to range between 0.1 and 0.4, with only small differences between countries.[58] Overall, elasticities for married women are found to be highest in countries with the lowest female participation rates. Blau and Kahn (2007), using

[56] Studies that use discrete choice estimates are overrepresented in their sample, because this approach is most often used in the recent literature.

[57] For the more recent time-period 1990-2010, their sample contains studies based on both OLS regressions and discrete-choice models for the US, while for Europe, they almost exclusively rely on structural models. Therefore, it is less obvious whether the decline in labour supply elasticities is due to the estimation method or a time trend.

[58] For married women, they identify a group of countries with slightly higher elasticities, ranging between 0.2 and 0.4 (Austria, Belgium, Denmark, Germany, Italy and the Netherlands), a group of countries with lower elasticities between 0.1 and 0.2 (France, Finland, Portugal, Sweden, Estonia, Hungary, Portugal, the UK and the US) and a group of outlier countries with elasticities between 0.4 and 0.6 (Ireland, Greece and Spain).

cross sectional (Current Population Survey) data from the US to estimate labour supply elasticities for married women for the years 1980, 1990 and 2000. They find that (mean) labour supply elasticities decreased steadily over this time period: from 0.8 to 0.9 (depending on the model specification) in 1980 to 0.4 in 2000. Elasticities fell at both margins: at the extensive margin from 0.5-0.6 1980 (again, depending on the model specification) to 0.3 in 2000, and at the intensive margin from 0.3 to 0.1 during the same time period. Using the same data and a similar methodology, Heim (2007) similarly estimates elasticities at the extensive margin to have declined from 0.7 in 1980 to 0.03 in 2000, while intensive margin elasticities decreased from 0.4 to 0.2 over the same time period. One reason for this change is mechanical: as the female labour force participation rate accelerated throughout this period, a growing share of married women was already in full time employment, and therefore unable to further increase their labour supply in response to rising wages. But Blau and Kahn (2007) also suggest that over time, women became more committed to their careers, as they expect to spend a larger fraction of their life without a spouse. As a consequence, their labour supply patterns increasingly resemble those of men.

One demographic group that has been shown to be particularly responsive to changes in the net wage are women with small children. For this group the extensive margin is particular important because they face high fixed costs of work (Blundell et al., 2013). Lone mothers have received a lot of attention in the literature because they face a higher risk of poverty, and are therefore often the object of targeted policies that can be exploited for exogenous variation in wages. Meghir and Phillips (2008) report participation elasticities of over 1 for this group. Bargain and Peichl (2013) note that elasticity estimates for this group, although generally higher than for the overall population, are quite dispersed - in their sample, the mean value is 0.6. In a recent study, Blundell and Shepard (2011) develop a structural model of the labour supply of parents with children in the UK, with a focus on lone mothers. They model the tax-benefit system in detail, and allow for unobserved heterogeneity and fixed costs of work, using data from 1998 to 2003. For single mothers, they report a total elasticity of 1.5 (including the extensive and intensive margin). The participation elasticity is more important than the hours elasticity, 0.8 vs. 0.04. The labour supply of women with young children is significantly less elastic than the labour supply of mothers of school-aged children, especially at the participation margin. For the US, using cross sectional data for the years 1979 to 2003, Bishop et al. (2009) find very similar values for the intensive margin with an elasticity of 0.05, while their estimate for the extensive margin is significantly lower at 0.25. In line with the findings of Blau and Kahn (2007) and Heim (2007) for married women for the same time period, Bishop et al. (2009) find that the labour supply elasticities of single women (with and without children) decreased significantly over the quarter of a century their data covers.[59]

For men, labour supply responses are strongest at the beginning of their careers, reflecting the education/ training versus gainful employment decision, and at the end of their careers, where the incentive structure of pension systems comes into play. They also react mostly on the extensive margin. The consensus in the literature is that labour supply elasticities for men on the intensive margin – adjustments in hours worked while employed – are very small (close to zero) (Meghir and Phillips, 2008,

[59] They report a drop of 82 % in the wage elasticity at the intensive, and of 36 % at the extensive margin.

Saez et al. 2012b).[60] In their meta-study of 209 estimates of labour supply elasticities, Evers et al. (2008) report a range of estimates between -0.08 and 0.18 for the male labour supply elasticity, with a sample mean of 0.07. This is not surprising, given the distribution of hours choices for men - men tend to either work full time, or not work at all, leaving little room for adjustments on the intensive margin.[61] In contrast, Bargain et al. (2014) find own wage elasticities for married men that are, though small, significantly different from zero, between 0.05 and 0.15. These responses are almost exclusively driven by the extensive margin; hours elasticities are very close to zero. The responses of single men are somewhat larger (between 0 and 0.4), mostly driven by the responsiveness of younger men who have lower overall employment rates.

Low wage elasticities at the mean can mask differences in the responsiveness of labour supply across the income distribution. Bargain et al. (2014) show that for single individuals, wage elasticities for the bottom 20 % of the income distribution can go up to one, mainly due to responses at the extensive margin. For married women, the opposite holds, with women at the top end of the (potential) wage distribution being more responsive than those at the bottom.[62]

3.3.4. Labour supply and household decision making

Family decision making matters for labour supply because we would expect the labour supply choices of an individual to be influenced by their spouse's labour supply and earnings, just as we would expect it to depend on unearned income. Families have to decide jointly how to organise home production and consumption, and we would expect some complementarity in leisure in the utility functions of couples. The standard economic approach to modelling the labour supply and consumption behaviour of couple households, the unitary model of household behaviour assumes that couples act to maximise a unique household utility function. This assumption has been criticised in the literature, primarily for violating the principle of methodological individualism (the idea that the basic unit of decision making is the individual, Chiappori, 1988), and for lacking empirical support.[63]

[60] An exception is Keane (2011), who suggests a mean value of the (compensated) labour supply elasticity for males of 0.31. He argues that the consensus in the literature of a zero or at least very small labour supply elasticity for males stems from the (flawed) assessment that many older studies that report higher labour supply elasticities failed to properly account for taxes, while there is actually a wide range of estimates irrespective of the estimation method.

[61] For example, while across 32 % of employed women in the EU-28 Member States worked part time in 2013, only 8 % of employed men worked part time (EUROSTAT database, http://ec.europa.eu/eurostat/web/lfs/data/database).

[62] This is consistent with the "added worker effect" that emphasises the role of risk sharing in marriage. When the main earner in the family – usually the husband – experiences a negative income shock, the labour supply of the secondary earner – usually the wife – becomes crucial for household income. Hence, married women in families at the bottom of the income distribution make a more important contribution to family income than women at the top, which leads to their labour supply being more inelastic. In contrast, women living in households at the top of the income distribution are more responsive to financial incentives. See e.g. Blundell et al. (2012) for a recent discussion.

[63] One particular empirical implication of the unitary model, income pooling, has been repeatedly refuted empirically. Income pooling is a feature of unitary household demand that postulates that which member contributes what to joint household income should not matter for consumption decisions. Among others, Lundberg et al. (1997) and Ward-Batts (2008) show that

Considering the household, rather than the individual, to be the relevant decision making unit implies assuming the existence of some form of decision process within the household. The literature on household decision making can be broadly categorised in two strands: cooperative and non-cooperative bargaining models of family decision making (the seminal contributions here are, Manser and Brown, 1980, McElroy and Horney, 1981, Lundberg and Pollak, 1993) and the literature on the collective model of household decision making, developed by Chiappori (1988). Bargain models generally impose a lot of structure on the household decision making process, complicating empirical implementation. The collective model on the other hand only imposes that within household allocations be efficient. The individual utilities of the spouses are determined through a generic decision making process that is influenced by individual bargaining power, but this bargaining element only determines the location of household demand on the Pareto frontier.[64]

It has been shown that, even without imposing much structure on the household decision process, testable restrictions can be derived from the collective model, and that it can be taken to data even if labour supply choices are discrete (that is, working hours do not vary continuously between zero and full-time, but individuals are either employed full time or do not work at all, as it tends to be the case for men, Blundell et al., 2007).

As Meghir and Phillips (2010) point out, although there is a very active theoretical literature on the empirical implication of the collective model, there are very few actual empirical applications. An exception is Blundell et al. (2007), who estimate a collective model of household labour supply using British survey data over two decades. They assume that men's labour supply decision is discrete (either work full time or be idle), while women can choose their working hours continuously. While preferences are allowed to depend on education, and education therefore cannot be excluded from the labour supply function, education-time interactions (and age-time interactions) can be excluded in their framework. That is, they assume that while preferences towards work (and leisure) may change over time, this change is the same for all educational groups. Because returns to education have changed in the period they observe, this exclusion restriction allows them to exploit this exogenous variation in the wage structure to identify the labour supply function. They find a wage elasticity of 0.33 for married women, which is in line with previous estimates for the UK.

Vermeulen et al. (2006) calibrate the collective model, assuming that preferences for consumption and leisure do not change upon marriage; therefore, these parameters can be estimated from data on singles using a standard labour supply model, which allows residual calculation of the sharing rule. Using this model, Bargain et al. (2006) compare labour supply elasticities based on the unitary and collective model. They find that, if the unitary model is wrongly assumed to be correct, women's labour supply elasticities are understated, whereas men's elasticities are overstated. However, these

this does not hold using a policy reform in the UK as a natural experiment. See Browning et al. (2014), chapter 5, for a recent survey.

[64] More formally, the collective model assumes that household maximise the weighted sum of the spouses' individual utility function, where the weight is influenced by distribution factors. Some of these distribution factors influence the couple's budget set, like wage rates, while others only influence the bargaining power, like the prevailing divorce law regime.

differences could also be due to differently specified utility functions and identifying assumptions (Bloemen, 2010). Although the household decision process does seem to influence labour supply elasticities, the empirical literature providing concrete estimates is still quite thin.

3.3.5. Using tax return data to estimate behavioural responses to taxation

When studying the intensive margin of labour taxation, one is usually interested in how hours of work respond to income taxation, i.e. the labour supply elasticity. Hence, traditional labour supply literature focused purely on hours of work as the variable of interest (in the intensive margin case). However, as already pointed out in section 3.2.2., hours worked by individuals are in most cases very difficult to observe, and relying on survey responses often comes with large measurement errors (e.g. people have a tendency to report 40 hours per week). Furthermore, difficulties arise because income taxes might distort many other margins beyond hours of work, for instance motivate to shift income between sources which are taxed at different rates. This is why in recent years the public economics literature progressed using the elasticity of taxable income (ETI) instead of pure labour supply, pioneered by the seminal work of Feldstein (1995). Focusing on taxable income as a broader measure of labour supply holds the potential to represent an upper bound of the labour supply elasticity since it captures all potential responses to income taxation in a single elasticity measure. Feldstein (1999) also puts forward the measure that the ETI is under some conditions a sufficient measure for the overall deadweight loss of the income taxation. This holds, since an optimising individual will reduce the hours worked or avoid taxation in such a manner that the marginal costs will equalise. Given that both real and avoidance responses to income taxation matter when aiming to understand the true impact of labour taxation, the ETI has taken to a large degree the centre stage of many normative questions in public economics. Furthermore, the increased availability of high-quality administrative tax data offers researchers the opportunity to observe the taxable income of large populations over many years. The use of administrative tax return data instead of survey data is preferable since it offers much larger sample sizes and has far fewer problems with attrition, non-response, and measurement error. In recent years a fast-growing literature has emerged using these large administrative datasets and compelling identification strategies to estimate behavioural responses to income taxation.

The Feldstein (1995) study

To estimate (intensive-margin) elasticities of taxable income most studies are using variation in tax rates for identification. In 1995, Feldstein published his influential work using administrative tax panel data to estimate the ETI for the Tax Reform Act 1986 put into force by the Reagan government. This reform brought especially large tax reductions for those at the top of the income distribution, with the top marginal tax rate falling from 50 to 28 percent. Hence, Feldstein focuses on estimating the effect of the reform on the taxable income of top earners. He groups taxpayers by their pre-reform taxable income and looks at how their incomes evolve after the tax cuts of 1986. Specifically, Feldstein uses a DiD methodology to compare the percent change in taxable income with the percent change in the net-of-tax-rate (= change in marginal tax rate) between two income groups. By doing so he obtains very large

elasticities of taxable income (above 1), with far-reaching implications for policy conclusions, such as that the United States has been on the wrong side of the Laffer curve for the rich and that cutting tax rates might raise tax revenue even further. Partly due to this result, Feldstein's study gained much attention, but also received strong methodological criticism. For instance, grouping taxpayers in a way as Feldstein does can result in very biased results for the DiD estimator when elasticities vary greatly between these two groups already before the reform. Further, the sample size Feldstein uses is rather small, and results are driven by few observations. Another source of bias are underlying secular income trends such as skill-biased technical progress that increase the income share of top earners but are unrelated to any tax-driven changes in top incomes. When considering tax cuts at the top of the distribution without accounting for underlying trends of increasing top income shares, the obtained elasticity estimates might be substantially upward biased. Finally, mean reversion can cause biased estimates when grouping taxpayers according to their pre-reform income level, since taxpayers with a positive income shock in the pre-reform year will tend to have a lower income in the following years, independently of the reform (= problem of transitory incomes).[65]

Other studies identifying the ETI through a tax reform

Subsequent studies aimed to address these issues and re-estimated Feldstein (1995) using both different methodological techniques and different tax variations as identification. For instance, Auten and Carroll (1999) studied the same tax reform but employed richer data and found much smaller elasticities (around 0.6). Gruber and Saez (2002) carefully examine the effects of mean reversion and secular trends in income inequality on the estimated ETI, using as well the Tax Reform Act of 1986 for identification. Specifically, they controlled for base year income by including 10-piece splines of pre-reform gross income. Furthermore, they emphasised the difference between taxable income and broad income responses, where broad income is defined as income before deductions. In Gruber and Saez (2002) the elasticity estimate of 0.12 for broad income is notably smaller than their corresponding estimate for taxable income, suggesting that much of the taxable income response comes through deductions, exemptions, and exclusions. Consistent with this conclusion, they find that most of the response in taxable income can be attributed to itemisers (for itemisers, the elasticity is 0.65, whereas for non-itemisers, it is negative and insignificant).

In a similar vein, Giertz (2007) investigates differences in elasticity estimates of taxable income versus broad income when using several distinct tax reforms (US tax reforms of 1986 and 1993 in particular) for identification. While finding large differences in the ETI estimates depending on the reform used for identification, the variation in elasticity estimates of broad income (e.g. wage earnings) was much smaller between the single tax reforms. This let him conclude that differences in the availability of deductions and exemptions matter in determining the ETI because itemizing was much more common after the Tax Reform Act of 1986. In sum, his findings support the argument that changes regarding the breadth of the tax base and

[65] In the econometric terms, the systematic differences in elasticities already before the reform constitute a selection problem, and different trends in wages for the top income earners constitute a violation of the common trend assumption, while the mean reversion can be seen as an example for the Ashenfelter (1978) dip.

exemption rules (which usually occur when a tax reform is enacted) have a strong effect on the ETI but leave the underlying elasticity of broad income rather unaffected.

Kleven and Schultz (2014) use a method similar to Gruber and Saez (2002) to uncover the ETI from various income tax reforms over the period 1984 to 2005 in Denmark. Methodological, their main advantage is a very stable income distribution in Denmark, allowing to identify behavioural responses to tax reforms much easier. Furthermore, they can rely on an impressive set of tax variation imposing different tax rates on different income components. They estimate an overall ETI of around 0.05 for wage earners and 0.10 for self-employed individuals. Moreover, they find larger elasticities when focusing on large tax reforms, consistent with the argument that taxpayers are more likely to overcome adjustment frictions when tax changes are salient and substantial in size.

Recently the approach of Gruber and Saez (2002) has been criticised by Weber (2014) for failing to adequately controlling for serial correlation and therefore mean reversion. Using the same dataset as Gruber and Saez (2002), it is argued that a different choice of instrumental variables can help to better overcome the endogeneity. In particular, Weber (2014) finds significantly larger elasticities (0.858 for taxable income and 0.475 for broad income) using higher order lags of the instruments. In contrast to previous studies the higher elasticities are interpreted as correctly estimated, rather than reflecting a longer-run elasticity. At the same time, the study still suffers from a number of the above mentioned limitations, most notably from the restricted sample of top income earners and the potential differential trends for this income group.

Using nonlinearities in the tax schedules to identify the ETI

A promising new avenue was laid out by Saez (2010), proposing a bunching estimator to uncover the elasticity of taxable income. His approach is based on the intuition that discontinuous reductions in wage rates at kink points of a tax schedule yield a non-parametric source of identification for the underlying elasticity. In other words, the standard labour supply model where individuals choose to supply labour until the marginal disutility of work equals marginal utility of disposable after-tax income predicts the bunching of taxpayers at kink points of a tax schedule where marginal tax rates increase discretely. Unlike other cross-sectional tax variations from tax reforms used to identify real labour supply responses which are usually contaminated by heterogeneity in tastes, this approach holds the potential to yield very credible estimates (see Chetty, 2012). Saez (2010) finds significant bunching of taxpayers at the first kink point of the US EITC as well as at the threshold of the first federal tax bracket. However, he finds the observed bunching to be prevalent only among the self-employed and largely due to reporting effects (e.g. itemised deductions), with no evidence for bunching at any kink for wage earners. This evidence is broadly in line with previous findings that the elasticity of wage income is close to zero while the taxable income elasticity is positive and statistically significant (with a value of around 0.3).

In recent years, increasing evidence of the ETI has also been gathered for European countries. A vocal point of empirical research on behavioural responses to taxation in Europe has been Denmark, thanks to the availability of high-quality administrative data containing detailed socio-economic information. Chetty et al. (2011) detect clear bunching of taxable income for both self-employed and wage earners at a top kink of

the Danish tax schedule, with corresponding elasticities of 0.02 for wage earners and 0.24 for the self-employed. This large difference in the ETI let them explore the role of optimization frictions such as adjustment costs. They find that elasticities of wage earners are positively associated with the flexibility of labour supply and collective bargaining, two forces that appear to effectively reduce adjustment costs. Their results suggest that adjustment frictions significantly attenuate the short-run ETI especially for wage earners, something which has to be taken into account when asking critical questions about the long-run elasticity of taxable income, a key parameter of interest for policy making. Bastani and Selin (2014) use Swedish data and find no bunching in the distribution of wage earnings, and only a very moderate response for self-employed. Similarly Kosonen and Matikka (2014) find no bunching at kink points in the Finnish income tax schedule. But studies argue that the lack of tax payer responses is mostly due to salience and optimization frictions.[66]

Summarizing the existing evidence of behavioural responses to taxation using tax return data, one can conclude that population-wide taxable income elasticities are rather modest. Especially when taking into account the different sources of taxable income (e.g. wage earners versus self-employed) which differ with respect to avoidance opportunities, the real behavioural response to taxation appears to be quite small. For instance, much of the evidence on the ETI suggests that it is higher for high-income individuals who have more access to substantial tax planning, including deductible expenses (Saez et al., 2012). Dörrenberg et al. (2014) confirm the importance of reporting effects using German data. This is also in line with the repeated findings that taxable income appears to be much more response than more general income categories such as broad income. Hence, a broadening of the tax base, the closing of loopholes and more effective tools of tax enforcement can have non-negligible effects on the size of the ETI. In return, this also means that the "pure" labour supply response of many taxpayers seems to be fairly inelastic (at least in the short-run), especially for wage earners and prime income earners.

However, the finding that the observed elasticities for wage earners are rather small does not mean that taxing labour comes without distortions. While it is difficult for taxpayers to respond to tax changes in the short-run due to adjustment frictions such as hours constraints and inattention, long-run responses to labour taxation might still be substantial. In particular, long-run responses to taxes do not need to take place at the individual level and as such, cannot be captured by conventional micro-economic models. Chetty (2012) addresses this issue in his meta-analysis of various ETI studies and proposes an econometric approach to put bounds on elasticities when responses to taxation are incomplete due to adjustment costs. Pooling estimates from the existing studies he calculates a structural (long-run) labour supply elasticity of 0.33.[67] He concludes that small frictions can explain most differences found between micro and macro elasticities, as well as between extensive and intensive margin elasticities. In sum, what can be learned from the literature on the elasticity of taxable income is the value of having low tax rates on a broad tax base, a position long advocated by economists.

[66] See also Kleven and Waseem (2013) who use Pakistani income tax data to analyse optimisation frictions.

[67] Jäntti et al. (forthcoming) find similar result in their approach, bridging the gap between micro- and macro estimates of labour supply elasticities.

3.4. Review of the literature on labour demand elasticities

The studies discussed above implicitly assume that labour demand is completely elastic, and therefore changes in labour supply directly translate into changes in employment. If labour demand is only somewhat elastic (downward sloping, as depicted in Figure 5, panel B), a shift in the labour supply curve, e.g. following a tax reduction, will decrease market wages, and hence dampen the employment effect of the reform.

The consensus in the literature however does not support the notion that labour supply is completely elastic. In his seminal work on labour demand, Hamermesh (1993) reviews nearly 200 empirical studies on the static demand for labour. He brackets the long run **constant output**[68] demand elasticity of labour between 0.15 and 0.75, with a "best guess" point estimate at 0.3. He also notices that the demand elasticity decreases with education, pointing to a better substitutability between low-skilled workers and capital. In a recent study, Lichter et al. (2014) perform a meta-regression analysis on 945 labour demand elasticity estimates from 105 micro-level studies. They do include micro-level studies reviewed in Hamermesh (1993), but also add newer research published up to 2012. They find

- that the labour demand elasticity is higher in the long run than in the short run,
- that it is higher for low-skilled workers, and somewhat lower for high skilled workers, than for the general workforce (although this last difference is less clear)
- there are no significant differences between genders,
- demand elasticities are higher for atypical (fixed contract) workers and
- labour demand elasticities are increasing over time.

This last effect might be related to globalisation and technological change giving firms more opportunities to substitute away from (domestic) labour as an input. Based on this analysis, they offer a new interval for the long run constant output labour demand elasticity of 0.072 to 0.446, with a preferred estimate of 0.25, very close to the Hamermesh's (1993) "best guess". Hence, assuming labour demand to be completely elastic might lead to biased estimates of labour supply elasticities.

To allow for the interaction of labour supply and demand, Peichl and Siegloch (2012) develop a structural labour demand model, to use alongside a structural labour supply model (as discussed in section 3.3.2). Using matched firm – employee data from a German administrative dataset, they estimate labour demand elasticities by imposing a cost function and minimising costs given constant firm output and individual wage rates. They distinguish three skill levels or educational groups. In line with Hamermesh (1993), they find that labour demand elasticities vary across skill levels: the demand elasticity is highest for low-skilled workers at -1.05, and lowest for medium skill workers at -0.37. To link the demand and supply models, in a first step, they estimate labour supply elasticities by marginally increasing wages in their

[68] Two elasticity concepts are used in the literature: the constant output demand elasticity of labour, which only captures the firm substituting between input factors, and the total demand elasticity of labour, that takes into account the effect of wage changes on output prices. The constant output elasticity is smaller in absolute terms than the total elasticity: a perfectly competitive firm must raise prices as costs increase, which in turn decreases market demand, causing the firm's labour demand to further decrease (Hamermesh, 1993). Here, we concentrate on the constant output elasticity.

structural labour supply model. These elasticities are fed into the labour demand model to calculate new wage rates given the new (increased) labour supply. These new wage rates in turn serve as input for the labour supply model, and so on, until changes in labour supply and wage rates become very small. The incorporation of labour demand does work to offset the labour supply effect by about 25 %.

Another approach to allow for labour demand restrictions in a labour supply model is to introduce the probability of involuntary unemployment into a discrete choice labour supply model as discussed in section 3.3.2 without fully modelling the firm side. Demand side frictions are introduced into the model only on the basis of worker characteristics. These models are called **Double Hurdle Models** because the labour supply decision can be seen as a two-step process: first, the worker determines her preferred working hours category, and if she decides to work positive hours, she faces the probability of not finding employment. The probability of involuntary unemployment typically depends on worker characteristics (education, labour market experience, industry and so on) as well as on local labour market characteristics (Peichl and Siegloch, 2012, Bargain et al., 2010). A recent example of this approach is Bargain et al. (2010). Using German survey data from 2002, they estimate two labour supply models: as a benchmark, they use a standard structural labour supply model (as discussed in section 3.3.2), which is unconstrained in the sense that it assumes realised labour supply decisions to be the result of individual optimisation. In other words, the model assumes that unemployed individuals choose to be so, given their after-tax income and their preferences for consumption and leisure. This can lead to overestimated preferences for leisure, especially for groups with a high incidence of involuntary unemployment (such as single men). For the second, constrained, model, the authors use information on desired working hours, as available for unemployed or non-participating individuals in their data-set, as the optimal hours choice. Additionally, the probability of not finding employment, conditional on moving from non-participation into employment, is explicitly introduced into the model. They find that labour supply (employment) reactions are overstated if all unemployment is assumed to be voluntary: individuals who are involuntarily unemployed find themselves unable to react to an increase in their wage rate, and individuals who want to react face a risk to be rationed on the labour market. Simulating a policy reform geared to encourage low-wage workers to work full-time, they find that this bias amounts to about 60 % of the total employment effect.

3.5. Learning about labour tax incidence in CGE models

CGE models are general equilibrium models, which are calibrated to given economies. The particularity of the models varies from simple extensions of theoretical models to extensive versions with many countries, many production sectors and many household types. Also the modelled behaviour of the households and firms vary from exogenous supply or demand in some markets to dynamic optimization under uncertainty. In basic models the prices in the labour, capital and goods markets adjust without frictions to equalise demand and supply.

The benefits of the CGE models are well recognised. The models have sound theoretical basis laid on the optimization decisions of firms and households. They allow an analysis of the investment, labour demand and production decisions of the firms

and consumption and labour supply decisions of the households. Dynamic versions of the model allow studying optimal adjustment to new equilibrium. The use of these models avoids the Lucas critique and allows also quantifying the effects of large policy changes, which may generate non-trivial reactions in many markets. The model builder must specify the optimization behaviour, markets and institutions, which compels making conscious choices and makes the models transparent. Peichl (2009) stresses the potential of linking CGE models with a microsimulation model. This allows to combine the analysis of distributional effects from microsimulation models with feedback effects from CGE models. However, due to the complexity and high set up costs of these combined models only very few researchers are applying them.

3.5.1. Properties, which are important for incidence of taxes

The choices made by the modeller on the specification of the markets and institutions and the optimization of households and firms determine largely the incidence of taxes. The key benefit of CGE models is that complex interactions between different markets are taken into account, which in turn makes it difficult to clearly single out the effect of a particular assumption. It is however possible to review the effects of the individual assumptions in isolation, which gives an indication of the broad direction of the effect. Table 5 provides a summary of the expected effects on the tax incidence of several key assumptions made in the model design of CGE models.

Table 5: Modelling choices in CGE models affecting tax incidence

Channel	Assumption	Ceteris paribus effect on tax incidence
Market environment	Country size and openness	In smaller and more open countries more incidence is on labour
	Goods market competition	Imperfect competition results in less incidence on labour
Labour Demand	Elasticity of substitution between input	More substitutability results in more incidence on labour
	Adjustment frictions on the capital market	More frictions on the capital market result in less incidence on labour
Labour Supply	Intratemporal labour supply elasticity	The higher the elasticity the less the incidence is on labour
	Intertemporal substitution elasticity	The higher the elasticity the less the incidence is on labour
	Migration	More migration results in less tax incidence on labour
Public sector	Link between contributions and benefits	A stronger link between contributions and benefits shift tax incidence on labour

Source: Own elaboration.

Four broad channels are identified through which the tax incidence is determined. The general market environment determines whether the tax burden ultimately can end up on consumers rather than on capital owners or workers. The labour demand and labour supply channels determine whether the tax incidence is borne by capital or labour and features of the public sector can shift this balance.

The **size and openness of the economy** influence strongly the market conditions. In one extreme there are small open economies, which have high, if not infinite, price elasticities in capital and goods markets. If endogenous migration is ruled out, the incidence of taxes is mainly on labour.[69] In another extreme there are economies like US, which influence both domestic and world market prices and interest rates. In this case the incidence is rather complicated, because also foreign households are affected by the price changes (see e.g. Bovenberg and Goulder, 1993 or Fehr et al., 2013). Besides the size of the economy, also other market conditions can play a role on the incidence result. For example, imperfect **competition in goods markets** is sometimes assumed, which enables shifting the incidence of payroll taxes on consumers.

Not surprisingly the modelling of the labour markets is fundamental to the incidence outcome. Analysis of labour markets with CGE models is not very common. In many historical models labour supply was exogenous and market-clearing wages balance demand and supply. This is likely to be a sufficient description of the markets if the studied policy does not change the after-tax wages much.

Studies directly aimed at analysing labour markets require naturally the specification of supply, demand and market clearing. As discussed by Boeters and Savard (2012), there are two ways to refine the analysis; either more detailed description of the mechanisms or disaggregation of the relevant units.

The nation-wide **labour supply** potential is constrained by the working-age population. Endogenous participation and hours of work decisions depend on preferences for leisure, net wages and outside options like unemployment benefits or pensions. In life-cycle models individuals may also have a hump-shaped productivity profile, which has a different shape in different educational groups.[70]

The substitution elasticity in the utility function of individuals determines the intratemporal labour supply and consumption reactions to changes in the relative prices of leisure and consumption. The higher the elasticity, the more taxation of labour increase consumption of leisure and the less the incidence is on labour.

In dynamic models the intertemporal substitution elasticity defines the substitution between current and future leisure and consumption, when the prices change. The higher the elasticity, the more individuals react to changes in taxation by smoothing lifetime consumption and labour supply. Also the time preference of the individuals matter: the more impatient the households are, the sooner they prefer to consume

[69] Endogenous migration would increase the net wage elasticity of labour supply and may amend the conclusion.

[70] The heterogeneous productivity of households does not necessarily mean that there are many wage levels. Assuming that the labour units supplied are homogenous, but various households have different productivity in supplying those, these units can be aggregated. The wage determined in markets is paid to these efficiency units.

their lifetime resources. Correspondingly, higher probability of dying in future years reduces the willingness to postpone consumption. These factors imply that the reactions of individuals to changes in labour taxes depend both on the preferences and the age of the individuals. On the other hand, borrowing constraints may restrict the lifetime choices. If they are binding as young, labour supply is higher earlier in the working life.

Additional richness to labour supply reactions and incidence comes from educational differences. Well educated have typically rising lifetime productivity and wage profiles, which start later and end later in the life cycle. Less educated have flatter labour income profiles, which start and end earlier and bend downward near retirement.

The labour-leisure choices of individuals are described above. The number of individuals supplying labour is determined by the size of the working age population, participation rate and unemployment. The size of working age population can be endogenous, if labour taxation influences immigration. The more elastic is immigration, the more the incidence of labour taxes is on capital. Location, as well as cultural and linguistic differences matter.

Heterogeneity among the utility maximizing individuals or households allows analysing intra- and intergenerational incidence of taxes. Typical characteristic which differentiate individuals are income, gender, education, age and birth cohort.[71] The typical optimization horizon of households is either one period, rest of the lifetime or infinite.[72] The information about the future may consist of perfect foresight, idiosyncratic uncertainty regarding e.g. lifetime wages of the individual or aggregate uncertainty regarding e.g. future prices in the economy.

The **demand for labour** is derived from production functions and is based on the productivity of the marginal unit of labour and the price of output. Therefore the production technology is also an important driver of the tax incidence results. Especially the capital-labour ratio and the **elasticity of substitution between inputs** matter. Both can vary among industries. Some models include also investment adjustment cost to increase realism in the changes of the capital stock. There might also be several types of labour with varying substitutability between each other and with capital.[73] The higher the elasticity, the easier is for firms to shift between labour to capital when labour supply changes and the less the incidence of taxation of labour incomes is on the yield of capital.

There might be also other technological constraints that influence the possibility for substitution. In some dynamic models, the capital in use is determined by investments done during the previous period, which means that the first period incidence of labour

[71] CGE models seldom include very many types of households. It has been increasingly popular to study redistribution of income by combining micro-simulation models and CGE models, see e.g. Hérault (2010). Another possibility is to generate ex post heterogeneity by introducing idiosyncratic uncertainty in life cycle models, see e.g. Conesa and Krueger (1999).

[72] Planning horizon of one period refers to static models, or sequential dynamic models with myopic decision makers (e.g. Ballard et al., 1985), rest-of-lifetime horizon refers to lifecycle models with overlapping generations (OLG) structure (e.g. Auerbach and Kotlikoff, 1987) and infinite horizon refers to neoclassical growth models (e.g. Chamley, 1986).

[73] The actual labour input in production is modelled often to include labour augmenting productivity growth. There are also endogenous growth CGE models where tax reforms influence the decisions to accumulate human capital, see e.g. Granzau and Martin (2003).

income tax change is on capital. A more advanced model type includes investment adjustment costs, which also tend to increase the incidence on capital, but separates between owners of old and new capital. If the required rate of return on capital is fixed, as in case of frictionless capital movements, the tax changes are immediately capitalised in the market value of the firms and the future owners of capital gets the global market rate of return. Also anticipation interacts with frictions: if the tax rate change is surprising, the investment adjustment costs become more important determinant of incidence. More generally, the use of dynamic models means that the incidence of a given tax can vary in time.

Restricted substitutability of different types of labour in production provides an extension for the incidence results. Another extension is introduction of several production sectors with varying production technologies.

Labour market mechanisms refer to choices between perfect competition and various versions of imperfect competition. The dominating theories of endogenous unemployment are based on search and matching, efficiency wages and collective bargaining. These theories have been used as a basis of determining an empirically estimated wage curve or the theories have been modelled explicitly and the structural parameters have been estimated (Boeters and Savard, 2012). Search models create involuntary unemployment due to frictions in the search for new jobs, e.g. (Keuschnigg and Keuschnigg, 2004). Efficiency wage and collective bargaining models create unemployment due to higher than market clearing wages. There might also be an exogenous amount of unemployment in perfect competition models, but it must be allocated to the individuals exogenously.

Finally the use of the tax revenues in the **public sector** can largely influence the tax incidence result.[74] One example is that any policy which influences wages in the private sector also increases public expenditure since the wages of the public sector employees are likely to rise as well as income transfers indexed to wages. Also the social security system influences the labour supply elasticities by providing income transfers, such as unemployment benefits and pensions, which are conditional on not working and influence thereby the labour supply decision in extensive margin. On the other hand, the more labour income generates (net-of-tax) pension rights, the more it increases the price of leisure during working years. As an example, taxation of earnings-related pensions reduces labour supply. Also the means tested basic income transfers may affect the labour supply reactions of low income individuals.

3.5.2. Reviewing the incidence of labour income taxes in CGE models

CGE models are not very often used to study incidence of labour taxes. One reason might be that the final tax burden of these taxes is generally considered to be anyhow on labour. This section presents examples of representative studies, which analyse

[74] Unfortunately, a typical limitation in the CGE models is that the existence of the public sector is not well justified. Public services are typically assumed to generate no utility to households or to enter household utility functions in a separable fashion. Intra- and intergenerational redistribution with income transfers has often been modelled, but a full recognition of the benefits of public policy would require modelling insurance effects of taxes and transfers (see e.g. Harenberg and Ludwig, 2014) and the influence of externalities and other market imperfections.

comprehensive tax reforms, fiscal devaluations, pension reforms and the insurance role of the progressive tax and transfer system. Even though these studies do not aim directly the incidence of the labour income taxes, they provide also interesting incidence results.

One popular policy issues studied with CGE models has been **comprehensive tax reforms** in which the current progressive tax system is replaced by different versions of a flat tax or a consumption tax. The aim of these reforms is to increase efficiency by limiting progressivity in the labour income taxation and moving to cash flow taxation of profits. The studies offer also rich results on intra- and intergenerational and in some cases also international incidence of the tax system, see e.g. articles in Aaron and Gale (1986), Auerbach and Hassett (2005) or Diamond and Zodrow (2008).

Altig et al. (2001) studies five alternatives to U.S. federal income tax with a large scale dynamic life-cycle simulation model, which is an extension of the famous Auerbach-Kotlikoff (1987) model. The tax reform alternatives are a proportional income tax, a proportional consumption tax, a flat tax (Hall and Rabushka, 1995), a flat tax with transition relief and X tax (Bradford, 1996), which is a progressive version of the flat tax. The model used includes 12 types of households, which different lifetime labour productivity profiles, and 55 birth cohorts. The changes in market prices are strong since the economy is closed. There are no market imperfections.

A transition to a proportional wage income tax without exemptions would increase the long run capital stock and output due to lower marginal tax rates on labour, which increase overall labour supply. But the elimination of progressivity increases the tax rates of the poor and reduces their incomes permanently.

A transition to a proportional consumption tax (actually implemented as a proportional wage income tax and a business cash flow tax) has largely similar influence on growth and income distribution. But it hurts also the initially rich due to the fall in the purchasing power of wealth. The working-age generations compensate it by working and saving more, but the retired generations suffer a loss of consumption.

A flat tax introduces a deduction in the consumption taxation, which eliminates some of the adverse income distribution results. But now the reaction of labour supply and economic growth is subdued and the loss of welfare extends also to middle income citizens. The initial negative wealth effect remains.

Next the wealth effect is mitigated by allowing tax depreciations of the existing capital stock. The subsequent loss of tax revenues compels to increase permanently the flat tax rate and the labour supply effects and the overall long run gains from the reform are small. Sheltering the poor and the current rich from the adverse outcomes lowers the welfare of the current and future middle class citizens.

The last experiment was a transition to an X tax, which preserves the progressive taxation of wages and combines it with cash flow taxation of capital incomes. The cash flow tax rate is the same as the highest marginal tax rate of the wages. The growth effects are large, since the cash flow tax allows immediate expensing of new investments against the high tax rate. Also the distributional effects are more favourable, except that the initial implicit wealth tax is now higher.

The simulations of large scale CGE-OLG model highlight the diverse incidence outcomes of the various fundamental tax reforms. The strongest limitations in the used model are the closed economy assumption and perfect foresight of the agents. Also a more detailed production and consumption structure would increase realism of the results.

Fiscal devaluation aims to improve the international competitiveness of the economy. Its effects are known to be mostly temporary and therefore it represents counter-cyclical policy more than structural policy. In the most common version it is a revenue neutral combination of a reduction in employers' social insurance contributions and an increase in the VAT rate. Actually this reform also increases efficiency, since the burden of an increase in VAT rate is spread broadly to the economy: in addition to wage incomes its falls on current wealth and income transfers, which are not indexed to consumer prices. Therefore the needed increase in the VAT rate is also smaller than the reduction in the contribution rate. The problems of the reform are its potentially negative effects of income redistribution and short-lived impact on external balance. The analysis can also be made stepwise to reveal the different incidence effects of the reduction in the contribution rate and the VAT rate.

The crisis in the Euro area has increased interest in fiscal devaluations. There are several recent simulation studies that focus on the Southern European members of the EMU, such as Annicchiarico et al. (2014), Bosca et al. (2013), Gomes et al. (2014) and Engler et al. (2014). Typical methods to analyse the outcomes are dynamic multi-country CGE models or estimated macroeconometric models. Unfortunately these types of models are not able to separate the incidence of the reform on income redistribution. In some models also the important price and wage rigidities are lacking.

The study of CPB and CAPP (2013) covers both the macroeconomic and distributional effects of fiscal devaluations. The macroeconomic effects were studied using the macroeconometric multi-country model NiGEM and an OLG model and the distributional effects with several microsimulation models. The NiGEM simulations suggested that the balanced-budget reform increases GDP and employment, but has little effect on the trade balance. The OLG model simulation revealed that there might be permanent effects on the labour costs, if non-indexing the social transfers weakens the bargaining power of labour unions. The microsimulations show that fiscal devaluations are regressive, if the cut in social security contributions is not restricted to low income workers.

The main motivation for **pension reforms** is population ageing, which has weakened the fiscal sustainability of the pay-as-you-go (PAYG) financed defined benefit pension systems. Smaller birth cohorts and longer lifetimes have resulted in an unfair intergenerational allocation of the burden of financing pensions. Most of the reforms also aim to improve efficiency by strengthening the link between paid contributions and the received benefits. This reduces the degree to which the contributions are considered as taxes. In most countries the majority of pension contributions are paid by employers, which brings into question the final incidence of these taxes.

The realization of the full effects of pension reforms takes decades. Therefore numerical OLG models are invaluable tools for the impact analysis. To cover the full effects, models include heterogeneity in education, which influences lifetime

productivity, length of working lives and life expectancy and risks related to employment status, disability and longevity.

While the incidence of labour taxes is mainly determined by elasticities of labour supply and demand, does the incidence of mandatory pension contributions depend on both the incidence of labour income taxes in general and on the degree in which contributions are considered as a tax. The latter varies in typical pension systems in time, between birth cohorts and between income groups. The less the employees' contributions are considered as a tax, the less they influence labour supply. The less the employers' contributions are considered as a tax, the more the employees are willing to adjust their wages. Therefore strengthening the link between contributions and benefits has shifted the incidence of employers' contributions on labour and reduced labour supply distortions.

A **non-distorting mandatory pension scheme** imitates the choices that a rationally behaving person would have done, if the scheme did not exist. These choices may include purchasing private pension insurance. Any deviation from this benchmark changes labour supply and saving decisions and asset portfolios of the households. The fact that there are mandatory pension systems reveals that the market solution is not considered to maximise the welfare of the citizens. But the market solution provides a useful point of comparison. So does another extreme, a mandatory tax-financed flat rate pension scheme.

The closest substitute to the market solution is a mandatory fully funded defined contribution pension scheme, especially if some additional conditions are fulfilled. Benefits should be determined individually by the amount of paid contributions, the yield of the funds, retirement age and actuarial longevity insurance. The contribution rate should not be higher than the individual would have chosen if the pension scheme had been voluntary, to avoid too large forced saving and longevity insurance and liquidity problems. Also the portfolio of the pension fund should correspond to the one that the individual would have chosen.

Full funding of contributions and investing the money in efficient portfolio corresponds to private saving for old age if the mandatory contribution rate does not lead to higher than optimal saving in any part of the life cycle. People are often liquidity constrained during their early working years. Therefore a fixed contribution rate may be too high during these years even though it would not lead a too high total saving for old age.

If a collective longevity insurance is actuarially neutral and compatible with longevity risk aversion of the individual, it may even be more efficient than voluntary individual pension insurance, which is vulnerable to adverse selection (and in some countries not available at all). On the other hand a too high level of longevity insurance cannot be neutralised by private actions. In an optimal situation the mandatory scheme would not insure very high incomes, but there is a possibility to top up it with fairly priced individual pension insurances.

Apart from a neutral pension scheme, also a neutral tax treatment of the contributions and benefits is needed to avoid distortions. A flat income tax rate and either EET or TEE taxation fulfils the criteria. In EET taxation the contributions are deductible from the income tax base and are taxed with the yield accrued, when withdrawn. The government participates in sharing of the rate-of-return risk, and is rewarded with

positive expected tax revenues. In TEE taxation the contributions are not deductible but the pension capital and its yield are not taxed when withdrawn. The income tax rates should be fixed in time.

In the neutral scheme described above there is no intra- or intergenerational redistribution between individuals and no distortions. A socially optimal pension system deviates from this benchmark for several reasons. Redistribution increases welfare in the society. Moreover, PAYG elements provide insurance against aggregate shocks, such as variation in the yield of the pension funds, if labour productivity and the yield are not strongly correlated. Therefore adding these elements to a pre-funded pension scheme expands the set of available portfolios and allows risk sharing between generations.

There are several aspects **how the current pension systems deviate from the neutral one**. The link between paid contributions and received benefits is in current pension systems weaker than in the non-distorting benchmark for many reasons. Typical features in mandatory earnings-related pension systems are defined benefits principle and PAYG financing. The monthly pension is determined typically by the earned wages and a coefficient which translates the wages to pension rights. Basic pension systems are typically tax-financed and provide flat rate residence-based pensions.

There is often a ceiling for the wages that generate earnings-related pension rights. It is also quite common that a limited amount of pensions is accrued during spells of inactivity, like unemployment and maternity leave. The third extensively used redistributing element is the means-testing of earnings-related pensions against basic pensions.

An overwhelming share of the mandatory pension systems is funded following a PAYG principle. Working generations pay the pensions of the retired. If the average growth rate of wage bill falls short of the average yield of pension funds, the ratio of received benefits to paid contributions is lower for an individual than in a fully funded system.

The PAYG funding principle is also sensitive to changes in demographics, employment rates and the rate of productivity. A temporary increase in fertility or immigration would lower the contribution rates of the large working cohorts, but increase those of the next generations. Baby boom generations are a good example of this. An increase in the growth rate of productivity would lower the contribution rates if the accrued pension rights and paid pensions are not fully indexed to growth rate of the wage bill. Realisation of these aggregate risks implies that in PAYG financed pension systems the degree of which the contribution rate includes elements of tax varies in time and between birth cohorts. The intergenerational variation in the tax contents is in many cases obscured by pension reforms, which include birth cohort specific grandfathering clauses.

Many of the **recent pension reforms** have tightened the link between the wages and pensions.[75] In some cases also elements of defined contribution pension scheme have been introduced in defined pension systems. Pensions, retirement ages or required contribution periods are linked to the remaining life expectancy of the retiring cohort.

[75] This tightening has abolished the rather arbitrary redistribution related to final salary plans. Other details of the recent reforms have been described e.g. in OECD (2012c, 2014b).

The notional defined contribution (NDC) principle goes further towards a neutral pension scheme. The benefits are determined by the amount of contributions paid during the working life, even though funding of the scheme is based on PAYG principle. Any variation in demographics or employment rates are reflected in the indexation of accrued pension rights and paid pensions. In ageing societies this indexation provides typically weaker average yield on pensions than a fully funded scheme.

The adequacy of pensions is typically secured by high contribution rates in mandatory pension schemes. But it means that these rates are likely to be too high to be optimal for some stages of life. Also the amount of income insured against idiosyncratic and aggregate longevity risk may be too high to be optimal. This issue may appear both in defined benefit and defined contribution pension schemes, making it more likely that contributions are considered as taxes. The recent cuts in pension benefits have reduced the likelihood of having too high replacement rates.

Uncertainty and the insurance role of the tax system

The recent development in the numerical models has improved the potential of studying new issues such as optimal progressivity of the income taxes, when there is idiosyncratic uninsurable labour income uncertainty. The models are still rather simple descriptions of the economies.

Conesa and Kruger (2006) compare the insurance benefits of progressive income taxes and the efficiency losses due to lower labour supply and investments. They find out that a transition to a flat tax system with a tax rate of 17.2 % and fixed deduction of $ 9400 would be optimal for US. The lower labour income tax rate for the high income earners increase labour supply so that initially the real wages fall and output increases. In the long term also the capital stock increases allowing the productivity of labour and real wages to rise above the initial level. The welfare calculations show that income-poor gain from the tax deduction and income rich benefit from the lower tax rate. It is not possible to separate the incidence of labour taxes due to the comprehensive taxation of incomes.

Kindermann and Krueger (2014) simulate the optimal tax rate for the highest 1 % of income earners. The simulation model is a large scale OLG model with uninsurable labour productivity risk. The optimality criterion is the weighted sum of expected lifetime utility of households currently alive and born in the future. With this kind of measure, the welfare loss of the top income earners has little weight in the social welfare function. They find out that the revenue maximising marginal tax rate for the highest 1 % of income earners is 95 % and the welfare maximising tax rate is 89 % in the long run. The jump in the tax rate reduces initially the labour supply of the top income earners by 40 %. The aggregate labour input falls by 10 % and the output by 7 %. The tax transition is financed with public debt, which crowds out private investments. In the long term the supply of labour recovers somewhat, but remains lower than in the initial steady state. The aggregate consumption falls by 7 % in the long term. The stochastic labour productivity process is the key element in the study. It generates very high and somewhat persistent income with small probability. Badel and Hugget (2014) suggest that if individuals have the possibility to accumulate human capital, the optimal top marginal tax rate is substantially lower.

3.5.3. An illustration of the link between contributions and benefits

We simulate the incidence of employers' pension contribution rate using a numerical OLG model. The aim of this example is to show the main driving forces of the adjustments in the economy.

Description of the FOG model

The FOG model is of the type originated by Auerbach and Kotlikoff (1987). The model is modified to describe an almost small open economy and calibrated to the Finnish economy. The FOG model consists of four sectors and three markets. The sectors are households, enterprises, foreign sector and a government sector. The general government is divided further to central government, municipalities, two pension funds and a social security institute. The labour, goods and capital markets are competitive and prices balance supply and demand period-by-period. There is no money or inflation in the model. The unit period is five years, and the model has 16 adult generations living in each period. The model is described in more detail e.g., in Lassila and Valkonen (2007).

We assume that the pre-tax rate of return on saving and investments is determined in global capital markets. Household and firms take the interest rate as fixed in their plans. The stock market value of the firms adjusts to generate a stock market yield which corresponds to the bond yield. Only immediately after an unexpected profit shock there will be share price changes which deviate from this arbitrage rule.

The firms have some monopoly power in exports, which makes the terms of trade endogenous. The goods that are used as intermediate good, in private consumption and in investments are CES composites of the imported and domestic goods, implying that their substitutability is imperfect. Foreign economies are assumed to grow with the trend growth rate of the domestic labour productivity.

Labour input is determined partly by exogenous assumptions and partly due to endogenous adjustments in the model. Hours of work are decided by households, but age-specific participation rates and unemployment rates are exogenous. Real wage adjusts to equalise the value of marginal product of labour and labour costs in the production of domestic goods.

We assume that the modelled subsectors of the general government have their own budgets, which are balanced either by social security contributions or earned income taxes. The only exception is the state budget, which is balanced by using a lump sum transfer. Earned income tax brackets are adjusted with the growth of the economy. Households react to the income and substitution effects of taxation, social security contributions and pension rules.

The current statutory Finnish pension system is modelled in detail. It consists of a flat rate tax-financed basic pension scheme and an earnings-related scheme, which is partially pre-funded. In the earnings-related scheme all earnings during the lifetime accrue pension rights with age-specific accrual rate. The pension rights and paid pensions are indexed to wage rate so that for the accrued rights the weight of the wage increase is 80 % and weight of the consumer prices 20 %. The corresponding weights in the indexation of pensions are 20 % and 80 %. The pensions are reduced further by life expectancy adjustment. Pensions are taxed using the EET principle.

Simulation results

We simulate the outcomes of an unanticipated pension financing reform in which 2.5 percentage points of the employers' contribution rate is shifted to be paid by employees. A similar reform was actually implemented in Finland 1992-1993 to support the competitiveness of the firms. It was also agreed that the new employer's contribution will reduce the pensionable wage that is used to calculate the earned pension rights each year. The aim was to keep the relative living standards of employees and pensioners unchanged. The changes in the employees' contribution rate also influence the indexation of benefits. Third element was to agree that any further changes in the contribution rate are divided equally between employers and employees. All these elements are also included in this simulation example.

If the shift in the tax burden would have been implemented without the link between employees' contributions and pensions, it would have expanded the pension system permanently. This is because lower employers' contributions increase wages and thereby the future pensions, even though the marginal product of labour does not change.

Table 6 shows how the contribution rates, wages and pensions react to the reform. The first observation is a small decline in the total contribution rate. This is because of the increase in the employees' contribution rate lowers the pensionable wage and pensions. Furthermore, the increase in wages is only partially reflected in the pensions, due to the indexation rules. The replacement rate reduction is larger for future generations.

Table 6: Changes in contributions, wages and pensions, in percent

	Contribution rate, private sector				
Time	Employee	Employer	Total	Wages	Pensions, of total wages
2013-2017	2.32	-2.68	-0.36	2.13	-0,46
2023-2027	2.23	-2.77	-0.54	2.16	-0.66
2033-2037	2.13	-2.87	-0.75	2.23	-0.75
2043-2047	2.07	-2.93	-0.85	2.29	-0.74
2053-2057	2.04	-2.94	-0.91	2.33	-0.72

Source: Own simulations with FOG.

The initial 2.5 % increase in the employees' contribution rate is reduced to two percentage points in the long term. Similar outcome is observable in the employers' contributions. The reason for the adjustment is that falling pension expenditure. The net effect of the changes in the wages and employees' pension contributions on the disposable income of the workers is rather small.

The reform has very small effects on the economy. The labour supply falls marginally (0.08 %) in the long term. Dividends of the firms, as well as the market value of the

firms decline a little due to the reduction of the labour supply. The effect on capital stock is almost non-existing, as well as the change in the amount of domestic production. In the short run, the reduction of pensions generates a marginal decline in the private consumption. In the long term, wage income increases enough to reverse the trend. The price of the domestic good falls initially somewhat, because the fall in consumption requires an increase in exports. Also this trend reverses in the long term.

The influence of the reform on the public finances is rather complicated. The increase in the wages both expands the tax base for income taxes and compounds the public expenditure due to higher income transfers. The wages in the public sector increase, but the need for employers' contributions falls.

The employees' contributions are deductible from taxable wages. With the high marginal taxes prevailing in Finland approximately only a half of the increase in the contribution rate would decrease the disposable income of the employees. Firms can deduct the labour costs from the taxable profits. The more completely the wage reacts to the cut in the employers' contribution rate, the less the corporate income tax revenues fall. The net outcome of all these changes is a marginal reduction of the municipal income tax rate and a somewhat higher increase in the lump sum tax used to balance the central government finances. The total tax revenues as a percentage of GDP increase marginally.

Discussion

As noted earlier, the incidence of labour income taxes is largely determined by the main features of the CGE simulation model. With the almost small open economy structure and frictionless labour markets, the incidence of pension contributions should be mainly on wages, with only small effects on profits, production, employment, prices and public finances. Furthermore, the 5-year unit period in FOG rules out analysis of short-term reactions. The results are largely as expected.

The details of the pension system matter however. Without a compensating link between employees' contributions and pensions, the reform would have expanded the pension system. Another important rule is the indexation of pensions. In the Finnish case, where the change in real wages has little effect on pensions, the reform causes a rather large intergenerational shift in incomes. If the accrued pension rights and paid pensions were indexed to total labour income costs of the employer, the incidence of changes in pension contributions would be more equally distributed among the households and even less important for the real economy. But this kind of indexation does not exist in practice.

3.6. Summary

Who ultimately bears the burden of labour taxes is a question which has been around in the academic literature for a while and yet there is no clear consensus in the empirical evidence. In a recent meta-analysis Melguizo and González-Páramo (2013) find that on average about two thirds of the incidence of labour taxes falls on workers. However, there is too much variation across different countries to view this result as a precise estimate. There are however a number of intermediate results which can be taken away from the survey of the literature. Table 7 summarises the main points of the three strands of literature considered.

Even if the tax incidence literature does not provide a clear answer to the question of how the tax burden of labour taxation is shared, it still does indicate that there is some degree of sharing even in the long run. The second key finding is that the literature looking at the long run tax incidence is struggling with identification issues and that there are up to our knowledge so far no convincing studies available which look at medium-term effects or adjustment processes. Regarding the IIP the evidence is also less than compelling, but allows the tentative conclusion that the legal incidence matters at least in the short run. In fact, the finding that tax incidence is not fully on workers already hints at a relevance of legal incidence.

Table 7: Overview of results of survey on labour tax incidence

Strand of literature	Aspect	Result
Tax incidence	Overall finding	Tax incidence does not fully fall on worker, large variation across countries
	Time horizon	In the long run more incidence is on workers, severe identification issues with long-run estimates
	Invariance of incidence proposition (IIP)	No clear evidence, most likely legal incidence matters at least in the short run
	Role of centralised bargaining	More centralised bargaining results on more incidence on workers, intermediate centralization results on more incidence on employers
	Level of observation	Market level incidence can vary substantially from micro level incidence
Labour Supply	Overall finding	Labour supply elasticities vary widely across demographic groups and are falling over time
	Differences across socio-economic groups	Women (in particular mothers) are more responsive Younger persons are more responsive
	Margins of response	Response is mostly at the extensive margin More recent studies also find evidence for reporting responses
Labour Demand	Overall finding	Labour demand elasticities is not completely elastic, but increasing over time
	Differences across socio-economic groups	More elastic labour demand for low skilled and those with flexible contracts, no gender differences

Source: Own elaboration based on literature review.

There are differences across countries which can be at least partly attributed to the non-trivial role of centralisation of bargaining. The evidence is relatively robust that

more centralised bargaining shifts the tax burden towards labour, while intermediate levels of coordination result in a partial shift of the tax incidence on employers.

Following the argumentation of Metcalf (2002) the question of tax incidence can also be seen as a question of the relative elasticity of labour demand and labour supply. The review of these two strands of the literature in this section allows some tentative conclusions. First, labour supply elasticities appear to be falling over time and recent meta-analyses place them around 0.4 to 0.3. The overall elasticity is driven to a very large extent through the extensive margin, whereas the elasticities at the intensive margin are close to zero. Furthermore recent studies, as discussed in Saez et al. (2012b), exploiting tax return data find that the elasticities at the intensive margin can mostly be attributed to reporting effects. The literature is also relatively clear as to how the elasticity at the extensive margin varies across different socioeconomic groups. Women and in particular single mothers have a more elastic labour supply. Men typically have a higher labour supply elasticity at the extensive margin at the beginning or the end of the career when they face trade-offs with further education respectively early retirement.

Concerning the labour demand elasticities a recent meta-analysis by Lichter et al. (2014) suggests that the elasticities are increasing over time with a best guess of -0.3 as the average labour demand elasticity. The long-run elasticity is found to be higher, as well as higher labour demand elasticities are observable for fixed term contracts and low-skilled workers.

Finally a brief review of the CGE literature suggests that the incidence outcome will depend on the size and openness of the country, the substitutability between capital and labour and the migration patterns. Of further importance is the link between the taxes and contributions and the benefits. This is in particular true for pension contributions, where the incidence is likely to fall fully on workers if they acquire pension entitlements and therefore do not perceive the pension contributions as taxes.

For our framework of indicators the most important conclusion is that legal tax incidence matters, which demands a more detailed look at the composition of the tax burden on labour. Furthermore the role of wage bargaining is found out to be an important determinant of the tax incidence results. Therefore, together with further labour market institutions discussed in the next subsection, the level of centralisation of the wage bargaining will be a key indicator. The review of the labour supply literature reinforced the importance of distinguishing between different socio-economic groups. Additionally, the fact that labour supply is more responsive at the extensive margin, especially for the young who face a trade-off between work and education and for mothers who face a trade-off between work and child care and home production, highlights that aspects of the welfare state can alter the work incentives. Therefore the next subsection will also investigate how these aspects affect the labour supply decisions.

4. Review of the interplay between labour market institutions/regulations and labour taxation

This section of the study embeds the previous review of the literature on the economic incidence of labour taxes into the context of labour market institutions and the broader economic environment. To this end, we will focus on institutions that are considered to be the most influential for the labour market outcomes and economic incidence. Specifically two important aspects of the institutional environment of the labour market will be considered: The wage setting process and the welfare system.

4.1. Wage setting institutions

Taxes do not create unemployment when they operate in isolation in a competitive labour market. They may, however, reduce employment; the magnitude of this reduction depends on the elasticities of supply and demand as broadly discussed in section 3. However, labour market institutions such as unions influence the wage setting process and change the labour supply curve faced by firms by imposing a mark-up over the reservation wage of individuals (Boeri and van Ours, 2008).

The analysis of taxes in a labour market with perfect competition omits unemployment entirely. In this section we discuss models of imperfect labour markets (union bargaining, search und matching) to analyse the impact of taxes on unemployment and on tax incidence. Cahuc et al. (2014) present a simple search and matching model to analyse the impact of taxes and unemployment. First, the model illustrates that tax has the same impact on unemployment whether it is paid by the firm or by the employee. Second, increases in the level of taxes increase unemployment. Tax increases reduce the surplus of jobs. It is the difference between the wages net of taxes and the income of the unemployed that exerts an impact on unemployment. Therefore, all taxes and transfers that decrease the income of the unemployed by the same amount should have no effect on unemployment. Third, increases in tax progressivity, keeping tax level constant, reduce unemployment because more progressive taxation exerts a downward pressure on wages. As progressivity increases, any wage rise produces a smaller utility for workers and entails a higher marginal cost for the firm.

The seminal paper of Pissarides (1998) shows the dependence of the impact of taxes on wages and employment on the structure of the labour market. In addition to the competitive model he distinguishes three alternative settings: a labour market model where unions and firms determine the wage through bargaining; a search model where there are costs for firms and workers in finding each other – potential transaction costs lead to rents both parties bargain about; an efficiency wage model in which the firm sets the wage in order to avoid employees from shirking.

In the competitive model the tax structure does not matter. The same is true for the efficiency wage model. The simulations show, however, that a tax cut leads to much higher effects on employment in the efficiency wage model compared to the competitive model, where most of the tax cut is absorbed in wages. This is due to the no-shirking condition being flatter than the labour supply function in the competitive model, what leads to a higher impact of taxes on employment.

In the two models with bargaining over wages (between unions or individuals and firms) the tax structure matters. In the union model introducing a progressive tax with no tax revenue effects at all decreases unemployment with almost no effect on wages. In this model the key factor is a flat labour demand curve. A shift in the wage curve due to a change in the tax structure leads to considerable effects on labour demand with only a small fall in wages. The search model shows similar, albeit smaller, results of a change in the tax structure.

A second focus in Pissarides' paper is on the design of unemployment benefits. He distinguishes two scenarios: in the first unemployment benefits are determined by a fixed ratio to wages, in the second unemployment benefits are kept constant. All four labour market models imply that tax cuts have little impact on employment when the ratio of unemployment benefits to wages is constant: If unemployment benefits are increased in line with the wages the tax is more likely to be absorbed by the wage. However, if unemployment benefits remain constant the employment effects of the tax cuts can be large.

Summing up, different labour market models imply different results regarding the impact of employment taxes on wages and employment. In some models the tax structure matters considerably. In all models the design of unemployment benefits has a large influence on the outcome.

Interactions between labour market institutions and labour taxation

Labour market institutions like taxes, unions, employment protection legislation, unemployment benefits and active labour market policy interact with each other. The effect of one policy cannot be analysed in isolation, as it depends on the characteristics of other institutions. Thus, considering interdependencies between institutional factors is important when identifying country-specific reform effects on unemployment. For example, Belot and van Ours (2004) model and empirically test interactions of labour market institutions and their impact on employment within a right-to-manage union bargaining model. They focus on three particular interactions: the interaction between the unemployment benefits system and labour taxes; the interaction between the level of bargaining and employment protection legislation; and the interaction between the level of bargaining and the union density. An increase in the replacement rate of unemployment benefits shifts the wage curve upwards leading to higher wages and less employment. However, the magnitude of this effect depends on the value of the replacement rate as well as on the magnitude of labour taxes in place. An equal sized shift of the wage-setting curve lowers employment more in case of low tax rates (as the second derivate of the demand curve is negative). However, the size of the shift in the wage-setting curve due to a change in the replacement rate also depends on the tax level. Thus, whether the interaction is positive or negative does not follow from the theoretical model. Empirically they find a positive interaction.

Various studies use cross-country panel data to investigate the impact of average rates of taxation on unemployment. Reduced-form unemployment equations consistent with standard-job-search and wage setting/price setting models are estimated. The unemployment rate is regressed on usual labour market policies and institutional variables (e.g. tax-wedge, unemployment benefit generosity, degree of employment protection legislation, union membership rates, degree of centralisation in

the wage bargaining, product market institutions).[76] Control variables for the output gap, country and time fixed effects and dummy variables for large idiosyncratic shocks are also included. Generally this strand of literature finds that an increase in the tax wedge leads to higher unemployment (see e.g. Bassanini and Duval, 2009).

From theoretical considerations (e.g. Belot and van Ours 2004, Coe and Snower 1997) we know that the impact of labour taxes on employment depends on their interaction with labour market institutions. When analysing the incidence of labour taxes it is thus important to take these interactions into account. In this chapter we scan the empirical literature for specifications that allow for interactions between labour taxes and other institutions when analysing the impact of taxes on employment. Most papers we found allow for interactions between labour taxes and the degree of centralisation and coordination in wage bargaining. We found little empirical literature on the interaction of taxes and minimum wages and taxes and unemployment benefits.

Note, that the use of cross-country panel regressions to analyse the effects of labour market reforms on unemployment has been heavily criticised. The results of macroeconomic studies with short-time series have failed to provide convincing evidence about the robustness of their results (Bassanini and Duval, 2009). Moreover, theory suggests that interdependencies between institutional factors are important to identify country-specific reform effects on unemployment. Sachs (2015) provides a short methodical critic of the empirical cross-country literature that estimates the impact of labour market institutions on unemployment considering interactions between institutions. Several empirical papers have dealt with the identification of interdependencies between individual labour market institutions to determine conditional institutional effects on unemployment. However, interaction terms are often selected in a subjective and unsystematic way. Unfortunately, the large number of potential interactions hinders the construction of detailed and comprehensive models, which would be able to provide clear-cut predictions on institutional effects. Theory can only provide limited support which institutional interactions to consider.

Economic institutions matter for the impact of labour taxes on labour costs and unemployment (see Melguizo and González-Páramo, 2013). Empirical evidence indicates the impact of labour taxes is higher in economies with an intermediate centralisation of the wage bargaining process and a strong trade union presence.

When looking at employment outcomes and the degree of centralisation and coordination in wage bargaining Calmfors and Driffil (1988, p. 14) reason that "extremes work best". Highly centralised systems with national bargaining (Nordic countries, Austria) or decentralised systems with wage bargaining at the firm level (USA, Switzerland) perform best. Small unions on the firm level have little market power. Large trade unions have market power, but take into account the potential unemployment effects of wage increases when bargaining over wages. In contrast, medium-sized unions have some market power, but do not consider macroeconomic consequences of their bargaining results. Thus, the relationship between centralisation of wage bargaining and wages is not monotonic but rather hump-shaped.

[76] Alesina and Perotti (1997), Arpaia and Carone (2004), Nunziata (2005) and Azemar and Desborde (2010) use labour costs as dependent variable.

Summers et al. (1993) use the measure of corporatism developed by Calmfors and Driffill (1988) to test their hypothesis that labour taxation is less distortionary on labour supply when centralisation is higher. They find a linear connection between tax distortions and centralisation in an estimate for 17 countries. In addition to the reasoning of Calmfors and Driffill that macroeconomic consequences of bargaining results are considered by the bargaining parties they argue that unions also take into consideration that taxes raised lead to public goods benefiting their members. Thus, although in countries with high centralisation taxes are higher, these are less distorting.

There are some empirical studies measuring the impact of taxation on employment outcomes in the presence of **union bargaining**.[77] Alesina and Perotti (1997) analyse the link between taxation and labour costs on a panel of 14 OECD countries for the period 1965-1990. They find that the shifting of labour taxation to labour costs increases with the degree of centralisation. However, in highly centralised labour markets it is lower than in labour markets with negotiations on the level of industries. They thus confirm the hump-shaped form of the relationship found by Calmfors and Driffill (1988) and developed in their own theoretical model.

Elmeskov et al. (1999) assess the effectiveness of OECD policy recommendations regarding unemployment by estimating the impact of labour market institutions. They allow for interaction between labour taxes and degree of coordination in wage bargaining. They find that the negative impact of labour taxes on unemployment is especially high in countries with intermediate levels of coordination.

Nickell et al. (2000) analyse the determinants of the falling unemployment rates in the United Kingdom and the Netherlands during the 1980s and 1990s (especially when compared to other European countries). While the wage bargaining power in the United Kingdom was reduced by legislation, the unions in the Netherlands have operated very co-operative and co-ordinated. Both "extremes" led to only moderate increases in wages and thus to a low level of unemployment.

Daveri and Tabellini (2000) distinguish three models of wage-setting institutions across OECD countries: Anglo-Saxon countries (little centralisation in wage bargaining), continental Europe (powerful trade unions with little coordination) and Nordic countries (centralised wage bargaining). Estimating the effects of taxes on employment and growth for a panel of 14 OECD countries from 1965-1995 they find that negative effects of labour taxes on employment and growth are higher in continental Europe. In these countries higher tax rates are shifted onto higher gross wages, which is not the case in the other OECD countries analysed.

Arpaia and Carone (2004) use dynamic panel data techniques for a sample of EU-15 Member States and test whether the composition of labour taxes affects labour costs (both in the short- and in the long-run) and whether employment performance is better in highly centralised bargaining systems. They use three different measures of centralisation of bargaining in their equations and assign countries to low, intermediate and high levels of centralisation. While the first variable concentrates on the wage-setting procedure, the latter two focus on coordination. Simulation results

[77] See also Section 3.2 for a review of the literature which includes the centralisation of bargaining in the analysis of tax incidence.

do not differ strongly for the different variables used. In contrast to previous studies, they find that labour costs are not influenced by the tax wedge in countries with centralisation at intermediate level. Labour costs increase with an increase in the tax wedge in countries with high or low level of centralisation. This diverging result can be reconciled through their use of a dynamic panel estimator which includes the lagged dependent variable. Indeed, the coefficient for the lagged real labour cost is around 0.95 for almost all regression, leaving very little room for other variables to explain the variation of real labour costs.

Nickell et al. (2005) analyse the determinants of unemployment in 20 OECD countries from 1961-1995. They interact labour taxes with an index of coordination (low, middle, high) stemming from two different series. They find that the negative impact of labour taxes on unemployment becomes stronger in countries with little coordination. In general, they find a lower impact of labour taxes on unemployment in the long-run than Daveri and Tabellini. For a country with medium coordination a 10 percentage points increase in employment tax leads to a 1 percentage points rise in unemployment.

Alesina and Perotti (1997) and Daveri and Tabellini (2000) keep the assignment of countries to a level of centralisation constant over the observation period. In contrast, Nunziata (2005) uses a different measure of labour market coordination.[78] He constructs three variables: net union density (the ratio of total reported union members to employees), bargaining coordination (an index with range 1 to 3 constructed from the OECD data on bargaining coordination) and dummy variables for six different coordination types following a taxonomy by Traxler (1996) and Traxler and Kittel (2000). With this specification he takes into account that countries change their coordination and centralisation level over time. He finds that the impact of the tax variable on labour costs is reduced in the presence of high bargaining coordination. In order to test the hypothesis of the hump shape relationship between tax wedge and labour costs in the presence of centralisation/coordination he then divides the countries into three groups (again allowing the countries to move from one group to the other over time). Although the tax variable has the highest impact on labour costs in intermediate countries he finds a shift to labour costs in the long-run in the other groups too. A 2 percentage points increase in the tax induces a 0.5 % increase in labour costs in not coordinated and coordinated countries and a 0.6 % increase in the intermediate countries. When focusing on centralisation only (like Alesina and Perotti, 1997) he also finds slightly deviating results: While there is no impact of taxes on labour costs in centralised countries, a 2 percentage points increase in taxes induces a 0.6 % increase in labour costs in decentralised and intermediate countries.

Azemar and Desborde (2010) use the index of bargaining coordination created by OECD and provided in Nickell (2006).[79] They estimate the impact of a rise in non-wage labour costs on real manufacturing labour costs in OECD countries. This impact

[78] While centralisation only refers to the level at which wages are bargained, coordination refers to mechanisms where the aggregate employment implications of wage determination are taken into account. This can be due to highly centralised wage bargaining, but also due to institutions (e.g. employers') assisting bargainers to act in concert although bargaining itself takes place on industry or plant level. (Nickell et al., 2005).

[79] The index ranges from 1 to 5 and increases in the degree of coordination.

decreases with the degree of wage bargaining coordination. In the short-run in countries with high coordination a rise in the tax rate by 1 percentage point would lead to a fall in gross wages by 0.77 %, whereas in countries with low coordination gross wages would decrease by 0.25 %. In the long run about 45 % of the tax increase is shifted to employers in countries with little coordination, whereas in highly coordinated regimes workers bear the tax increase entirely.

Sachs (2015) applies a Bayesian model approach on panel data for 17 countries from 1982-2005. This methodology allows him to test all relevant institutional interactions for significance and he does not need to make a subjective selection of interactions. He finds a negative interaction term between bargaining coordination and the tax system, meaning that an increase in the income has a less adverse impact on the labour market in case of coordinated wage setting. However, when it comes to a reduction in the tax burden the negative coefficient of the interaction term implies that a tax cut is more beneficial when bargaining coordination is low. Sachs argues that coordination avoids a strong labour demand effect of a tax cut by letting employees benefit from the tax gain. He finds no robust and significant interaction effects between labour taxes and other labour market institutions (unemployment benefit system, employment protection, product market regulation).

Next to the level of unionization and the wage-setting process the existence of a **minimum wage** can influence the incidence of payroll taxes. When an employee already receives the minimum wage, it is impossible to shift a rise in the payroll tax onto the worker. The burden of the extra tax must fall on the employer (see Nickell, 1997).

Picard and Toulemonde (2001) derive conditions for taxes levied on workers to have the same employment effects as taxes levied on firms considering processes of wage determinations. They find that in a competitive labour market a budget neutral restructuring of taxes levied on employers and employees is irrelevant to employment. It is also irrelevant if unemployment benefits depend on the net wage and not on the gross wage. However, it is not irrelevant when the employment level is determined by a binding minimum wage. If the net wage is constrained by a binding minimum value of the net wage then again it is irrelevant.

Bassanini and Duval (2006) study the determinants of structural unemployment in OECD countries allowing for interactions between labour market institutions. They put special emphasis on the complementarity of labour and product market institutions and find a strong interaction between the minimum wage and the tax wedge: An increase in the ratio of minimum to median wages by 10 percentage points would increase the impact of the tax wedge on unemployment by 50 % in the average OECD country. This is consistent with the theory that minimum wages prevent employers to shift the incidence of pay-roll taxes to wages.

Some studies find interactions between the impact of taxes on employment outcomes and the design of **unemployment benefits**. Belot and van Ours (2004) find that taxes have a higher impact on the unemployment rate when the replacement rate of unemployment benefits is high. High replacement rates and high taxes reduce the gap between work and non-work income. Increasing one of the two variables has a more negative impact on unemployment if the other is already at a high level.

Overall, we found some empirical support for interactions between labour taxes and the degree of centralisation and coordination in wage bargaining. There is however a limited number of studies and consequently little empirical evidence for interactions of taxes and minimum wages and taxes and unemployment benefits.

4.2. Welfare state and labour supply

Traditionally, theoretical models studying the relationship between public policies and labour supply mainly focus on the role played by the tax system, and consider to what extent labour supply decisions, either at the extensive or the intensive margin, are influenced by taxation. However, a more elaborate and realistic model should incorporate also two other sets of policy instruments that shape the budget constraints of households and influence their decisions of whether to work or not, and for how many hours: **cash transfers** for low income households and the **subsidization of services**. Some micro studies (not the macro ones) include cash transfers in the analysis (for example, Kaliskova, 2015), but usually neglect in-kind benefits. Further, one should also consider the impact of the legislation regarding the rules about maternal and paternal leave, as well as the regulation of the possibility to access part time work or work sharing arrangements within firms. In this section we first provide a synthetic description of the interrelationships between these variables and labour supply decisions from a theoretical point of view and then present a synthesis of the relevant empirical literature.

The effective tax burden depends not only on the structure of social security and personal income taxation, but also on the interactions between these taxes and public cash transfers to households with low incomes or with family burdens. Taking into account transfers through the welfare system is particularly important for women with children living in poor households, and for those with low education, especially in countries with high unemployment rates. The presence of high withdrawal rates of benefits or greater costs for accessing public services (e.g., kindergartens or health care) when a person starts working may produce the risk of poverty, inactivity or unemployment traps, even if the formal income tax rate is not particularly high (Carone et al., 2004, and Maag et al., 2012).

The effects of a transfer on labour supply depend on its design and on its interaction with the structure of the tax system. **Means-tested cash transfers** provide an income for those who do not work or are in-work poor (i.e., they live in households with disposable equivalent income lower than the poverty line). The benefit is then reduced if hours of work and earnings increase. If leisure is a normal good, this kind of transfer should unambiguously reduce labour supply. Its impact depends on the rate at which the transfer is reduced when income from work rises, as well as on the amount of the transfer, in the sense that small sums could be ignored in deciding how much to work. If the cash transfer is provided only with a strict work requirement, it should have a positive impact on labour supply. **Earnings subsidies** (or in-work benefits) that increase the take-home pay of workers up to some point and then are phased out act as a negative income tax first and then like a supplement to a traditional income tax. Therefore they should increase work effort in the first phase, in particular concerning the decision to work, and should have negative labour supply effects in the second stage, i.e. in the withdrawal segment of the budget constraint.

Benefits in kind, i.e. services provided for free or at prices lower than their market value (housing, child care, health care, etc.) could have a positive effect on work effort if they are complementary to labour supply (Gavhari, 1994). Their impact is, therefore, an empirical question, and depends also on the size of the subsidy. If the amount of the good or service provided by the government is higher than the optimal amount that the beneficiary would choose, i.e. if the individual is obliged to consume more of it than its optimal quantity, it is crucial to verify the relationship between the in-kind transfer and labour supply: if they are complements (i.e. if the in-kind good or service and leisure are substitutes), the demand for leisure should decrease, therefore increasing labour supply (Moffitt, 2002). For example, the provision or subsidization of housing services may be expected to have negative effects on labour supply because housing and leisure are complements, while child care services could have a positive impact on labour supply, because child care and labour are complements (child care is a substitute for leisure).

The interaction between these different forms of transfers, together with the structure of the personal income tax and of social security benefits, determines the change in disposable income associated to the decision to start working, or to devote more time to work. Following the reasoning in section 2.1 we group the incentive issues resulting from the welfare system into adverse incentive problems of the tax benefit system and a reduction of the opportunity costs of work.

4.2.1. Incentive issues of the tax and transfer system

Concerning the impact of **cash transfers** on labour supply, the review of Moffitt (1992) concluded that the most important income tested benefits in the USA do reduce work effort, but the effects are generally low. A similar conclusion is contained in Ben Shalom et al. (2012). This means that these transfers are able to reduce poverty even if we evaluate their effect against a counterfactual that incorporates the correct number of hours of work without the transfers (higher than the number of hours after the receipt of the transfer). A pure cash transfer that reaches it maximum amount when earnings are zero and then falls with an implicit tax rate of 100 % when the individual starts working has a very strong disincentive effect, but this case is mainly theoretical, because beneficiaries of social assistance transfers are mostly subject to a series of conditions (accepting reasonable job offers, participation to training programs, school attendance, etc.) that they must accept if they do not want to lose the benefit.

Unemployment benefits have a theoretically unambiguous effect on labour supply: the more they last and the higher their amount, the lower should be the propensity of the unemployed to seek work until they are available. High replacement rates can create an "unemployment trap". This fear has stirred a vast number of reforms of these benefits in all advanced economies in the last few decades.

Replacement rates have been lowered and their length shortened. From "passive" policies, aimed simply at providing income to the unemployed, there has been a shift towards "active" policies, which underlines the importance of training and investing in the human capital of the unemployed, so as to increase the likelihood of finding a new occupation and to reduce the loss of capabilities during the period spent out of work. The general consensus is that the predictions of the simple theoretical argument are

difficult to observe in reality because there is a vast heterogeneity of particular cases, regarding for example the presence and strength of active labour market policies and job conditionality, and that as a consequence it is unlikely that unemployment benefits, at least in their present configuration, exert a significant negative effect on employment. The aim of recent reforms has been to "activate" the weaker segments of the labour market (long-term unemployed, younger and older people, single mothers, migrants, disabled), with important challenges for the organisation of training services and local public authorities, cash transfers, patterns of human capital formation. However, recent budget problems induced by the recession and austerity measures have often reduced the resources available for forms of activation of high quality, with negative effects on the skills of the unemployed and on their perspective of finding new jobs (Graziano and Heidenreich, 2014). The set of these institutional, political and cultural changes make, in any case, less relevant the possibility that labour market policies may have important negative effects on labour supply.

The OECD has done an extensive work about the effects of cash benefits and taxes on financial incentives to work. The results show that in many developed countries implicit tax rates can be very high, although they are nearly always below 100 %, indicating that in general household income rises after the decision to work more. An important result from the comparative studies is that for jobless households the marginal effective tax rates associated to a low-wage work are generally higher than those associated to an average-wage work. The reason is simple: in a jobless household when one of the adults starts working the household loses a substantial part of assistance benefits. The combination of this loss of benefits with a small income from work results in marginal effective tax rates that are often higher than 60 % and in some cases reach 90 % or more. In households where one member is already working, the marginal effective tax rate associated to the beginning of a low-wage activity for the partner is much lower than in jobless households, because if a member is already working, the household has already lost much anti-poverty benefits. The result is that if partner is already working, even a low paid work is a convenient option for the partner, with marginal effective tax rates usually lower than 50 % (without considering child care costs). The transition from a low-wage job to an occupation paid at the average wage is subject to not particularly high tax rates since, again, only the personal income tax generally applies to these cases, not the loss of benefits, in particular for two-earner households.

The effects on labour supply of changes in the amount or other institutional characteristics of cash transfers to poor households may be evaluated with a rich set of tools. The main distinction is between *ex-ante* and *ex-post* studies. The first ones use simulation techniques to study the likely effect of these changes, while the second group rely on data that refer to specific episodes of policy change, either experimental or quasi-experimental. Ex-ante studies are typically divided into a first stage in which a behavioural model of labour supply is estimated on existing data, and a second one where the coefficients are applied to a hypothetical reform. Ex-post studies are based either on a structural model of choice applied to the data or on a reduced form estimation strategy. Many of the studies based on the microsimulation model Euromod are examples of ex-ante simulations of the potential effects of a tax or transfer scheme (Figari et al. 2013). Some of these analyses do not account for behavioural reactions and are therefore able to simulate the immediate distributional impact of a

policy change, evaluating the potential disincentive effects only through an examination of the changes in average and marginal tax rates. Other papers apply to the simulated distribution of incomes and policy parameters the labour supply elasticities estimated on the same dataset or taken from other studies (Colombino and Narazani, 2013). Examples of ex-post studies based on "real" policy changes, with data collected both before and after the reform, either experimental or quasi-experimental, are provided in the following subsection on in-work benefits.

What are the effects of the basic form of cash transfers, i.e. minimum-income schemes (cash transfers aimed at providing a basic income for those without other sources of income) on labour supply? A first important factor is the design of the scheme with respect to other possible sources of income: its amount when there are no other resources, its level with respect to average earnings or to the national poverty line, and its relationship with the level of unemployment benefits. Further, it is important to observe the speed with which the benefit declines for each additional unit of income from work, in particular the phase-out point and the marginal effective tax rate over the phase-out range. Second, the presence of work-related requirements for the receipt of the transfer means that the effects of minimum income benefits on labour supply is typically very different from what can be inferred from the examination of the individual budget line in a simple graph linking net income with hours of work. A survey conducted by the OECD (Immervoll, 2009) shows that all OECD countries providing minimum income benefits impose on beneficiaries a (variable) series of conditions, for example the willingness to accept suitable job offers for those who are able to work, the registration to the local employment office, participation in integration measures like training so as to improve their employability without losing a contact with the labour market. A constant monitoring of current circumstances can also guarantee that benefits are not wasted and do not encourage a state of dependency. These characteristics should greatly reduce the risk of distortions of minimum income schemes on labour supply. Some caveats are however important. First of all, it is not always clear whether the formal rule governing benefit administration and eligibility conditions are tightly or loosely applied in the different countries. Second, it is important to reduce the risk that, in case the beneficiaries do not comply with the rules, other family members unable to work (children, disabled, etc.) may suffer the consequences of a reduction or a withdrawal of the benefit. Further, not all the poor adults are able to work, for a variety of reasons, so that only a fraction of the beneficiaries will manage to be "activated" and reach self-sufficiency.

Bargain and Doorley (2011) find that the French guaranteed minimum income (*Revenu Minimum d'Insertion*) for young uneducated men reduces the participation at the labour force by 7–10 %. Other national experiences however show, in general, a significant effect of minimum income schemes on the extent and gravity of poverty, although the level of protection is almost always not enough to reach the commonly used relative poverty line set at 60 % of median disposable income. The impact on the number of beneficiaries who find a job is much more limited: it is usually positive but low, ranging between 12 % and 35 % (Blommesteijn and Malee, 2009, Marchal and Van Mechelen, 2013).

In-work benefits are tax credits or direct cash transfers reserved to people who are working but are earning low wages, or live in households with low total disposable

income. When they take the form of tax credits, they are refundable, i.e. they turn into cash benefits, so as to guarantee in any case an increase in disposable income for the worker. The main difference to traditional transfers aimed at supporting the incomes of poor households, is that the subsidy is zero for those who are not working. In contrast, a more standard anti-poverty subsidy would reach its maximum amount exactly for households with zero incomes from work. Such schemes, many argue, have the drawback of stimulating passivity and dependency, while the main effect of an in-work benefit consists in making low-paid or unqualified jobs attractive. One of the main reasons that justify the widespread interest for this kind of benefit is the by now general awareness of the importance of in-work poverty: many persons are still in poverty (defined at the household, not personal level) despite being engaged in a working activity. It is deemed that such a situation can be ameliorated either by way of an increase in the labour intensity within the household, i.e. through an increase in the number of workers, or with a greater take-home pay of those who are already working. For both these aims, an in-work benefit can be useful, since it increases the wage of workers with low market incomes, and provides a stimulus for currently non-working members of the household. In-work benefits are also judged to be more consistent than passive cash transfers with a series of measures aimed at improving self-sufficiency and individual activity, like child care services, investment in education and training, and active labour market policies. In general, the impact of in-work benefits on labour supply is a problem that deserves to be studied because these benefits are targeted to some of the groups of the population with a more elastic labour supply, in particular low-income workers, lone parents, women earning low wages. We therefore expect a positive effect on labour supply, at least at the extensive margin.

Concerning the effects of in-work benefits on labour supply (Immervoll and Pearson, 2009), there have been numerous studies of their most important application, the Earned income tax credit in the USA. The EITC is zero for those who are not working, then provides a positive transfer (negative income tax) if household income is below a certain amount, remains constant for a segment of the earning-labour supply line and finally decreases with increasing values of household income, until it becomes zero. It should therefore have a positive effect on the extensive margin, inducing some non-workers to start working, while it should have a negative impact on the phase-out region. Numerous empirical studies suggest that the EITC has actually increased the number of single mothers who are employed: Meyer and Rosenbaum (2001) for example found that 60 % of the increase in the employment rate for single mothers between 1984 and 1996 was due to the EITC. Further, the program has virtually zero impact on labour supply of married men, and a small negative effect on the occupation rate (-1 %) and on the number of hours worked by married women, i.e. the secondary earners in the family, by between -1 % and -4 % (Eissa and Hoynes, 2006, Hotz and Scholz, 2003). The negative effects on hours worked are however small, so that the net effect of the EITC on labour supply is surely positive (Keane and Moffitt, 1998; Ellwood, 2000; Hotz and Scholz, 2003; Eissa and Hoynes, 2006).

Blundell et al. (2000) use simulation techniques to study the impact of the UK Working families tax credit (later replaced by the Working tax credit and the Child tax credit) on labour supply. They use a discrete behavioural model of household labour supply with controls for fixed and childcare costs, and unobserved heterogeneity. Their main

finding is a substantial increase in labour supply for single mothers (+2.2 % in participation rates), and a modest reduction in labour supply for married women as a result of the EITC. Brewer et al. (2006) found similar results.

In France, a small in-work benefit (Prime pour l'emploi) has been introduced in 2001. Various studies, using in part simulation methods and in part ex-post evaluation techniques on quasi-experimental "real" data distinguishing between a treatment and a control group, have found that this scheme, which was inspired by the American and UK examples, has a very small, almost negligible positive effect on the labour supply of women. The main reason is the limited amount of the benefit (no more than 600 yearly euro per recipient), as well as the significant lag between the moment when one starts working and the receipt of the incentive, reducing its visibility (Cochard et al., 2008).

Simulation studies have stressed the preference, from an efficiency point of view, for the determination of the benefit on the basis of the income of the single individual involved, and not of the total household income. The reason is that the individual basis avoids the possible negative effect on the labour supply of secondary earners deriving from the means-test on household income (Blundell et al., 2007).

Given these generally small negative effects on the number of hours of those who are already working and a positive impact on the number of workers, one can conclude that the positive impact of the EITC on the living standards of workers are not significantly weakened by incentive effects. Programs of this kind should therefore be able to improve the living standards of those earning modest wages without negative behavioural reactions on labour supply, and with positive results on the participation rates of some of the weaker segments of the population, in particular women with low earning potentials.

4.2.2. Opportunity costs of work and the welfare system

For a given structure of labour supply elasticities, the actual effects of current personal income and payroll taxation, and of their possible reforms, also depend on the socio-economic environment. For example, women's labour supply is influenced by the availability and cost of social services like child care and care for the elderly. The absence of a satisfactory public provision of these services, at prices lower than in the corresponding private markets, may significantly reduce female labour supply through their effects on the cost of work (Gornick and Meyers, 2003, Del Boca and Wetzels, 2008). More generally, the study of the effects of public policies on labour supply cannot be confined to personal income taxation, social security contributions and means-tested cash transfers, but must also consider how the revenue is spent, and in particular if public expenditure is designed also with the aim of favouring labour supply. As already discussed, if the state provides or subsidises **in-kind transfers** that are complementary to work effort, like child or elderly care or public transport, then the distortionary impact of taxes and transfers on labour can be significantly reduced, particularly at the extensive margin, which is generally considered as the most important dimension for the study of the effects of the tax-benefit system on labour supply. Kleven (2014) builds from aggregate data of a sample of advanced economies a measure of the participation tax rate, i.e. an average net tax rate representing the share of earnings that remain to the worker after he/she decides to

take a job. A simple plot of the employment rate (either of the whole population or only of women) against this measure should provide a negative relationship, but the striking result is that the relationship is clearly positive, i.e. nations with the highest participation tax rates (notably the Scandinavian countries) have also the highest employment rates. In other words, the elasticity of labour supply with respect to the overall tax rate at the extensive margin could be positive. The difference with respect to other macro studies, which usually provide a more standard negative correlation between average tax and employment, may be due (apart from the time span covered by the data) to the neglect of an important factor that can have an effect on incentives: the provision or subsidization of services that are complementary to labour: across OECD countries, there is a positive relationship between the employment rate and the share of GDP that goes to public expenditure on child care, preschool and elderly care. Countries may compensate the heavy distortions caused by their tax burdens with public spending for services that lower the costs associated to work effort, therefore benefiting in particular the group of the population with the highest labour supply elasticities, i.e. women with family burdens and low or average earning potentials.

Empirical research on the effects of child care provision consistently finds a positive effect of the availability of places on mothers' labour supply, as well as a favourable impact deriving from a reduction in the cost of the service. In the UK and the USA, where the service is mainly privately provided, women's labour supply is mainly dependent on the cost of the service, while in continental and south European countries the more relevant variable is the availability of subsidised places. Del Boca et al. (2004) study the impact of child care provision on labour supply and child care demand of Italian mothers aged from 18 to 45 years. They simulate the effect of changes in the cost of the service and in its availability. Public services are mainly used by working mothers with high education. An increase in cost reduces the demand for public child care and also labour supply, while an increase in the supply of public child care has a strong positive impact on female labour supply. An increase in the degree of subsidization of the service would have a positive effect on labour supply only in the absence of rationing in service provision. Vandellannoote et al. (2014), for the Flanders region, find again a strong impact of the service provision on labour supply, while the effect of the cost of the service is lower.

Having a child is a happy event for a family, nevertheless it also entails economic costs for parents. The costs of a child can be divided into two components: a rise of family expenditures and an increase of opportunity costs, i.e. foregone earnings (Del Boca et al., 2003). As a result, the government could be interested to reduce the cost of this precious "good". Given the high cost that a state has to face to provide a reliable and universally accessible system of public childcare for children under six, several countries found an alternative in the system of child-related leaves (De Henau et al., 2008). The public option to set up an adequate system of **child-related leave** is supported by the fact that, for most parents, home represents the safest and coziest place for their children. Moreover, parents often consider themselves the best caregivers when their child is very young.

Table 8: Average duration and payment rate for type of leave, 2013

	Maternity Leave	Average payment rate[1]	Paternity leave [2]	Average payment rate [1]	Parental and prolonged period of leave [3]	Average payment rate [1]	Total paid leave for mothers [4]	Average payment rate [1]
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = (1)+(5)	(8)
Austria	16.0	100.0	13.0	24.2	65.0	24.2	81.0	39.2
Belgium	15.0	72.7	15.0	28.7	13.0	19.9	28.0	48.2
Canada	17.0	46.8	0.0	0.0	35.0	51.8	52.0	50.2
Czech Republic	28.0	70.0	0.0	0.0	84.0	46.4	112.0	52.3
Denmark	18.0	51.5	2.0	51.5	32.0	51.5	50.0	51.5
Estonia	20.0	100.0	0.0	0.0	62.0	104.4	82.0	103.3
Finland	17.5	80.7	9.0	70.0	140.8	20.1	158.3	26.8
France	16.0	98.4	2.0	98.4	26.0	18.7	42.0	49.1
Germany	14.0	100.0	8.7	49.4	43.3	49.4	57.3	61.8
Greece	17.0	100.0	0.3	100.0	0.0	0.0	17.0	100.0
Hungary	24.0	70.0	1.0	100.0	136.0	20.9	160.0	28.2
Iceland	13.0	64.0	13.0	64.0	13.0	64.0	26.0	64.0
Ireland	42.0	26.1	0.0	0.0	0.0	0.0	42.0	26.1
Italy	21.7	80.0	17.3	30.0	26.0	30.0	47.7	52.7
Latvia	19.0	100.0	2.0	80.0	52.0	70.0	71.0	78.0
Lithuania	21.0	100.0	4.0	100.0	44.0	100.0	65.0	100.0
Luxembourg	16.0	100.0	26.0	42.2	26.0	42.2	42.0	64.2
Netherlands	16.0	100.0	0.3	100.0	26.0	18.6	42.0	49.6
Norway	9.0	88.9	12.0	88.9	27.0	88.9	36.0	88.9
Poland	22.0	100.0	1.0	100.0	104.0	12.8	126.0	28.0
Portugal	17.1	100.0	20.1	51.6	13.0	25.0	30.1	67.7
Slovak Republic	28.0	55.0	0.0	0.0	136.0	20.5	164.0	26.4
Slovenia	15.0	100.0	2.1	100.0	37.1	100.0	52.1	100.0
Spain	16.0	100.0	2.1	100.0	0.0	0.0	16.0	100.0
Sweden	15.6	80.0	10.0	78.3	44.4	61.6	60.0	66.4
Switzerland	14.0	80.0	0.0	0.0	0.0	0.0	14.0	80.0
Turkey	16.0	66.7	0.0	0.0	0.0	0.0	16.0	66.7
United Kingdom	52.0	22.5	2.0	19.1	0.0	0.0	52.0	22.5
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[1]) The "average payment rate" is defined as the average replacement rate over the length of paid leave entitlement for a person normally on average wages. If this covers more than one period of leave at two different replacement rate then a weighted average is calculated based on length for each period.

[2]) Information refers to the entitlement for paternity leave and the father quota included in some parental leave regulations (for example, Finland and Iceland).

[3]) Information refers to parental leave and subsequent prolonged periods of paid leave to care for young children (sometimes under a different name, for example, "Childcare leave" or "Home care leave", or the Complément de Libre Choix d'Activité in France).

[4]) The total paid leave for mothers refers to the maximum duration of the paid parental leave entitlement not for exclusive use by the father minus any period of maternity leave taken after the birth of a child that overlaps with the period of parental leave.

Source: OECD Family database (omission of some non-EU countries).

In general there are three types of child-related leaves, which differ with respect to their length and their effect on mothers' behaviour in the labour market: (1) maternity and paternity leave; (2) parental leave; (3) childcare or home-care leave. The first type of leave consists in an employment-protected leave of absence for employed mothers or fathers at around the time of childbirth (OECD, 2011). It is generally short and directed separately to the two parents. The second type consists

in an employment-protected leave of absence for employed parents, which is often supplementary to specific maternity and paternity leave periods, and usually, but not in all countries, follows the period of maternity leave (OECD, 2011). Although the entitlement to this (generally long) leave period is individual, it is addressed to both parents to allow them to stay close to their child during his early life. The third type of leave is very similar with the second one, but, in this case, payments are not restricted to parents with a prior work attachment (OECD, 2011).

The ILO, within the framework of the Maternity Protection Convention (2000), recommended a minimum period of "not less than 14 weeks" of paid leave. Nowadays almost all OECD countries have ratified this recommendation, but many countries have fixed maternity leave entitlements just above this minimum (ILO, 2010). Indeed, across the OECD, the average duration of maternity leave was around 18.1 weeks in 2013. Table 8 summarises the situation in the OECD countries.

Women are entitled to the longest maternity leaves in the United Kingdom (52 weeks) and Ireland (42 weeks). In the United States, instead, there is no statutory right to any of the types of leave or other statutory measures. Only some individual States provide income support during leave through either sick-leave insurance or maternity leave programmes (OECD, 2011; Kamerman and Waldfogel, 2011).

Entitlements to parental, home-care or childcare leaves vary widely in their length across the OECD: from no parental leave (Greece, Ireland, Mexico, New Zealand, Spain, Switzerland, Turkey, United Kingdom and the United States) to about 141 weeks in 2013 in Finland. Moreover, parental leave payment rates are often considerably lower than maternity pay, and income support often only covers a limited part of the parental leave period (OECD, 2011).

The impact of child-related leave on female labour supply has been analyzed by several studies (Klerman and Leibowitz, 1997; Waldfogel et al., 1999; Del Boca et al., 2003; Pronzato, 2009). According to most of these, the impact on the mothers' participation in the labour market is very ambiguous (Klerman and Leibowitz, 1997; Del Boca et al., 2003). In general, child-related leaves rise female participation because women are not forced to exit the labour market after the birth of their children to better care them (Waldfogel et al., 1999; Del Boca et al., 2003). Moreover, the higher the replacement income provided to the mothers during leave period, the higher the increase of their participation (Klerman and Leibowitz, 1997). On the other hand, when leaves become significantly long, they run the risk of determining a rise of dismissal probability during pregnancy, a deterioration of the mothers' skills and therefore to compromise their long-run employment prospects, in terms of promotions and opportunities for work experience (Klerman and Leibowitz, 1997; Del Boca et al., 2003). Too long child-related leaves can, contrary to what is expected, produce negative effects both on female employment rate and on mothers wage (for an employer the cost of hiring a woman is bigger). In support of this finding, OECD (2011) shows that: countries with shorter periods of leave had, in 2008, higher employment rates among mothers with young children than countries with prolonged periods of paid leave; prolonged periods spent out of work significantly affect career development and the so-called "family pay gap" that measures the lifetime differential in earnings between mothers and childless women.

Further, there are differences on the impact of child-related leaves on female participation in the labour market according to their voluntary or compulsory character and the mother education level. First of all, a comparison of leave policies implemented in the different EU countries showed that only a lengthy compulsory maternity leave has a negative effect on the work probability of a woman, while the length of an optional maternity leave determines a positive effect on the female employment rate (Del Boca et al., 2003). Secondly, several studies state that highly educated mothers are less likely to take a long time out of work after childbirth (because of their elevated opportunity costs), while low-educated mothers (generally also low-income earners) are most likely to make full use of prolonged leave arrangements and, in many cases, exit the labour market (Del Boca et al., 2003; Del Boca et al., 2009; Pronzato, 2009; OECD, 2011). Waldfogel et al. (1999) perform their analysis on the effects of family leave coverage on women's employment using microdata from the United States, Britain and Japan. To better assess the effects of family leave policies on women's labour supply, they use panel data to track women's employment path after childbirth. In all countries the retention rate (percentage of women that return to work for their previous employer within 12 months of their most recent birth) was clearly higher for those who were covered by maternity leave than those who were not covered (especially in Japan). Moreover, the increase in retention probability due to maternity leave coverage is 16 % in Britain, 23 % in the United States and 76 % in Japan. Del Boca et al. (2003) review the main factors that may affect women's participation in the labour market: availability and costs of childcare, child-related leaves, own characteristics of the labour market, child benefit and so on. Using the European Community Household Panel (ECHP) and selecting all women aged 21-45, married (or cohabitant) from Italy, Spain, Denmark, the Netherlands available for the years 1994-1999, they develop several logit estimations on the probability of working. The results show that the length of maternity leave has a negative impact on participation, because the longer women stay out of the labour force, the greater the loss they incur in terms of skill deterioration and lost opportunities.

Another way to reduce the incompatibility between motherhood and career prospect, reducing the potential opportunity costs of children, may be increasing **employment flexibility** in the labour market (Del Boca and Locatelli, 2008), particularly when other policies to improve female labour supply are underdeveloped (Hegewish and Gornick, 2011).

Part-time work allows mothers to have more time in the day and, therefore, it is more suitable for workers who have family responsibilities and care commitments (Del Boca et al., 2009). Indeed, according to an OECD report (2011), the recent wide mobilization of unused labour supply, particularly among women, is attributable to the strong growth in part-time work since the 1980s. Moreover, to highlight the importance of part-time jobs in balancing family and work, many OECD countries have set statutory rights for parents to request part-time work, usually as long as the child reaches primary school age (OECD, 2011).

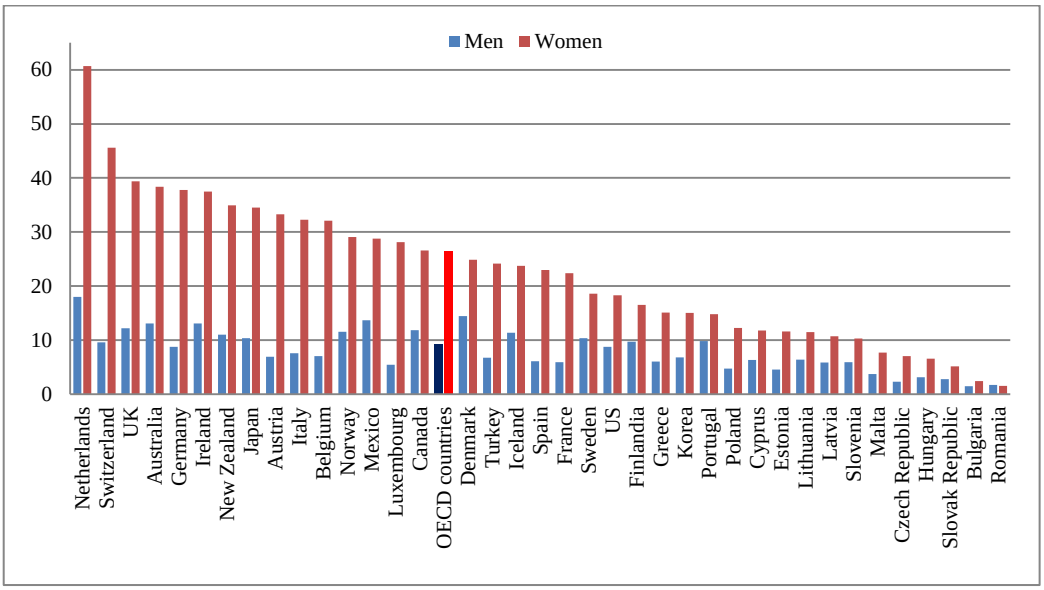
The positive effect of part-time work on women's labour supply has been reported in numerous studies generally based on cross-country analyses. Del Boca et al. (2003), using the ECHP for the years 1994-1999, showed a positive impact of the diffusion of part-time jobs on the women's probability of working in Italy, the Netherlands,

Denmark and Spain. Similar results are attained by Del Boca et al. (2004) in their study on Italian data (matched data set for 1998 from the Bank of Italy SHIW and ISTAT Multiscopo). Indeed, they found through a bivariate probit estimate that regional part-time employment leads to a statistically significant increase in the mothers' probability of working.

Sauer and Del Boca (2006) formulate a dynamic utility maximization model of married women's labour force participation and fertility choices in France, Spain and Italy. To compare labour markets of these three countries, they analyze ECHP data from 1994 to 2001. France, Spain and Italy have similar cultural characteristics; nevertheless show very different labour market statistics. According to Sauer and Del Boca (2006), this cross-country difference is substantially determined by dissimilar social policies related to labour market flexibility and child care availability. And, effectively, their estimates confirm this proposition evidencing the higher number of working mothers in the French labour market, which is the most flexible, with respect to the Spanish and Italian ones.

Finally, another recent evidence of the positive effect of part-time work on female labour supply is given by Addabbo et al. (2015) who, using EU-SILC micro data from 2007 to 2012 for Spain, find that for women there is an increase in the probability of working also when the status of part-time worker is assumed by the partner. In particular, they show that being married to a part-time worker increases the labour supply of women by 38 % for those aged from 20 to 29, and by 28 % for those from 30 to 39 years.

Figure 7: Share of part-time employment (in %) in 2012



Notes: 1) Part-time employment refers to persons who usually work less than 30 hours in their main job.
2) Data are updated to 2007 for Cyprus, Malta and Romania.

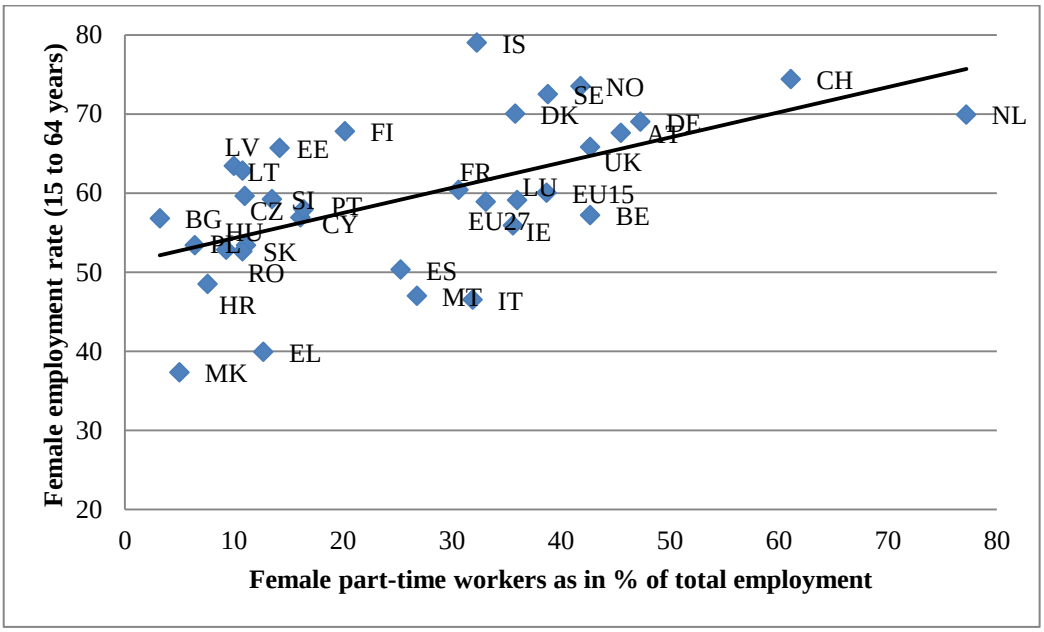
Source: OECD Employment Outlook, version April 2014; and ELFS for non-OECD EU countries, version December 2013

Figure 7 shows that in most developed countries part-time work is used more by women than by men. This evidence is attributable to the fact that usually part-time jobs are seen as a tool to balance work and family responsibilities, primarily for

mothers. According to OECD data, in 2012 the highest incidence of part-time employment for females is found in the Netherlands (60.7 %), followed at length by Switzerland (45.6 %) and UK (39.4 %). Below the OECD countries mean (26.4 %), we find France (22.4 %), Sweden (18.6 %), USA (18.3 %) and Eastern European countries. Naturally some of these values cannot be read per se, but must be seen in their specific context. For example, the low incidence of the female part-time employment in Sweden does not represent a limit for Swedish women's work decision, because in Sweden there is a considerable availability of childcare services and other important social policies to support families.

The share of female part-time employment and female employment rate are positively correlated across the European countries as can been seen in Figure 8. In the Eurostat data, the Netherlands and Switzerland show the highest share of female part-time employment, but in this case we can link these values with a very high employment rate for women aged from 15 to 64. However, the shown correlation in Figure 8 is stronger in the EU-15 countries than in the Eastern European countries. With the exception of Greece and the Republic of Macedonia, part-time work is not very developed in Eastern European countries, while women's employment rate is high.

Figure 8: Female part-time workers as in % of total employment and female employment rate (15 to 64 years) in 2013



Source: Eurostat – Data Explorer

Among the EU15 countries, Greece has the lowest female employment rate (39.9 %) as well as the lowest share of part-time among workers (12.7 %). Other Mediterranean countries (Spain, Malta and Italy) have a higher share of female part-time and employment rates, but still below the European average.

However, part-time work does not always have a positive effect on female participation in the labour market. Under particular conditions, part-time jobs may have also negative effects on hourly earnings, training, career prospects, job security and on the access to unemployment insurance (Del Boca et al., 2003; OECD, 2011).

Part-time jobs tend to be more frequent in low-qualified occupations (Del Boca et al., 2003), often leading to very fragile work positions especially for young women (Addabbo et al., 2015), and if part-time workers living in families with low disposable incomes have high probabilities to leave the labour market (OECD, 2011).

Bardasi and Gornick (2008), investigating the wage gaps between part-time and full-time women workers in six OECD countries (Canada, Germany, Italy, Sweden, the UK and the US) in the mid-1990s, find the existence of a part-time wage penalty among women in all countries except Sweden. For their analysis the authors use comparable micro-data from the Luxembourg Income Study (LIS). According to Bardasi and Gornick (2008) there are several factors that lead to expect part-time pay penalties: unadjusted wage differentials that favour full-time workers, because full-time work may be seen as a signal of higher levels of human capital; the existence of a pay gap between full-time and part-time workers that depends on unobserved characteristics (for example, the attention level). Generally women with a part-time employment are presumed to be less productive on the job because their energy and attention are divided between employment and caregiving. The results of their analysis across countries reveal that the highest wage gaps between part- and full-time workers are found in the US (18 % in less for part-time workers) and in Italy (15 %), while Canada and Germany stay close the average values (8-9 %). Moreover, while the UK difference is not statistically significant, the Swedish wage gap is even positive (+2.8 %).

Matteazzi et al. (2012) compare Austria, Italy, Poland and the UK in the EU-SILC data for the year 2009 and conclude that different profiles of female participation and part-time employment can be observed within Europe. The statistics analysed show that the largest full-time/part-time wage differentials, in percentage terms, are found in the United Kingdom and Poland where, on average, a full-time worker earns about 15 % more than a part-time one, while the wage gap is significantly smaller in Austria (8.9 %) and Italy (10.3 %). In conclusion of their study, Matteazzi et al. (2012) divided the four countries under examination into two groups: in Austria and the UK part-time employment is widespread, while in Italy and Poland it is still rare and underdeveloped. Nevertheless, within both of these groups, there is heterogeneity in the entity of the wage gap.

4.3. Summary

This section reviewed the literature on the broader economic environment affecting the incidence of labour taxation. Among the wage settings institutions the role of wage bargaining is once more stressed, with a more centralised bargaining resulting in more incidence on workers than bargaining at the industry level. Furthermore minimum wages will affect the labour market outcome. In case they are binding the incidence result is clear, with the incidence fully falling on the employers. However, even in the case of non-binding minimum wages the literature suggests that they contribute to labour tax induced employment problems.

Theoretical results suggest that the progressivity of the personal income tax affects the labour market outcome in the presence of matching inefficiencies. For a given tax burden a more progressive tax system will reduce the search effort of unemployed people because a higher part of the additional match-specific rent will be tax away.

Similarly the incentive to pay efficiency wages above the market clearing wage rate is reduced in progressive tax system. Despite the lack of conclusive evidence for these theories so far, we therefore will also include progressivity measures in our framework of indicators.

A review of the impact of welfare state on labour supply stresses the importance of measures of unemployment or participation trap. The withdrawal of cash benefits or transfers in-kind can create adverse incentive problems which can translate into employment problems through the labour supply side. Another important aspect affecting especially female labour supply is the availability of part-time work and possibility of parental or maternity leave.

5. Framework with indicators to identify the role of labour taxation in causing and solving employment problems

This section aims to unify the findings of the study so far and embed them in a framework, which allows identifying the scope of labour taxation reforms to improve the labour market outcomes in the different Member States. We will develop a number of indicators, which will break down the question of how effective tax measures are to solve employment problems into components.

The first set of indicators aims to identify the extent of the unemployment, non- or underemployment and whether these are mainly structural in nature or whether these can be traced back to business cycle reasons. The second set of indicators sheds some light on the tax structure and the public finance situation in the Member States and therefore evaluates the potential role of labour taxation in causing or solving employment problems. The third set of indicators tackles the question what will affect the incidence of labour taxation.

Before we set out to derive a framework of indicators, we take a step back and highlight the value-added and the limitations of indicators in the next subsection. To this end we will have a closer look at the Lisbon Methodology Working Group (LIME) assessment framework (LAF) as it is developed by the European Commission (2008). Where appropriate we will also consider the comparison to the simple averages and to best practice examples additionally to the LAF.

5.1. Value-added and limitations of indicators

The LAF is very prominent analytical tool to systematically compare the GDP growth performance and 20 policy areas affecting growth in the individual Member States to a benchmark. The heart of the LAF is a standardised continuous score system where the score of each indicator is defined as

$$\text{Score}=[(\text{Indicator-EU15 average})/\text{Standard deviation}]*10$$

with a cap at 3 standard deviations.[80] However, as the European Commission (2008) very clearly pointed out it is neither a rule nor is it free from caveats or limitations. In the following we briefly summarise the main benefits and drawbacks already mentioned by the European Commission, and add a few additional limitations in the context of this study and how we aim to circumvent these.

5.1.1. Key benefits and value-added of LAF

The most obvious advantages of the LAF are the **systematic approach** and its **transparency**. Given the clear documentation and the simple formula used there is a straightforward answer provided to the question which in growth relevant aspect Member States under- or over-perform. Additionally the framework is **flexible** in two key aspects. First it is easily possible to introduce additional policy areas or to replace current policy areas with more fitting ones. And secondly the transparent list of qualification reasons can be expanded to cover extraordinary circumstances for

[80] See also European Commission (2008) for a description and discussion of the methodology.

particular circumstances in Member States. In sum, the LAF can be very useful to identify policy areas to enhance the growth potential in the Member States, but only if one bears in mind a number of limitations as the next subsection will show.

5.1.2. Main limitations and caveats of LAF

Following the European Commission (2008) we start with the limitation of the LAF which were already pointed out by the developers themselves. A lot of this critique is not specific to the LAF, but rather general in nature. First and foremost, the framework of indicators is showing a correlation and **does not provide any information about causality**. This limitation will also apply to the framework of indicators developed in this study. To say anything about causality one would either have to find exogenous variation in indicators or make strong (most likely non-testable) theoretical assumptions. Since this is beyond the scope of this study, the limitation of non-causal interpretation is also applicable for all our indicators.

Secondly a very general limitation of LAF is the problem of inevitable **time lags**, which will result in many indicators used in the LAF not reflecting the impact of recently adopted reforms. This problem exists for very data-based indicator and highlights potential a trade-off between more recent data and more reliable data. For complex information like GDP and corresponding growth rates, output gaps, tax revenues and public expenditures there is likely to be a bigger chance of revision if the Member States need to provide the necessary information at short notice. This problem is even more pronounced if major reforms have been implemented. The provision of very recent data is then often only possible with a prediction of the impact of the reforms. Hence relevant reforms contribute to the trade-off between timeliness of the data and reliability.

A further caveat is the **level of aggregation**. Again, this is a very general limitation which not only applies to the LAF. Similar to the timeliness, there is a clear trade-off between data availability and comparability and the level of aggregation. The more disaggregated the data is used, the better the actual situation in the Member States is represented. At the same time the more disaggregated the individual indicators become, the less comparable they will get across the Member States. In consequence one needs to strike a balance between comparability and availability and level of detail to make comparisons amongst all Member States.

An additional issue may arise when two sets of indicators are to be interpreted together because of **spill overs or complementarities** between them. If the level of the score in one particular indicator depends either directly (in some instances even mechanically) or indirectly through a third latent variable on the score of another indicator the isolated interpretation of this indicator can be misleading. A prominent example is the youth unemployment rate which is strongly dependent on the labour force participation of the young population. If a large fraction of the youth is still in education, this can drive up the youth unemployment rate and therefore lead to wrong conclusions.

Two further aspects of (potential) limitations are pointed out by the European Commission (2008). The first one is the fact that LAF is not covering all relevant aspects of policies which might be growth relevant and the second one is the fact that no relative importance can be assigned to the individual indicators. These are again

very general aspects which are not met by any set of indicators and therefore also apply to any indicators put forward in this study.

More importantly there are some aspects of the LAF framework, which are clearly limitations and are not fully addressed in European Commission (2008) and relevant for the framework of indicators in this study. The first one is the fact that the **main benchmark** in the LAF is the **average of the EU15** countries. By fixing this benchmark a lot of weight is given to the value of the large Member States like France and Germany. The LAF does somehow acknowledge this by allowing a qualification rule if the average is not ambitious enough, but there is no clear discussion of the role of the big countries in the average.[81]

Furthermore the comparison to an average does not necessarily provide the correct answers if the indicator has a **non-linear impact** of the outcome in question. This could create a simple under- or overestimation of the relevance of the indicator if the relationship is not monotonous but progressive/regressive. Or in the case of a non-monotonous impact the result could be meaningless. To provide an example in our context, take the degree of centralisation in the bargaining process. If intermediate levels of centralisation, i.e. bargaining at the industry level, are associated with the biggest share of incidence on the employers a comparison to the average level of centralisation of bargaining will not be very informative.

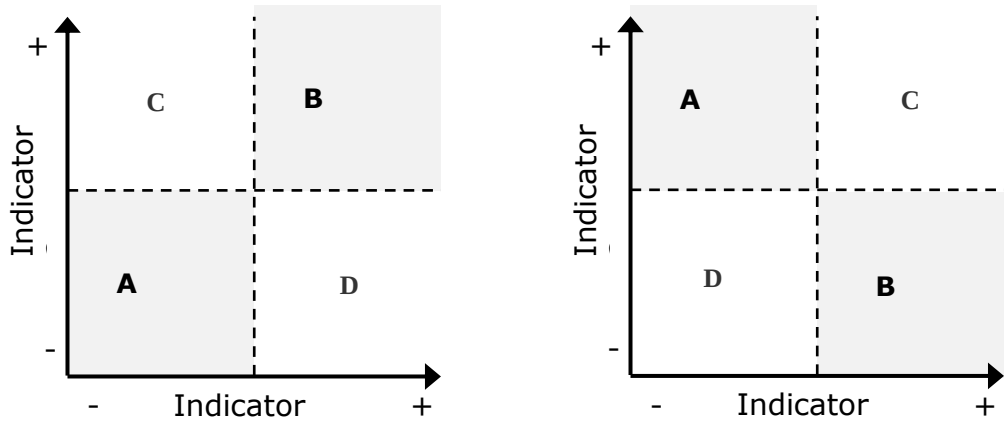
5.1.3. Dealing with limitations of the LAF

Most of the above mentioned limitations of the LAF are inherent to any data-based indicators. While this should not allow the potential users of indicators or any framework of indicators to ignore the limitations, it is little more which can be done, other than openly discuss the inherent problems. It is noteworthy that the European Commission (2008) does raise most of the problems themselves, like the trade-off between timeliness of the data and data availability/quality, the trade-off between the level of aggregation and data comparability/availability and the impossibility to use the framework of indicators for causal interference. It is also beyond the scope of this study to address these issues, but for the last two points of criticism at the LAF, i.e. the weight of the large countries in the benchmark and potentially non-linear impact, we want to offer an additional approach to complement the approach of LAF.

Particular aspects we want to address are the complementarities, the potential weighting problem through using the average of the EU15 as a benchmark and non-linear relationships. To identify these issues and to make further progress in understanding the potentially complex relationship between indicators we propose a simple extension of the LAF framework. We start to plot indicators which are theoretically linked to each other against each other. Figure 9 sketches the idea. The simple scatter plot of two indicators can reveal a number of things.

[81] The LAF framework has more recently been used with the EU28 as benchmark, which mitigated, but not solves the problem with the weight of large countries. Additionally the use of averages for ordinal scales or categorical data is not appropriate.

Figure 9: Proposed extension to the LAF



Source: Own illustration

On the left panel we depict a combination of two indicators where we expect a positive correlation; while on the right panel we depict a combination with a negative correlation. Examples for a positive correlation include the plot between total unemployment rate and structural unemployment rate, total tax revenue and tax revenues on labour taxation. On the other hand we would for example expect a negative correlation between the total unemployment rate and the employment rate or between tax on labour and tax on consumption, if both are measured as share of tax revenues.

The dashed lines represent threshold values of the indicators and therefore divide the area of the scatter plot into four areas. Note that these areas would only be equally sized if the distribution of the values of the indicators is not skewed and the simple average is use as a threshold. It is also easily possible to use the weighted average of all EU Member States, or the EU15 as in the original LAF. If one also excludes the areas plus/minus 3/10 of a standard deviation from the weighted average, one is back to plotting two LAF scores against each other, which allows a direct link to the existing framework. The two shaded areas A and B represent the regions where we would expect most observations to lie in. In contrast if Member States lie clearly in the area of C or D they have at least to some extent altered the link between the two indicators. In the right panel, the case of the positive correlation between the indicators, countries falling to area A (B) are clearly (over-) underperforming on both measures. In the left panel there exists a trade-off between the two indicators, and countries falling to area C have managed best to achieve a good result on both indicators. In contrast the area A and B now give an indication on the relative weights Member States put on policies with a trade-off.

An additional benefit plotting two indicators against each other can be the illustration of non-linear relationships between the two indicators. For example, if a plot between two indicators does only fall in A, B and D in the right panel, this could be an indication of an exponential relationship between the two indicators. A possible example could be the relation between the total tax wedge and tax avoidance. Similarly a u-shaped or hump-shaped relationship can be detected, like one would expect between the decentralisation of union and tax incidence falling on employers.

In the following we will illustrate the benefit of the additional graphical analysis through the plots for some of the indicators aiming to identify employment problems and the socio-economic groups especially vulnerable to the employment problems. It is beyond the scope of this study to collect data of sufficient quality for all proposed indicators and all countries. Therefore and for reasons of space and to keep the length of this study manageable we abstain from presenting full tables or graphical representation of all indicators. In this section we present data for the first indicator groups, but limit the exposition to the latest year available. This could easily be an extreme value; hence it is advisable to also consider the recent changes in the individual indicators, to see the historical path leading to current outcome. To further illustrate this section 6 will go further and work out more of the framework for a number of countries.

5.2. Indicators group 1: Identification of employment problems

The results of the indicators in this first group set the background and clarify how big the need for labour market improving tax reforms is. Building on the short discussion in section 2.1 we start with the distinction of different employment problems. After establishing a broad overview of the general situation of the employment problems in the Member States the indicators go one step further to identify the situation in the various groups of vulnerable persons, namely women, the youth, the elderly, migrants and persons with low levels of education. The third aspect in this first indicators group is to highlights mismatches between labour supply and demand as non-tax factors influencing structural unemployment.

5.2.1. Group 1a: Unemployment, non-employment and structural unemployment

Obvious starting point for the identification of employment problems is the level of the **unemployment rate**. Following the discussion about the non- and underemployment in section 2.1 simply looking at the unemployment rate would fall short of capturing the full extent of the employment problems. Consequently the second indicator we propose to use is the **participation rate** to capture the share of the population which stays outside the workforce. Also along the crude distinction we propose in section 2.1 the differences between unemployment and non-employment can already hint at the employment problem being more on the labour demand side if both the unemployment rate and the participation rate are high. Put differently, if the participation rate is low, the employment problem is more likely also due to labour supply problems.

Furthermore, since the recent recession has had an important influence on the cyclical part of unemployment the third indicator in this group is the **NAWRU**, aiming to describe the level of structural unemployment. While the discussion in Box 2 highlights that the NAWRU is only an approximate measure of structural unemployment, the difference between the unemployment rate and the NAWRU will give at least an indication how much of the unemployment is due to cyclical reasons. The bigger the difference between the two concepts of the unemployment rate the more is the employment problem due to an indirect labour demand problem because of a lack of aggregate demand.

Box 2: On NAWRU as a measure of structural unemployment

The concept of NAWRU to measure the structural unemployment is controversial. The European Commission (2013c) investigates the concept of the NAWRU further and finds that this measure indeed includes significant cyclical variation. If the real wages only adjust slowly to large cyclical shocks the labour demand will be cyclical in nature and the NAWRU consequently will contain a cyclical component. To gain further understanding of the extent of the cyclical part in the NAWRU the analysis of the European Commission (2013c) predicts the NAWRU only on structural features (labour market institutions, tax wedge etc.) of the individual Member States. The result show that this predicted part of the NAWRU is markedly lower in most Member States. In particular the difference is most pronounced for some southern countries like Spain, Portugal and Greece where the aggregate demand shock was very large. However, since there is no comprehensive data for structural unemployment available, the first set of indicators still relies on the NAWRU. A further reason for not relying on a measure derived from estimations based on institutional features is that this measure will be endogenous to the question we aim to address in this study. Therefore, in the absence of a better measure of structural unemployment, we have to rely on the NAWRU and the caveat, that this measure may still contain a significant share of cyclical variation needs to be borne in mind.

For this first group of indicators Table 9 shows both the values and the corresponding scores calculated according to the LAF.[82] The three indicators aim to pin down where the overall employment problems are most pronounced. Starting with the unemployment rate the countries already discussed in the introduction (Greece, Spain, Portugal and Croatia) emerge as those with the biggest employment problems.[83]

The participation rate reveals different countries with employment problems. Simply looking at the LAF score the countries which are identified as having a low participation rate include Croatia, Hungary, Italy, Malta and Romania. While at this stage the underlying causes for the differences in the participation rate are not clear, it seems natural to go beyond the overall participation rate and evaluate the participation rate for the identified vulnerable groups. This will be done in the next subsection.

Before turning to the vulnerable groups, Table 9 also reports a measure of structural unemployment. The idea behind the use of NAWRU is to filter out unemployment which is driven by cyclical factors. However a closer look at the values and LAF scores for the NAWRU already points at the very close relationship to the actual unemployment rate. The countries with the highest structural unemployment are again Greece, Spain and Croatia.

[82] We deviate somewhat from the original calculation, since we use the average of the EU 28 countries as benchmark.

[83] We calculate the unemployment rate for the active population in working age, defined as 20 to 64 years.

Table 9: Indicator group 1a: Values for 2013

Country	Unemployment rate		Participation rate		NAWRU	
	Value	LAF Score	Value	LAF Score	Value	LAF Score
Austria	4.6	-10.6	79.2	5.9	4.4	-12.8
Belgium	8.3	-4.1	73.2	-6.9	7.7	-3.7
Bulgaria	12.8	3.9	72.8	-7.8	12.6	9.6
Cyprus	15.8	9.4	79.8	7.1	11.3	5.9
Czech Republic	6.9	-6.6	77.9	3.0	6.8	-6.2
Germany	5.2	-9.5	81.6	11.0	5.6	-9.7
Denmark	6.6	-7.1	80.9	9.5	5.8	-9.0
Estonia	8.7	-3.4	80.3	8.2	9.8	2.0
Greece	27.3	29.8	72.7	-8.0	17.7	23.4
Spain	25.6	26.8	78.8	5.1	18.8	26.5
Finland	7.5	-5.4	79.3	6.0	7.5	-4.4
France	9.5	-1.9	76.9	0.9	9.6	1.3
Croatia	16.6	10.8	68.6	-16.8	14.1	13.8
Hungary	10.1	-0.9	70.3	-13.2	9.7	1.5
Ireland	12.9	4.1	75.2	-2.7	11.7	7.2
Italy	12.0	2.5	67.9	-18.3	10.4	3.6
Lithuania	11.9	2.3	79.3	6.0	11.1	5.3
Luxembourg	5.6	-8.9	75.4	-2.3	5.5	-9.8
Latvia	11.9	2.4	79.1	5.7	12.2	8.6
Malta	5.6	-8.9	68.8	-16.3	6.2	-7.8
Netherlands	6.2	-7.8	81.5	10.8	5.3	-10.3
Poland	10.2	-0.6	72.3	-9.0	9.6	1.4
Portugal	16.5	10.6	78.3	4.0	11.8	7.5
Romania	7.3	-5.9	68.9	-16.1	6.9	-6.0
Sweden	7.1	-6.1	85.9	20.2	7.0	-5.8
Slovenia	10.2	-0.6	74.9	-3.4	8.1	-2.6
Slovak Republic	13.9	6.0	75.5	-1.9	13.0	10.8
United Kingdom	6.7	-6.9	80.2	8.0	6.0	-8.4
European Union	10.6		76.4		9.1	

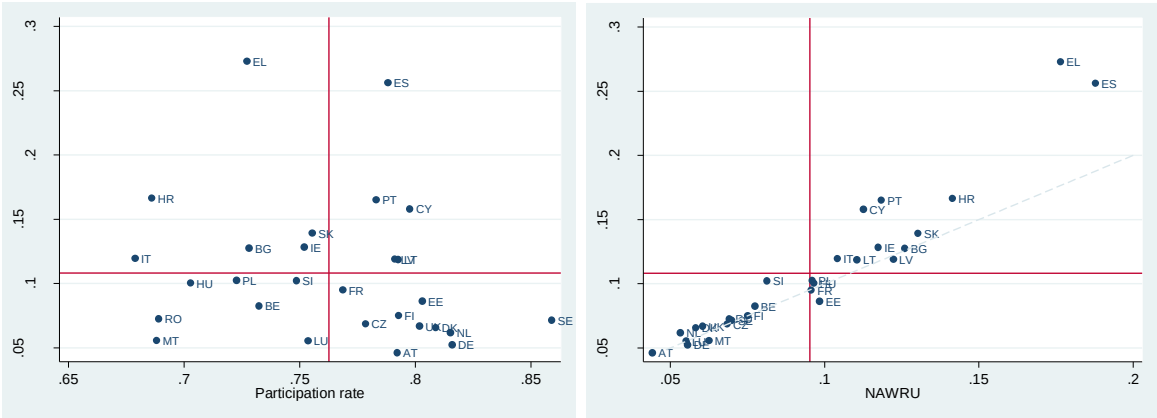
Source: LFS and AMECO database

To directly investigate the relationship between the indicators in group 1 we follow the argumentation above and plot them against each other. The left panel of Figure 10 shows the unemployment rate plotted against the participation rate and the right panel plots the unemployment rate against the NAWRU.

The red lines represent the weighted average for the EU 28 countries and divide the graphs into four quadrants. The upper left quadrant in the left panel shows countries which are potentially facing the worst employment situation. The combination of a high unemployment rate and a low participation rate hints at the fact that in addition to a large fraction of the workforce looking for a job a substantial fraction of the

population stays away from the workforce because of unfavourable job prospects. Countries very clearly falling into this category are Greece and Croatia. The upper right quadrant in the left panel show countries which have a high unemployment rate but also an above average participation rate. These countries still face big challenges at the labour market, but the unemployment rate is not artificially masking the problem but rather painting a realistic potentially even too negative picture. Countries falling into this category include Spain, Portugal and Cyprus. The lower left quadrat in contrast contains countries where the unemployment rate might send too optimistic messages, because of a low participation rate. Countries falling into this quadrant include Malta and Romania. Finally countries, in the lower right quadrant e.g. Austria, Germany, the Netherlands or Sweden, have with respect to this measure, the best labour market outcome.

Figure 10: Unemployment rate, participation rate and NAWRU, 2013



Source: LFS and AMECO database, own illustration

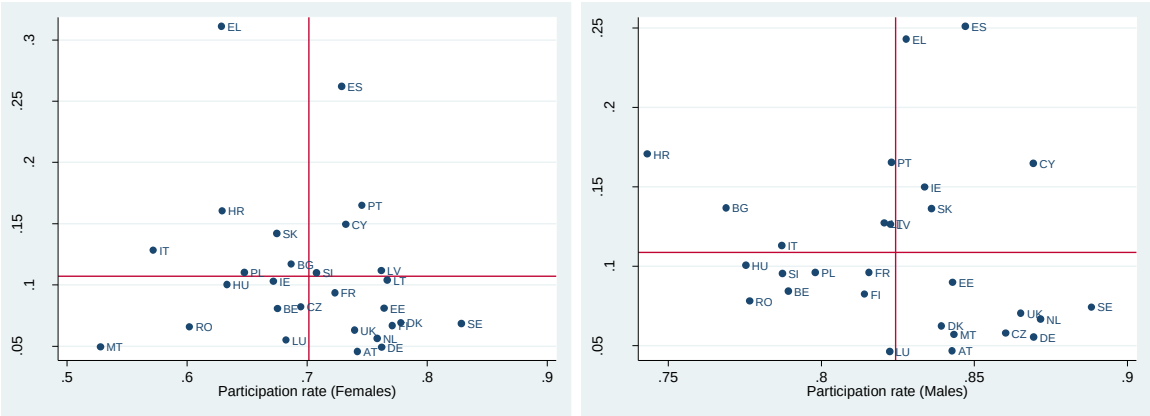
The right panel of Figure 10 plots the unemployment rate against the NAWRU. The most obvious thing to learn from this plot is the close relationship between these two measures of unemployment. The second, more subtle, thing that can be observed is that some of the new Member States tend to have a slightly smaller difference between the overall unemployment rate and the structural unemployment rate. The grey dotted line represents the 45 degree line. Countries lying above this imaginary line have a cyclical component – according to the NAWRU measure of structural unemployment – component in their current level of unemployment. The biggest cyclical component is not surprisingly observable for the countries with a large overall unemployment rate, name Greece, Spain, Portugal and Cyprus.

5.2.2. Group 1b: Employment problems and vulnerable groups

The indicators in the previous subsection give a first impression of the countries with the potentially largest employment problems, but do not contribute much to the further understanding of the underlying causes, or the situation of the different socio-economic groups in the various Member States. To go beyond the overall number of unemployment we suggest to repeat the exercise for the unemployment rate and the participation rate separately for each of the vulnerable groups and the corresponding non-vulnerable group. Figure 11 illustrates this for **women**, with the unemployment rate plotted against the participation rate for women in the left panel and the

corresponding plot for men in the right panel. A quick comparison of the weighted average again depicted through the red lines shows no big difference in the unemployment rate with 10.5 % for men and 10.6 % for women. The participation rate in contrast is with 70 % for women much lower than the 83 % for men. This reflects the more responsive labour supply of women.

Figure 11: Unemployment and rate participation rate, by gender, 2013



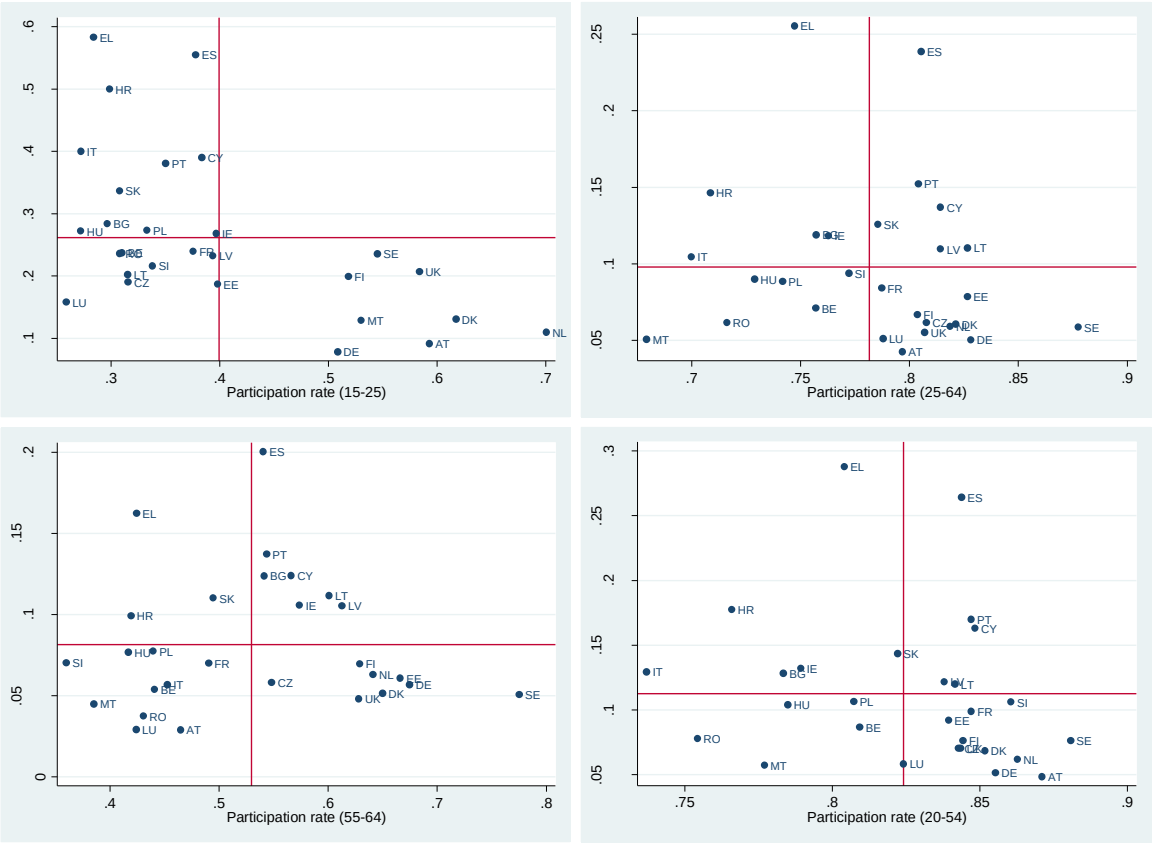
Source: LFS, own illustration

The relative situation for women varies substantially across the different Member States. For example in countries like Malta, Cyprus and Ireland the unemployment rate is higher for men than for women, which reflects the much smaller participation rate of women in these countries. In other countries like Greece and Italy women have a clearly lower participation rate and a higher unemployment rate reflecting the very severe situation at the labour market. It is mostly the Nordic countries, in particular Sweden, where the labour market situation for men and women is comparable.

Figure 12 shows the same plots for different age categories to identify Member States where **young people** or **elderly people** face more difficult situations at the labour market. The top two plots compare youth unemployment and participation rate to the rest of the workforce. From the red lines, again representing the weighted average of the EU28 countries, it becomes apparent that the population between 15 and 25 has a much weaker attachment to the workforce with an average participation rate of approximately 40 %. At the same time the unemployment rate is much higher for the young people. The clearly visible negative correlation reflects that a large fraction of young people is still in education and low-skilled are overrepresented in the workforce between 15 and 25 years. Nevertheless the results in Figure 12 clearly demonstrate the employment problems of the youth.

The lower part of Figure 12 analyses the situation for the elderly. Here we can observe a lower participation rate of only 54.3 % together with a lower unemployment rate of 7.6 % for the part of the workforce aged between 55 and 64. This reflects that elderly people losing the employment are more likely to leave workforce altogether. Or, indeed, that a large share of the population opts for early retirement and thereby reduces both unemployment and participation rate. Again, there are large differences between the Member States. In Sweden the elderly still have a participation rate of 77.5 %, while in other countries with seemingly healthy labour market like Austria or Luxembourg the participation rate is only at 46.5 % respectively 42.4 %.

Figure 12: Unemployment and rate participation rate, by age groups, 2013



Source: LFS, own illustration

The clearly lower participation rates for both the young and the elderly hint at a labour supply problem. The reasons for not participating at the labour market, however, are very different. Young people very often stay in education while the elderly opting for early retirement. The much higher unemployment rate for the youth confirms that there is also a labour demand problem, while the lower overall unemployment rate for elderly might disguise an issue of long-term unemployment. Here, a further refinement of the indicator might be in order to separately analyse long-term unemployment of the elderly.

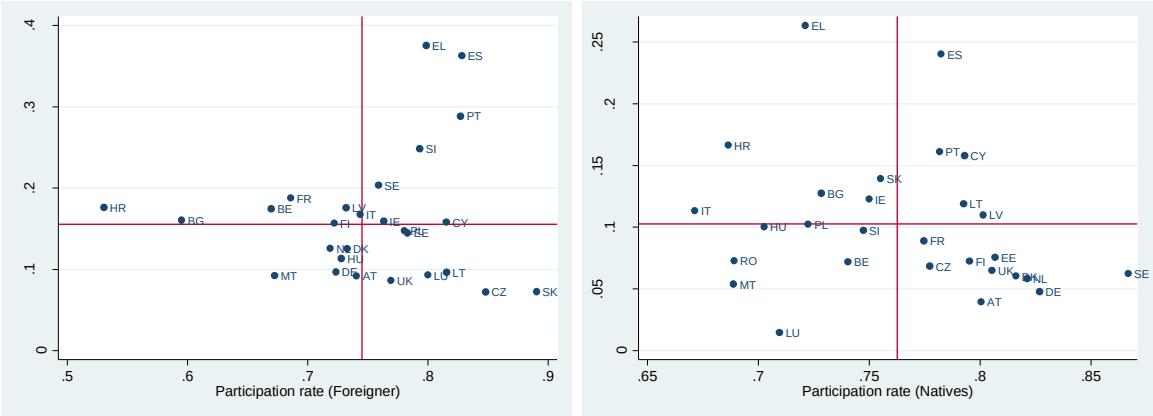
In Figure 13 we present the results for one more vulnerable group, namely **migrants**. Again the left panel shows the situation for the part of the workforce which is not included as domestic in the LFS and the right panel shows the situation for the native workforce as comparison.[84]

While the participation rate for the foreign-born part of the population is on average similar to the one of the native population, the unemployment rate is clearly higher. This is true across the board and even in Sweden the unemployment rate of foreigners is above 20 %. The countries with relative better labour market outcome for

[84] In fact the LFS does in principle break down the population into more migration categories such as non-European migrants or migrant from the new Member States, but since the data is incomplete for some countries we use the difference between "Total" and "domestic". Still for Romania no data about unemployment by migration status is reported, therefore the entry for Romania is omitted in the graph. The participation rate for foreigner is 59.3 % in Romania.

foreigners include the Czech Republic and the Slovak Republic. In other new Member States like Croatia and Bulgaria foreign born are participating significantly less at the labour market. However, a further look into the composition of the migrant population is necessary to put these numbers into perspective.

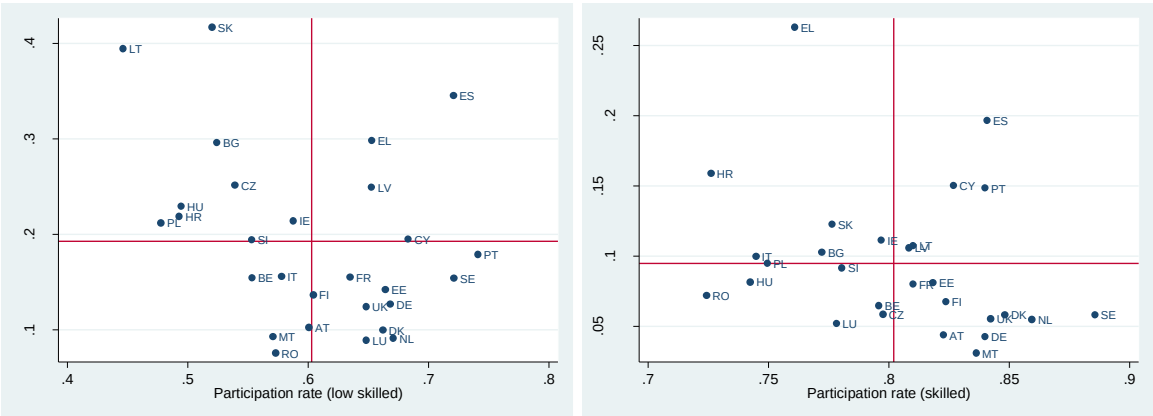
Figure 13: Unemployment and rate participation rate, by migration status, 2013



Source: LFS, own illustration

Finally the level of education, respectively the **skill-level** of workforce will play a crucial role for their chances at the labour market. Therefore Figure 14 compares the labour market outcome of low-skilled against the rest of the workforce. Evidently the low-skilled part of the workforce performs worse on both dimensions. The participation rate is only slightly above 60 % in comparison to the participation rate of slightly above 80 % for the rest of the workforce. Additionally the average unemployment rate is at 19.1 % for the low-skilled compared to only 8.4 % for the rest of the workforce. Interestingly the unemployment level of the low-skilled is particularly high for Eastern European countries like the Slovak Republic, Lithuania, Bulgaria and the Czech Republic. In contrast, for the higher skilled part of the work force unemployment is highest in the countries with a larger cyclical component of unemployment

Figure 14: Unemployment and rate participation rate, by skill class, 2013



Source: LFS, own illustration

A necessary further refinement of the indicators presented so far is therefore the link of the already presented vulnerable groups with their respective education level.

However, since these data result in a much more disaggregated data level with worse coverage and a large number of possible combinations we do not present results in this study.

Overall the look into the specific groups highlight that the underlying causes for employment problems are most likely very diverse. For women and the elderly, these first indicators point towards a labour supply issue. For the other groups, the lower participation rates together with high levels of unemployment indicate both a labour supply and a labour demand problem. The skill-level is also found to be a very important determinant, with the higher skilled workforce generally having a lower unemployment. In the countries where higher skilled are also hit by unemployment this this seems to coincide with a cyclical aspect of unemployment.

5.2.3. Group 1c: Non-tax factors contributing to structural unemployment

Before the next subsections set out to identify the contribution of labour taxation to employment problems, we propose to include a few indicators which identify important non-tax factors of unemployment. As already identified in the broad discussion of employment problems in Section 2.1 a mismatch between labour supply and labour demand can result in unemployment. Therefore the indicators in this group aim to capture the contribution of the mismatches to structural unemployment. The disparity between the labour supply and labour demand can originate in a difference in skills, in the sector of employment and geographical. Therefore we suggest to follow Arpaia, et al. (2014) and use their three mismatch indicators.

First there is the **sectoral mismatch indicator** defined as

$$Sectoral\ MI = \sum_{i=1}^{I} e_i |v_i - u_i|$$

where i indicates the sector, and e_i, v_i, and u_i denote the respective shares of employment, vacancies and unemployment. All of the necessary data to construct this indicator can be obtained from the LFS.[85]

For the **skill-mismatch indicator** a somewhat different approach is necessary since there is no detailed information about the skill level for vacancies available. Hence the indicator for the skill-mismatch is, again following Arpaia et al. (2014), based on the difference between the skill level in the population and the employed workforce. The indicator is then defined as

$$Skill\ MI = \sum_{i=1}^{S} q_i |q_i - n_i|$$

where q_i and n_i are the share of individuals with skill level i in the population and in employment. This indicator is typically built for S =3 education groups, namely low-

[85] It is however worth noting, that the data availability varies greatly across Member States. In particular Arpaia et al. (2014) only construct this indicator for 19 countries, and none of our example countries (Austria, Spain, Italy) is among those.

skilled, which are defined as having only pre-primary, primary or lower secondary education (ISCED levels 0-2), medium-skilled with upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4) and high-skilled with tertiary education (ISCED levels 5 and 6). The data is again available from the LFS.

The third mismatch indicator aims at geographical mismatches between the labour supply and labour demand. This **regional mismatch indicator** is defined as

$$Regional\ MI = \frac{\sqrt{\sum_{i=1}^{R}(u_i - \bar{u}_i)^2}}{\sum_{i=1}^{R} u_i\ /R}$$

where u_i describes the unemployment in region i and $\bar{u}_i$ the average unemployment over all regions R. Data for regional unemployment rates at the NUTS 3 level is again available from the LFS.

To learn more about the origins of the mismatch between labour supply and demand two more sets of indicators can be useful. First the mismatch can originate more from the labour demand side, which will be reflected in changes in vacancies and employment. Secondly the mismatch can result from the labour supply side if the characteristics of the population and consequently the workforce change due to socio-demographic trends.

Therefore the three mismatch indicators are complemented through adding corresponding indicators measuring the change in employments.[86] For a **sectoral employment change index** one can define

$$Sectoral\ employment\ CI = \sum_{i=1}^{I} \left| \frac{n_{it}}{N_t} - \frac{n_{it-s}}{N_{t-s}} \right|$$

where n_{it} denotes the employment in sector i in time t and N_t is the total employment. Correspondingly the n_{it-s} and N_{t-s} describe the situation s periods before. This indicator gives a broad idea of shifts in the relative employment in the sectors. The higher the value in this indicator is, the higher is the pressure on the workforce to adopt to avoid unemployment. Following the exact same logic one can derive corresponding **employment change indicators for skill-levels and regions**.

To capture changes in the labour supply side a corresponding measure of changes in the socioeconomic characteristics of the population can be derived. Specifically the **indicator for change in skill-levels** in the workforce can be defined as

$$Skill\ composition\ CI = \sum_{i=1}^{S} \left| \frac{l_{it}}{L_t} - \frac{l_{it-s}}{L_{t-s}} \right|$$

where l_{it} denotes the workforce in skill category i in time t and L_t is the total workforce. It is noteworthy that this change indicator is expected to change slower

[86] If available, disaggregated information about vacancies would be even more suitable. However, to have some consistence we propose to use employment information which is sufficiently available at this level of disaggregation.

than the employment change indicators above, therefore the length of the period *s* could be adjusted accordingly. Two additional workforce composition indicators which can provide useful insights are the age categories and the migrations status.

As a last step in this group of indicators we propose again to graphically analyse the relationship between the change and the mismatch indicators. In combination these indicators can give an indication about the extent of unemployment which is due to shifts in labour demand or labour supply and resulting mismatches in the labour market. Appendix Table 2 lists the values for some of the mismatch and change indicators. Apart from a few outliers, which include a large sectoral change in Hungary and a substantial skill mismatch in Malta the results show that there is a relatively strong regional variation in unemployment in Austria, Italy and Romania. The sectoral shifts seem to play a role in Spain, Ireland, Poland and Greece. This is, however, only a static view in one particular year, that's why will look at the change over time in the worked out examples in section 6.

5.3. Indicators group 2: Potential approaches for labour tax reforms

Indicators in group 2 will shed more light on how a reform of labour related taxes could look like. To this end the first set of indicators in group 2 follow the reasoning in Wöhlbier et al, (2014) and first identify fiscal challenges and the availability of "tax space". The second part of the indicators investigates the structure of the tax burden and thereby identifies the scope and need of labour tax reforms.

5.3.1. Group 2a: Fiscal challenges and tax space

As a first indicator in this category we propose to measure the fiscal challenges through the use of **general government debt as share of GDP** and the **net lending of general government as share of GDP**. Both of these indicators are available from the AMECO database, which is the main advantage of these indicators over the composite fiscal sustainability indicators as developed in Berti et al. (2012). The composite indicator does necessarily come with a longer time lag because of the greater data and computational requirements. In combination debt level and the deficit give an impression of the fiscal challenges of the Member States. Countries with high levels in both indicators will have to find a way to finance an eventual cut in labour taxation by either fiscal consolidation or increases in other taxes.

Similar reasoning applies to the second indicator in this group. The **tax-to-GDP ratio** aims at measuring the "tax space" for a reduction of labour taxation. In contrast to Wöhlbier et al. (2014) we see the tax space not as a room for further tax increases, but rather as space for labour taxation reforms, which reduce the tax burden on labour. Hence a high value in the tax-to-GDP ratio does primarily indicate that the tax pressure is high. If the indicators of the fiscal pressure do not show a strong need for more tax revenues this indicates that there is room for reforms, which reduce the tax burden on labour. A further explanation and reason why to include this indicator is the fact that a high tax-to-GDP ratio can contribute to the aggregate demand problem. Appendix Table 3 list the values for this group of indicators, showing the well-known fact that Greece, Italy and Portugal face a public debt problem with a debt level of more than 120 % of GDP. With net lending of more than 5 % of GDP the United

Kingdom, Spain and Slovenia are not in a position to lower labour taxation without finding other ways to reduce the deficit. In contrast, Germany and Luxembourg have a small surplus. The overall tax burden, measured through the tax-to-GDP ratio, is highest in Austria, Belgium, Denmark, Finland, France, Italy and Sweden with values clearly above 40 % of GDP. Therefore, in these countries a reduction of the overall tax burden might be in order.

5.3.2. Group 2b: Overall and labour tax structure

The first indicator in this group is the **ratio between the implicit tax rate on labour and consumption**. These implicit tax rates are based on the national accounts and are regularly published by the European Commission (2014b). The way the implicit tax rates are constructed is at the same time a benefit and a limitation of the indicator. On the positive side the very broad nature of this indicator does take into account all the aspects of taxation on labour respectively consumption. That also includes taxes which are levied on employers such as employers' contribution to social security and further payroll taxes. On the negative side these indicators do not recognise differences with respect to benefit entitlements linked to these contributions. Nevertheless the ratio between the implicit tax rate on labour and consumption gives a first indication of the overall tax burden on labour compared to consumption and a high value hints at room for tax shift towards consumption. The first column of Appendix Table 4 shows that in countries like Croatia, Luxembourg or Denmark the tax burden on labour is not much higher than on consumption. At the other end of the spectrum are Italy and Spain with a labour tax burden which is almost two and half time higher than the tax burden on consumption. A further refinement of this indicator is the **ratio between the implicit rate on labour and the implicit tax rate on immoveable property**. This follows the ranking of growth-friendly tax structures as proposed by Johansson et al. (2008).[87] Given the relative small denominator in this ratio the variation is likely to be rather large and the values need to be seen with some caution.

The next group of indicators is concerned with the structure of the labour taxes themselves. The first indicator is the **implicit tax rate on labour split up into the components** as it is regularly done by the European Commission in their publication Taxation Trends in the European Union.[88] Specifically this includes a split into employers' SSC, employees' SSC and personal income tax. These indicators provide a first insight on the legal incidence of the tax burden on labour. It is however important to see these indicators as a group of indicators since a low value on one or two aspects of the labour tax components can be misleading if the remaining part is high to compensate for this difference. Appendix Table 4 clearly illustrates this for the example Denmark, where the personal income tax makes up the lions' share of the tax burden on labour. Hence investigating only the personal income tax part would indicate a very high tax burden on labour while looking only at SSC would indicate a

[87] It is however noteworthy, that the national accounts data on the tax burden on property or more general on capital might be less accurate, since some countries do not tax a large proportion of property directly but rather finance their public services through fees which are only indirectly linked to the property. We therefore do not put too much emphasis on this indicator and do not collect data for it in this study.

[88] For the most recent edition see European Commission (2014b).

low tax burden. In combination one can learn that the labour tax burden is average in Denmark, and that the legal incidence is almost entirely on the worker.[89]

In addition to the implicit tax rates the **statutory tax rate and social security contribution rates** should be used as indicators. This immediately raises a number of questions since these rates are depending on a number of additional characteristics, like the income level, marital status and number of children. As a starting point we therefore suggest to use the information for a single person without children at the average workers wage.[90] Since labour taxation is typically not proportional but progressive it is important to use two measures of the statutory tax burden. First the **marginal effective tax rate** (METR) which describes the tax burden on an additional Euro of income and the **average effective tax rate** (AETR) which describes the share of the tax burden in the gross income. We suggest to start with these two statutory tax measures for the overall tax wedge, i.e. the sum of both employers' and employees' social security contribution and the personal income tax should be used. Furthermore, as already mentioned in the discussion of the implicit tax rates, each of the individual components should be used separately in comparison to the total wedge. Appendix Table 5 displays the values for an average worker, single and no children, in 2013. The average total tax wages is highest in Belgium with 55.8 %. Further in Austria, France, Germany and Hungary the total tax wedge for the average workers income is close to 50 %. This average total tax burden is equally split between employers SSC, employees SSC and personal income tax in Germany, while in other countries with a higher tax burden the employers SSC plays a dominant role. The marginal tax burden is about then percentage points higher in most countries, reflecting the progressive nature of the income tax schedules.

The tax burden for the average person needs to be put into context of the **progressivity** of the labour taxation. We think of a tax system as being progressive if a higher income will be taxed at a higher rate. This is reflected in the fact that the METR is higher than the AETR. However, no system of labour taxation will have the same ratio between the METR and AETR over the whole income range. To nevertheless have a simple and comparable measure we propose the following progressivity indicator

$$Progressivity\ Indicator = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{METR_i}{AETR_i}\right)$$

where $METR_i$ and $AETR_i$ are the marginal and average tax rate for income i and N is the total number of income levels considered.[91] To operationalise this indicator we propose to draw on the "Taxing Wages" publications by the OECD. The latter provides the necessary tax rates for income levels from 50 % of the average workers income up to 250 % of the average workers income. Therefore the progressivity measure will

[89] See graph 13 in European Commission (2014b, p.14) for an illustration of the decomposition of the labour tax wedge.

[90] This is one of the baseline scenarios in the data provided by the OECD. For more information on the OECD taxing wage database see: http://www.oecd.org/tax/taxing-wages-20725124.htm

[91] If the AETR is zero this indicator not defined. In these cases we suggest to replace the value in the bracket with 0, since - apart from the exact value of the threshold for the starting rate – the METR is also zero.

be based on N=201 income levels. This progressivity measure can be calculated for the overall tax wedge as well as for the components (income tax, employers' and employees social security contributions) separately. This yields most likely very different results since especially the employees' social security contributions are to some extent regressive in a most Member States because of upper earnings limits above which no more social security contributions are levied. Appendix Table 6 shows the results for the different progressivity indices for the year 2013. The Irish tax system is found to be the most progressive system overall, while the tax system in Hungary is a flat tax. Some of the systems are hardly progressive overall, because of the regressive nature of the social security system. Typical examples are here Austria, Germany or Spain. Looking only at the personal income tax system, Greece stands out with a very progressive system, according to our measure of the progressivity.

A limitation of the progressivity index so far is that is not taking into account the actual income distribution in the Member States. In fact if one wants to use the statutory tax rate and progressivity indicators for an evaluation of the development over time, it would also be possible that changes purely originate from changes in the average workers income. Hence in the next set of indicators we propose to link the tax measures with the income distribution to find out more about the broader context in which the labour taxation is set. An alternative approach would be to use the Kakwani (1977) index, which is based on the Gini index of both the tax burden and the taxable income. Provided that the necessary data is available the Kakwani index is be able to show the actual progressivity of any tax system. However, since the calculation of the Kakwani index is much more data demanding, we propose to initially use a simple measure of progressivity until the necessary data for the more elaborate measure is available.

5.4. Indicators group 3: Identification of factors affecting the incidence of labour taxation

The two groups of indicators describe the situation of labour taxation in the Member States, whether there is room and a need for a reduction in the taxation of labour, but have not put the situation into the broader context in the individual Member States. This is the aim of the third group of indicators. The first subgroup of indicators puts the level and the progressivity of labour taxation into the context of the income distribution. The second group highlights links between the contributions and the benefits and the third one aims to capture further aspects in the Member States which are likely to influence the labour market outcomes as a result of labour taxation.

5.4.1. Group 3a: Labour tax structure in a broader context

Starting point here are the indicators of the previous subsection. The level and progressivity of taxes on labour need to be put into the context of the income distribution in the Member States. To measure this we propose an income adjusted progressivity indicator defined as

$$Adjusted\ progressivity\ Indicator = \frac{1}{N}\sum_{i=1}^{N}\theta_i\left(\frac{METR_i}{AETR_i}\right)$$

where θ_i represent the share of the population which has an income of i. To operationalise this indicator we propose the use of the EU-SILC. The EU-SILC reports the income deciles of households in the individual Member States. The cut-offs for the deciles are reported in *equalised disposable households incomes*. This implies that the household income is divided by the number of consumption equivalents in the household to get comparable information about the disposable income. While this is not the taxable income of the individual workers it still gives a reasonable approximation of the income distribution of the households.[92] Grossing up the cut-off points and taking the average between the upper and lower cut-off point gives the income levels i for the adjusted progressivity indicator. The share of the population is either 1 % for the top and bottom 5 percentiles, 5 % for the remainder of the top and bottom decile and 10 % for the deciles in between.[93]

A related indicator is the **weighted statutory tax rate** which can be defined as

$$Weighted\ statutory\ tax\ rate = \sum_{i=1}^{N} \omega_i AETR_i$$

where ω_i is the fraction of the income of the population with an income level of i. This will result in a weighted average tax burden for the population, and can again be calculated for employers' and employees' SSC and the personal income tax. Despite the above mentioned issues in using the SILC information for the earnings distribution, this indicator provides us with some information for the overall statutory tax burden in the Member States. Relating this to the implicit tax burden indicators gives an impression of the width of the tax base definitions.

The second indicator which can be approximated with the use of the EU-SILC income distribution is the **fraction of the population** which falls **below the first tax income bracket**. The grossed-up cut off points from the EU-SILC income distribution can be compared to the thresholds of income tax as reported by the OECD in their Taxing Wags database. This shows what fraction of the workforce will not be able to benefit from a cut in labour taxation because their income level is so low that they fall below the first tax threshold.

5.4.2. Group 3b: Link between contributions and benefits

If there are strong links between SSC contributions and entitlements to benefits the labour market outcome will most likely be different since these parts of the labour tax burden will not be seen as taxes. The most obvious case for a link between the contribution and benefits entitlements is in the pension system. The OECD (2013b)

[92] The use of equalised disposable household income can be problematic because of a number of reasons. First it may contain government transfers which are not taxable, secondly it may contain other income (capital income) which is taxed at different rates, and thirdly the household composition can affect the tax burden on the income, especially in countries with joint filing. Therefore much more detailed research should go into the use of EU-SILC data as weights. Nevertheless, we think that due to the ease of availability and the standardisation the EU-SILC can serve as very useful starting point.

[93] Since there is no top cut off point for the top 1 percentile an assumption needs to be made. For a more sophisticated approach one could also estimate the appropriate mean through assuming a pareto distribution.

reports the **gross pension entitlements as a proportion of economy-wide average earnings** which can be used as an indicator for the strength of the link between the contributions and the benefits entitlement. The OECD (2013b, p. 155) depicts the link graphically and categories countries into groups with weak, strong and intermediate links. To move for this broad categorisation to an indicator we suggest the following approach:

$$Pension\ benefit\ link\ indicator = \frac{1}{(N-50)+1}\sum_{i=50}^{N} -\left(\frac{PE_i}{PE_N}-1\right)$$

Here PE_i and PE_N denote the gross pension entitlements at an income level i % of the average worker income. The OECD (2013b) reports gross pension entitlements for income levels between 50 % and 200 % of an average workers income resulting in 151 observations. This indicator will be zero if the gross pension entitlement is constant over the whole income range and positive if the gross pension entitlements increase over the income range examined. The higher the value of this indicator the more likely is a stronger link between the contributions and the benefits entitlement. Note that to fully measure the link one would also need to take into account eventual caps to the SSC contributions.

The second aspect covered in this subgroup of indicators is the interaction between the welfare system and the tax system. To this end we suggest to draw on the tax and benefits database by the European Commission. Specifically we propose the use of two indicators to measure the (dis-)incentives to take up work, namely the **inactivity trap** and the **unemployment trap**. Both these indicators measure the marginal tax burden for a labour market transition. While for the inactivity trap measures the METR for a transition into the workforce, the unemployment trap measures the tax burden on a transition from unemployment into employment. The key difference is that the inactivity trap includes the loss of social assistance while the unemployment trap includes the loss of unemployment benefits; see Carone et al. (2004) for an in-depth discussion.[94] Both indicators are targeted to shed light on tax effects on the labour supply at the extensive margin and ceteris paribus a higher value on these indicators will result in worse effects for the labour supply. Given the discussion about the link to benefits entitlement the METR measuring both inactivity and unemployment trap should also be split into the components. A high marginal burden may be much less harmful for labour supply effects if a benefit entitlement is linked to the SSC contributions. Appendix Table 7 summarizes the pension entitlement index, the unemployment and the inactivity trap indicators. The link between the earnings and the pension entitlement is strongest in Sweden, while it is weak in the United Kingdom and not existing in Ireland. Evaluated at a very low level of income, namely at 33 % of the average workers earnings, the inactivity trap results in net earning losses in Denmark and Ireland. In contrast in Italy and Romania the incentive to take up work is very strong because of a low share of the additional income taken away through taxes and reduced benefits. The situation is different for the unemployment trap indicator, which shows a net income loss in Denmark, Lithuania and the Netherlands. The incentives for moving from unemployment back to employment are strongest in

[94] The OECD tax benefits database is available at http://www.oecd.org/social/benefits-and-wages.htm.

the United Kingdom and the Slovak Republic with a more than 60 percent increase in net disposable income.

5.4.3. Group 3c: Other factors influencing labour tax effects

The literature review in section 3 and 4 has uncovered two further key aspects which should affect the employment effects of labour taxation. First there is the role of wage bargaining through unions and secondly there is the role of a binding minimum wage.

To tackle the first aspect we suggest to draw on the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) database provided by the Amsterdam Institute for Advanced Labour Studies. This comprehensive database contains an indicator for **centralisation of the wage bargaining process.** This indicator assigns a value from 1 (very decentralised bargaining at the firm level) to 5 (very centralised bargaining). The assignment of values from 1 to 5 already indicates that the level of decentralisation is not necessarily a continuous variable. Indeed, the review of the literature seems to suggest that the impact of the degree of centralisation to the outcome of bargaining is non-linear. Therefore the position relative to the average will be meaningless for this indicator. Instead intermediate values for the centralisation of bargaining should give an indication of more sharing of the tax burden while both low and high levels of this index point towards more incidence of labour taxation on workers. The second aspect of the wage bargaining process is the strength of unions, measured as the **union density rate**. This indicator is defined as the union membership as a proportion of wage and salary earners in employment, again available from the ICTWSS database.[95] A higher value for this indicator reflects a stronger bargaining position of the union and should therefore increase the share of tax burden borne by the employers.

A binding minimum wage rules out that the tax incidence of an employers' SSC or payroll tax increase falls on the worker. Therefore another indicator should be the **nominal monthly minimum wage**. Data on the nominal monthly minimum wage is available from the ILO. Since a number of countries do not have a nationwide minimum wage, but rather have sector specific minimum wages they will not appear in this dataset. To nevertheless get an idea of government intervention in the area of minimum wages we suggest to supplement the minimum wage indicator with the **index for minimum wage setting** by the ICTWSS. This index ranges from 0 to 8, where 0 stands for no minimum wage legislation and therefore no government intervention and 8 stands for a freely set minimum wage by the government. Intermediate values represent different levels of intervention. Values of 1 and 2 describe not nationwide minimum wage setting and values between 3 and 7 describe nationwide minimum wages with decreasing consultation and influence of businesses. Appendix Table 8 collects the information of centralisation of wage bargaining, union density and the minimum wage setting. The United Kingdom, Poland and the Baltic countries are classified to have very decentralised wage bargaining, while Belgium, Finland and Greece are characterised through very centralised bargaining. In line with

[95] The ICTWSS does provide two alternative measures for the net union density. First as a fraction of wage and salary earners as in the national labour force survey and the union coverage, defined as employees in workplaces or establishments covered by unions or works councils as a proportion of all wage and salary earners in employment.

expectation the union density is highest in the Scandinavian countries. At the same time Denmark, Finland and Sweden are along with Austria, Cyprus and Italy the only countries not to have a national minimum wage. Of the other countries having national minimum wage the value varies from 184 Euro monthly in Bulgaria to 1,923 Euro monthly in Luxembourg.

To get an impression whether the minimum wages are binding we propose to compare the nominal minimum wages to the **median monthly earnings** from the Structure of Earnings database as provided by Eurostat. Using the median rather than an average gives a better approximation of the share of the workforce for which the minimum wage is binding. The database does further allow to distinguish between gender, education and occupation.[96] This can give further insights whether the minimum wage is more binding for the above identified vulnerable groups. An alternative measure of the income distribution can be drawn from the EU-SILC. Appendix Table 9 compares the median monthly earnings to the top cut off value of the 2nd, 5th and 8th decile of the net equalised household income in the EU-SILC. The comparison shows that there is a significant dispersion of the income levels both across Member States and within Member States. A comparison between the information for the Structure of Earnings dataset and with the net equalised income from the EU-SILC shows that there is a considerable difference. This is due to the fact that the Structure of Earnings is measuring the gross labour income while the EU-SILC is looking at net income including other income.[97]

5.5. Overview and structure of framework of indicators

The subgroups of indicators in the previous subsections form an overall framework which helps to identify the scope of labour tax reforms to mitigate employment problems. The indicators in the different subgroups identify specific aspects on their own, but sometimes more information can be extracted if the indicators are viewed in the conjunction with each other. To facilitate a better overview Table 10, Table 11 and Table 12 summarise the indicators, their source and their use and interpretation.

The indicators in Table 10 quantify the extent of employment problems, how the different vulnerable groups are affected by them and to which extent non-tax factor determine employment problems. For example high levels of unemployment [1], which are not artificially inflated through a low level of participation rate [2] hint at a problem of unemployment. If primarily the participation rate [2] is low the country is dealing more with a non-employment problem. Comparing these results with the NAWRU [3] as a measure of structural unemployment and the mismatch indicators in [6] puts the employment problems into the context of business cycle fluctuations and matching efficiency as factors contributing to unemployment and non-employment. Repeating this exercise with the unemployment and participation rate for the vulnerable groups in indicators [4] and [5] further narrows down the employment problems.

[96] Again, this is seen as a first step to further the knowledge of the income distribution. Refinement of the use of the structure of earnings database should be subject to further research.

[97] A potential limitation is the fact that the Structure of Earnings Survey only includes employers from establishment with ten of more subsidiaries.

Table 10: Overview of framework of indicators (first part)

Indicator	Source	Use and interpretation
Indicator group 1a: Unemployment, Non-employment and structural unemployment		
[1] Unemployment rate	LFS	Higher values indicate employment problems, especially in conjunction with low values of [2] and high values of [3]
[2] Participation rate	LFS	Lower values indicate employment problems, especially in conjunction with high values of [1]
[3] NAWRU	AMECO	Higher values indicate structural unemployment problems. Big differences to [1] indicate a large cyclical part of unemployment
Indicator group 1b: Employment problems and vulnerable groups		
[4] Unemployment rate, by(gender, age group, migrant status, skill levels)	LFS	Higher values indicate employment problems, especially in conjunction with low values of the corresponding indicator in [5]. Differences to [1] highlight the vulnerability of particular groups
[5] Participation rate, by (gender, age group, migrant status, skill levels)	LFS	Lower values indicate employment problems, especially in conjunction with high values of the corresponding indicator in [4]. Differences to [2] highlight the vulnerability of particular groups
Indicator group 1c: Non-tax factors contributing to structural unemployment		
[6] Mismatch indicators (skill, sectoral, regional)	LFS	High values indicate non-tax related employment problems
[7] Employment change indicators (skill, sectoral, regional)	LFS, AMECO	High values indicate a labour demand side contribution to employment problems as indicated in [6]
[8] Workforce composition change indicators (skill, age, migrant status)	LFS	High values indicate a labour supply side contribution to employment problems as indicated in [6]

Source: Own elaboration.

The second set of indicators in Table 11 looks at the overall fiscal situation and the structure of taxation to identify whether there is room for reductions in the tax burden on labour. High levels of government debt [9] and a large fiscal deficit [10] especially in conjunction with a high tax-to-GDP ratio [11] indicate that any significant reduction of the labour tax burden needs to be financed through fiscal consolidation. A high ratio between the implicit tax rate on labour and the implicit tax rate on consumption [12] indicates the potential to shift the tax burden away from labour. The analysis of the

components of the implicit tax rate on labour [13] shows the distribution of the legal incidence. The statutory tax rates, i.e. the METR and AETR for the average worker [14] give further insights on the extent of the tax burden and the legal incidence. In combination with the progressivity measure [15] the structure of the labour taxation can be outlined. Higher levels of progressivity for a given level of taxation as measured in [12] can give an indication of the bargaining incentives for workers and should contribute to better labour market outcomes.

Table 11: Overview of framework of indicators (second part)

Indicator	Source	Use and interpretation
Indicator group 2a: Fiscal challenges and tax space		
[9] General government debt in % of GDP	AMECO	High values indicate little room for non-financed cuts in labour taxation, especially in conjunction with high levels of [10] and [11]
[10] Net lending in % of GDP	AMECO	High values indicate little room for non-financed cuts in labour taxation, especially in conjunction with high levels of [9] and [11]
[11] Total tax revenues in % of GDP	AMECO	High values indicate little room for non-financed cuts in labour taxation, especially in conjunction with high levels of [9] and [10]
Indicator group 2b: Overall and labour tax structure		
[12] Implicit tax rate on labour/implicit tax rate on consumption	Taxation Trends in Europe	High values indicate room for a reduction of labour taxation. Especially in conjunction with high levels of [11] and not too high levels of [9] and [10]
[13] Composition of implicit tax rates on labour	Taxation Trends in Europe	High values of implicit tax burden on labour and employees' SSC indicate legal incidence being mainly on workers
[14] Statutory tax rates, employers', employees' SSC and personal income tax	Tax and Benefits Database, OECD	High values indicate room for a reduction of labour taxation (see also indicator [12])
[15] Progressivity index for total wedge, employers', employees' SSC and personal income tax	Tax and Benefits Database, OECD	High values indicate a more progressive system. For a given level of [12] this should improve matching efficiency.

Source: Own elaboration.

The third set of indicators in Table 12 links the labour tax system with other relevant aspects of the economies in the Member States.

Table 12: Overview of framework of indicators (third part)

Indicator	Source	Use and interpretation
Indicator group 3a: Labour tax structure in a broader context		
[16] Adjusted progressivity index	Tax and Benefits Database, EU-SILC	High values indicate that a large fraction of the workforce is in the progressive part of the tax schedules. Tax reducing reforms should therefore have a stronger impact.
[17] Weighted statutory tax burden	Tax and Benefits Database, EU-SILC	High values indicate a larger tax burden (see indicator [14]) Values far above the corresponding values in [12] indicate a narrow tax base.
[18] Fraction of workforce with incomes below first income tax threshold	Taxation Trends in Europe	Higher value indicates less scope of labour tax reforms to reduce employment problems, because a large fraction is not subject to personal income taxation.
Indicator group 3b: Link between contributions and benefits		
[19] Pension benefit link indicator	Pensions at a glance, OECD	Higher value should reduce the employment problems due to SSC. Effect is strong in conjunction with a high value of SSC in [13].
[20] Inactivity trap and unemployment trap	Tax and Benefits Database, OECD	High values indicate potential for labour tax reforms to increase potential labour supply. In combination with low values for [2] or [5] labour supply problems can be identified.
Indicator group 3c: Other factors influencing labour tax effects		
[21] Centralisation of wage bargaining	ICTWSS	Intermediate values indicate more tax incidence on employers' side. Impact is likely to increase with low values for [19] and high values for SSC in [13] and [14]
[22] Union density rate	ICTWSS	Higher values reinforce result for [21]
[23] Nominal (monthly) minimum wage	ILO	Higher values are likely to increase unemployment regardless of taxation
[24] Index for minimum wage setting	ICTWSS	Complements [23]. Higher values imply stronger minimum wage regulation.
[25a] Median monthly earnings	Structure of Earnings Survey	Low values in combination with high values for [23] and [24] imply more tax incidence on employers.
[25b] Earnings distribution	EU-SILC	

Source: Own elaboration.

The adjusted progressivity index [16] measures the progressivity in conjunction with the distribution of the income in the Member States. High values in this indicator show

that a large fraction of the population earns income in the progressive part of the income tax schedules. This in turn suggests that tax rate reforms should have a stronger effect. The weighted average statutory tax rate [17] gives further an approximation of the tax burden. In comparison to the corresponding implicit tax rates in [12] the width of the tax base can be assessed. The fraction of workforce below the threshold for the starting rate for the income tax [18] yields information about the part of the workforce which cannot benefit from tax reductions in the personal income tax. The higher the value of this indicator the less is an income tax reform capable of reducing employment problems and reforms should tackle SSC.

Higher values for link between contributions and pensions entitlements [19] give an indication about the extent to which SSC can be seen as equivalent to taxes. A higher the value in [19] signals a stronger link and therefore less labour supply effects in reaction to the SSC should be observed. In combination with a large share of SSC in [13] the labour supply effects of the overall tax burden should be smaller. The inactivity and the unemployment trap [20] directly measure the labour supply effects of labour taxation. The higher the values of [20] the stronger the disincentives to take up employment are. If the high values of [20] coincide with low values in the participation rate [2] or for the vulnerable groups in [5] negative labour supply effects of taxation can be identified.

The last subgroup of indicators in Table 12 investigates the role of other institutional characteristics in the determination of tax incidence of labour taxation. The centralisation of wage bargaining [21] has a non-trivial impact on the tax incidence outcome, but the literature review suggests that intermediate values for this indicator should imply a larger fraction of the tax burden falling on the employers' side. A higher value for the union density rate [22] reinforces the results of [21], but may well also have a positive impact on the share of the tax burden borne by employers.

Higher nominal minimum wages [23] should result in more tax incidence on the employer side. For countries without a nationwide minimum wage the a higher value for the minimum wage setting process index [24] can give an indication that minimum wage legislation is nevertheless contributing to the employment problems. The value for the nominal minimum wage should be seen in conjunction with the median monthly earnings [25a] to gauge the extent to which the minimum wage is binding. A high value for [23] and a low value for [25a] indicate that the minimum wage legislation is most likely binding for a larger fraction of the workforce. This implies most likely more unemployment and also more tax incidence on the employers' side. More generally, minimum wages need to be seen in relation to the earnings distribution [25b] to have a better understanding on their relevance.

The get a better understanding how this framework of indicators can be used, the next subsection presents some worked out examples for three countries. Namely we will look at the situation of Austria, Italy and Spain.

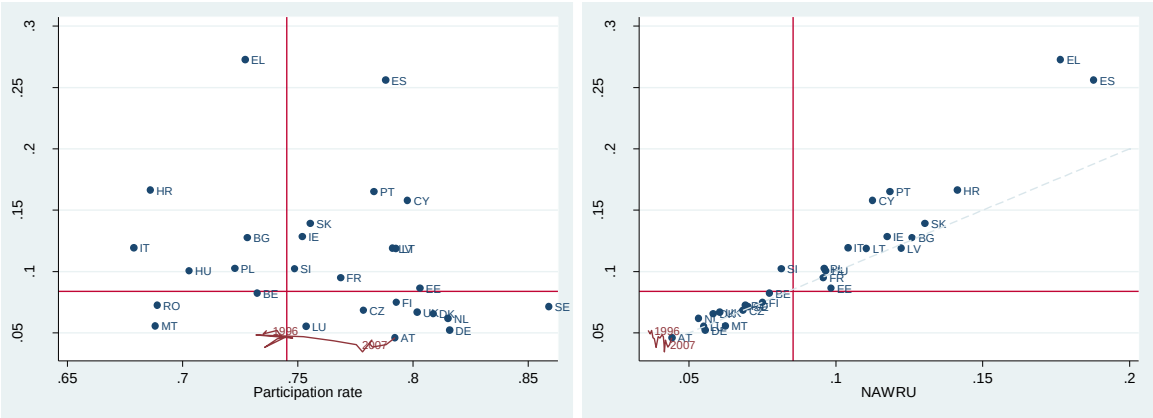
6. Country examples for the framework of indicators

This section works out more detailed examples for selection Member States to highlight the functioning of the framework of indicators. Specifically we look at Austria as a country with a very high level of labour taxation and seemingly no severe employment problems, at Spain as one of the countries hardest hit by the recession and at Italy a country with persistently high levels of unemployment, low female labour force participation and low GDP growth.

6.1. Austria

Starting with the overall picture we see that the labour market in Austria is characterised through a low level of unemployment and an above average participation rate in 2013. Figure 15 plots Figure 10 again with the development of the two indicators for Austria highlighted through the red line. Starting in 1996 the participation rate in Austria showed small changes and significantly increased over the last years. At the same Austria so a small fall in unemployment and after the crises a moderate upward trend set it. Latest figures for unemployment confirm that this trend in Austria is continuing with the result that Austria is no longer the country with the lowest unemployment in the EU. Even more importantly, the forecast is that Austrian unemployment continues to rise and Austria is predicted to fall behind a number of countries like Germany and Luxembourg. The right hand side of Figure 15 shows that there has been no strong pattern in both the movement of the NAWRU and the unemployment rate suggesting that over the period observed Austria was not affected strongly by cyclical unemployment.

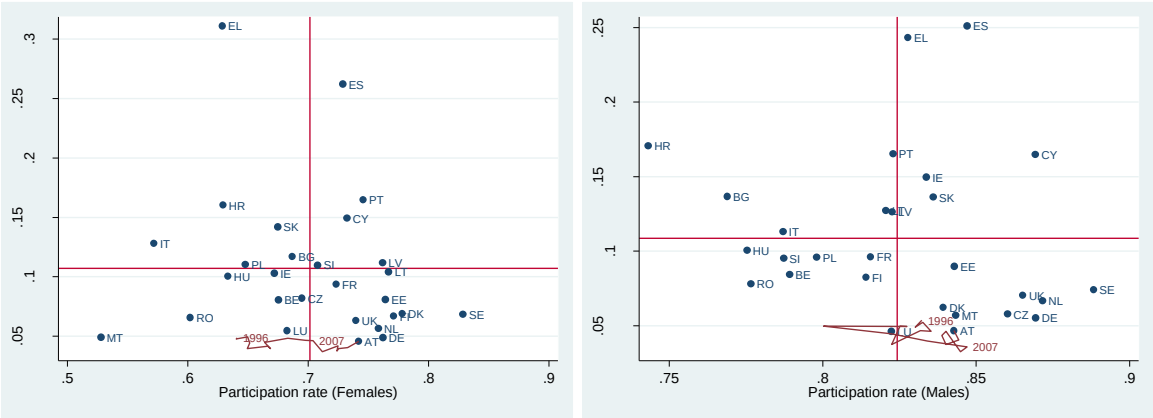
Figure 15: Unemployment rate, participation rate and NAWRU, Austria



Source: LFS, own illustration

In Figure 16 we compare the development of the participation rate and the unemployment rate separately for men and women. The red line again highlights the development in Austria between 1996 and 2013. The left hand part of Figure 16 shows the development for women and confirms that a large part of the higher overall participation rate in Austria is due to a higher participation rate of women. The right part of Figure 16 shows that there has been some rather unsystematic movement for men as well.

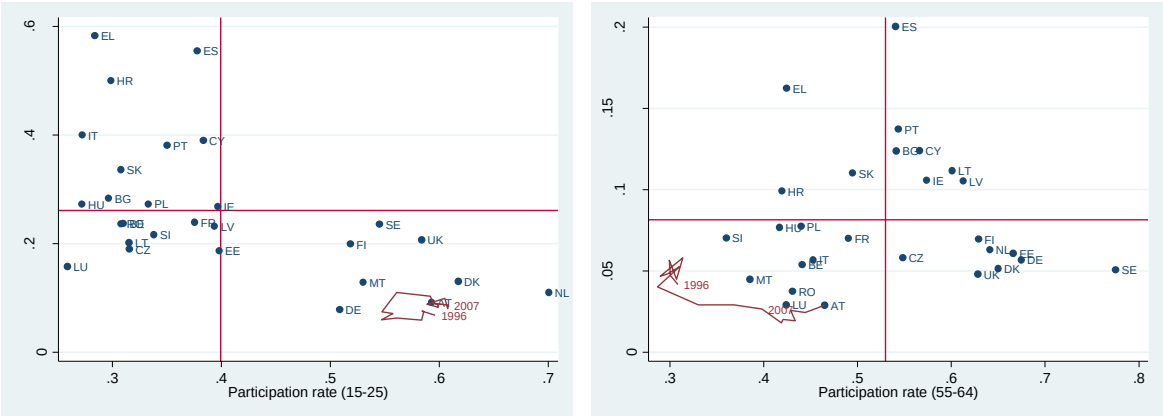
Figure 16: Unemployment rate, participation rate, by gender, Austria



Source: LFS, own illustration

Figure 17 and Figure 18 repeat this exercise for the other vulnerable groups. The left part of Figure 17 shows an initial reduction in the participation rate for the youth in Austria which then has been reversed. The participation rate of the youth in Austria has been high in comparison to other European countries throughout the period observed, which is to large part due to the Austrian system of apprenticeship. The right panel of Figure 17 show that after a few years of very low participation rates there has been a steady increase in the participation rates for the elderly in Austria. This is reflecting the policy change in Austria which aims to reduce early retirement.

Figure 17: Unemployment rate, participation rate, by age class, Austria



Source: LFS, own illustration

In the left part of Figure 18 the situation of non-Austrians in the Austrian labour market is plotted. There is no very clear pattern observable over the period 1996 to 2013, but the participation rate has dropped overall in this period and no improvement in the unemployment rate can be observed.

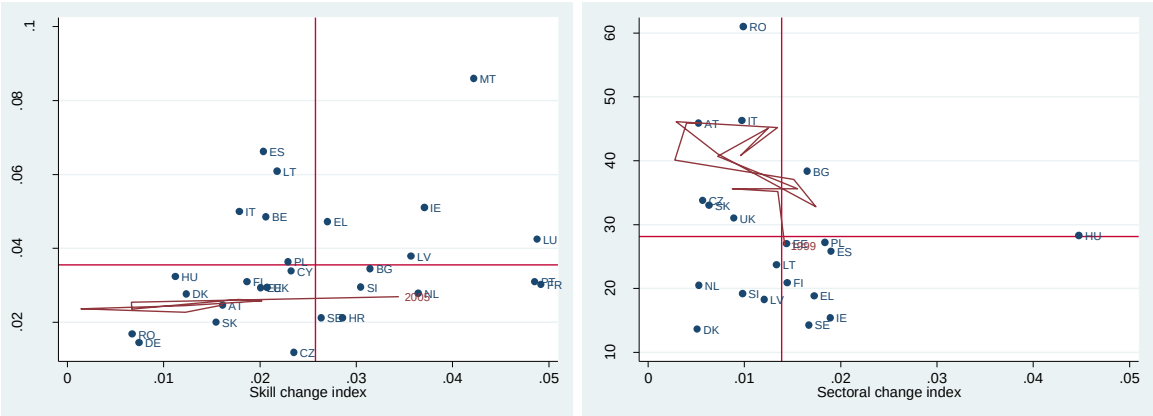
The right hand side of Figure 18 shows the change of the unemployment rate and participation rate for the low-skilled in Austria for the period 2004 to 2013. There has been an initial improvement in both the participation rate and the unemployment rate, but in the more recent year especially the unemployment rate of the low-skilled increased.

Figure 18: Unemployment rate, participation rate, foreigners and low-skilled, Austria

Source: LFS, own illustration

Figure 19 shows the relative situation and the development of Austria in the skill, regional and sectoral mismatch and change indicators. The most striking pattern here for Austria is the high position and the strong variation in the regional mismatch indicator. This highlights that the regional unemployment rates in Austria change quite differently over time. At closer inspection the regional mismatch indicator reduced during the financial crisis, which is however mostly due to an increase in unemployment in the otherwise stronger regions.

Figure 19: Skill, regional and sectoral changes and mismatches, Austria

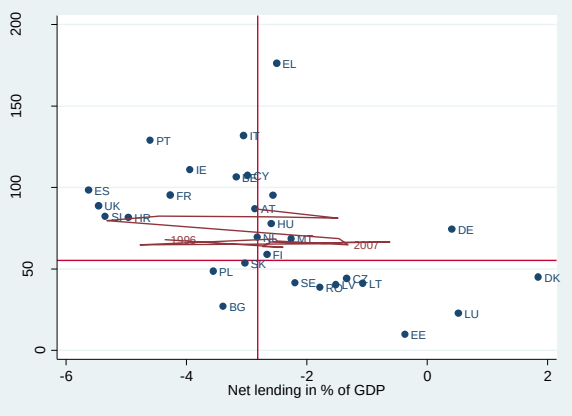


Source: AMECO, LFS, own calculation

The indicators so far show that labour market in Austria has not been characterised by severe problems over the period observed. There is an issue of labour supply by the elderly people, but other than that, there seems to be little reason from the labour market side to investigate Austria in particular. The picture changes somewhat, once we start to look at the public finance side. Starting with the overall situation of the public finance in Figure 20 one can see that the overall debt level has reached almost 87 % in 2014. The red line tracing the development of net lending as well, shows that net lending has been fluctuating wildly over the last few periods, but in none of the years observed Austria had a budgetary surplus. In combination with the weak

economic growth and high costs to stabilise the financial system this resulted in a high level of public debt.

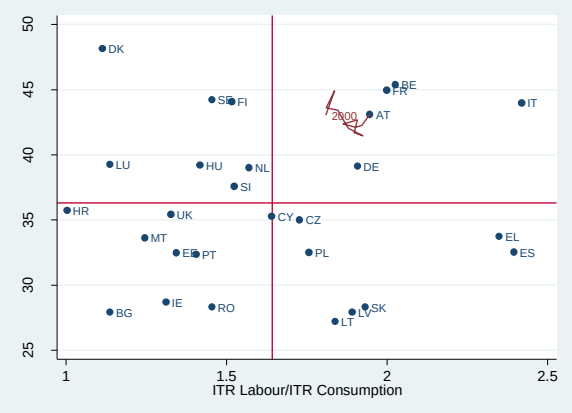
Figure 20: Debt and net lending, Austria



Source: AMECO, own illustration

It becomes even more apparent why Austria is included as an example, once looks at the overall tax structure in Figure 21. Both the overall tax-to-GDP ratio and the ratio between the implicit tax burden (ITR) on labour and the ITR on consumption are clearly above the unweighted average of the EU-28. Labour is taxed approximately twice as much as consumption in Austria and the trend has been increasing over the last decade.

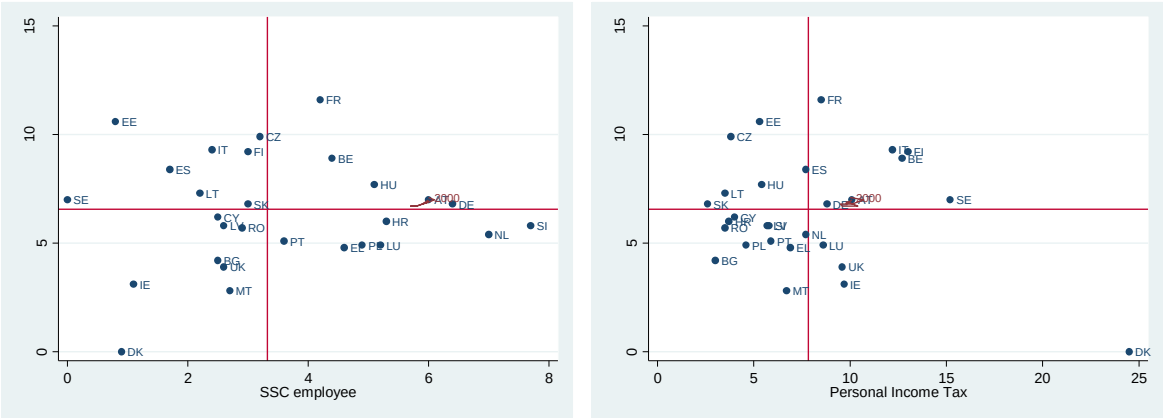
Figure 21: Overall tax structure, Austria



Source: AMECO, Taxation Trends in Europe, own illustration

Breaking down the tax burden on labour into its components, one can see little change in the development as depicted in Figure 22. Comparing the components to the European average one can see that the tax burden is high in all three components, but the SSC of the employees are the component which is furthest above the European average. The indicators so far show that there is a high tax burden on labour in Austria, in particular driven through the social security contributions of the employees. The overall tax burden does however not fully inform about the distribution of the tax burden within the Member States.

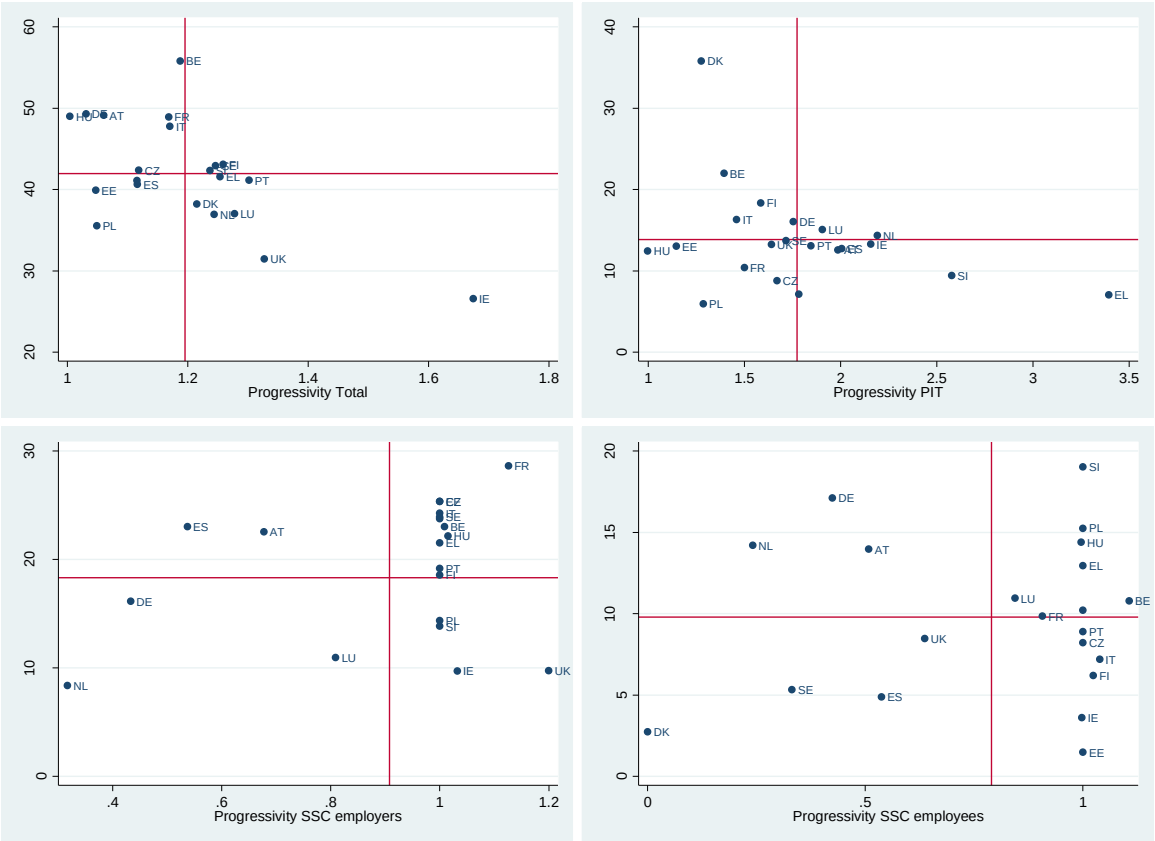
Figure 22: Structure of labour tax burden, Austria



Source: Taxation Trends in Europe, own illustration

To have more thorough understanding how different income groups are taxed, Figure 23 looks in more detail at the statutory tax burden.[98]

Figure 23: Structure of labour tax burden in 2013



Source: OECD Taxing wages, own calculation and illustration

The upper left part of Figure 23 plots the total tax wedge against the overall progressivity measure. One can see a rather clear negative correlation between the

[98] For reasons of space we only report these graphs once for 2013. For a more detailed analysis one would need to look into the development over time on a country by country basis.

overall tax burden and the progressivity measure, highlighting that the countries which have a higher overall tax burden at the average worker income also have a less progressive tax system. Austria lies in the quadrant with an above average total tax wedge and below average progressivity. This implies not only that the tax burden is rather high, but also that most likely a large part of the workforce is subject to a high tax burden. The other three parts of Figure 23 show the average tax burden for the personal income tax (PIT), SSC for the employers and SSC for the employees, each plotted against the corresponding progressivity measure. The overall picture is quite clear in that the PIT is progressive, while the SSC are proportional in a number of countries and regressive in most other. In Austria the rather high and clearly regressive SSC for employees at to the overall picture of a high but not very progressive tax burden.

Putting the statutory features of the Austrian income tax system into context of the earnings distribution in Austria Table 13 shows the different components of the Austrian tax system at the deciles of the net equalised income level from the EU-SILC. The median is at a net income of 22,073 Euro, where the total tax wedge amounts to 46.7 %. Interestingly at this point of the income distribution the SSC of the employer make up the lion's share of the total tax burden.

The fact that the labour market outcome in Austria is – at least for the period observed – not showing severe employment problems, despite the rather high tax burden on the employer side leads to the question of tax incidence. Looking at the parameters affecting the tax incidence in Appendix Table 7 and Appendix Table 8 one can identify two reasons which contribute to the still favourable labour market outcome. First there is the link between the SSC contributions and the pension entitlements which should shift the incidence on the worker. Secondly the lack of a nationwide minimum wage and the relatively centralised wage bargaining should also contribute to a larger part of the tax burden shifted onto workers.

However, the weak labour force attachment of the elderly and the resulting relatively low retirement age of the Austrian workforce puts increasing pressure on the pay-as-you go system. Necessary pension reforms might further weaken the link between the SSC contributions and the pension entitlement. Further the absence of a national minimum wage in Austria is masking the fact that there are wide-spread industry specific minimum wages. These might not be binding for a large part of the workforce, but if the tax incidence continues to fall on the worker, the pressure may well rise.

Finally, the recently announced income tax reform in Austria, scheduled to come into force in January 2016, include a lowering of starting tax rate to 25 percent, a reduction of the tax rates for most of the income distribution and the introduction of a new top tax bracket for very high incomes.

Table 13: Earnings distribution and tax wedges in Austria, 2013

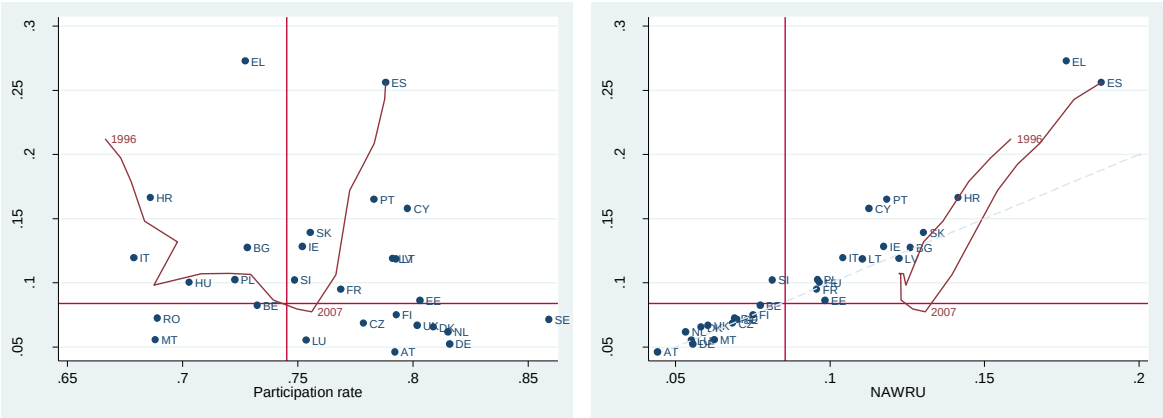
Income decile	Upper cut off value	Gross income	Total labour costs	Total tax wedge in %	Personal income tax		SSC employee		SSC employer	
					in Euro	in %	in Euro	in %	in Euro	in %
99th	72,498	121,689	146,689	50.6	38,048	31.3	11,144	9.2	25,000	17.0
98th	60,272	99,968	122,920	51.0	28,552	28.6	11,144	11.1	22,952	18.7
97th	52,863	86,805	108,075	51.1	22,798	26.3	11,144	12.8	21,271	19.7
96th	49,093	80,233	101,324	51.5	19,996	24.9	11,144	13.9	21,091	20.8
95th	46,809	76,555	97,299	51.9	18,603	24.3	11,144	14.6	20,744	21.3
90th	38,994	63,971	83,529	53.3	13,834	21.6	11,144	17.4	19,558	23.4
80th	31,368	49,416	64,828	51.6	9,189	18.6	8,859	17.9	15,412	23.8
70th	27,532	41,896	54,964	49.9	6,854	16.4	7,511	17.9	13,067	23.8
60th	24,653	36,253	47,560	48.2	5,101	14.1	6,499	17.9	11,307	23.8
50th	22,073	31,591	41,444	46.7	3,855	12.2	5,664	17.9	9,853	23.8
40th	19,785	27,486	36,058	45.1	2,773	10.1	4,927	17.9	8,572	23.8
30th	17,552	23,479	30,802	43.0	1,718	7.3	4,209	17.9	7,323	23.8
20th	14,974	18,405	24,145	38.0	500	2.7	2,931	15.9	5,740	23.8
10th	11,652	13,696	17,968	35.2	0	0.0	2,044	14.9	4,272	23.8
5th	8,877	10,435	13,689	35.2	0	0.0	1,558	14.9	3,254	23.8
4th	7,973	9,372	12,295	35.2	0	0.0	1,399	14.9	2,923	23.8
3rd	6,710	7,887	10,347	35.2	0	0.0	1,177	14.9	2,460	23.8
2nd	4,904	4,904	5,435	9.8	0	0.0	0	0.0	531	9.8
1st	2,544	2,544	2,820	9.8	0	0.0	0	0.0	276	9.8

Source: EU-SILC, own calculation and illustration

6.2. Spain

A first look at the overall situation in Spain in Figure 24 already shows the extent of the employment problems. In 2013 the unemployment reached a level above 25 %. At the same does the red line, which traces the development since 1996, show that the participation rate has been steadily increasing. The turning point in the development of the unemployment in Spain was clearly 2007 when the unemployment began to rise quickly. The right panel in Figure 24 shows that this development has been driven to a large extent by changes in cyclical unemployment. The changes in both the unemployment rate and the NAWRU were very fast implying that Spain moved from a situation with cyclical unemployment to a situation where the unemployment rate was clearly below the NAWRU in 2007. The crisis the reversed this trends resulting in the high current unemployment rate.

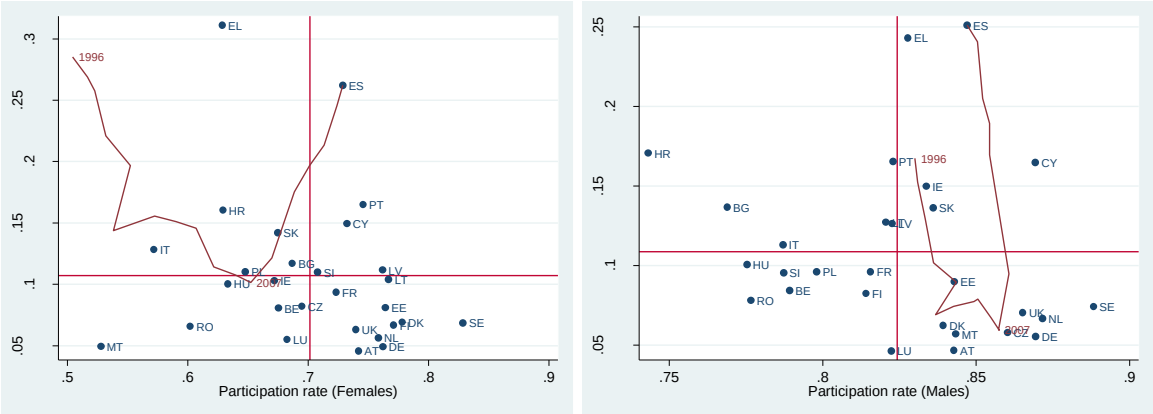
Figure 24: Unemployment rate, participation rate and NAWRU, Spain



Source: LFS, own illustration

Despite the weaknesses of NAWRU as a measure of structural unemployment this hints at an unsustainable situation in 2007. At the same time, the currently very high unemployment rate is also to a significant part due to cyclical components.

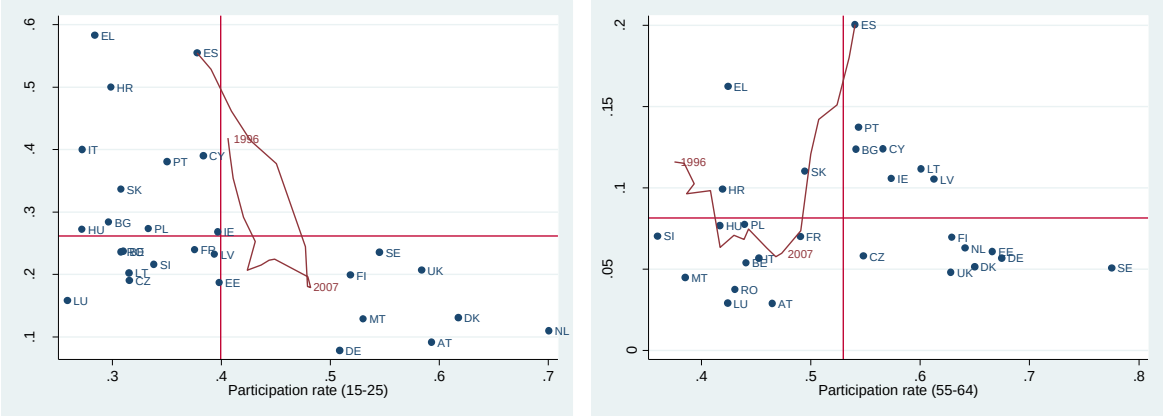
Figure 25: Unemployment rate, participation rate, by gender, Spain



Source: LFS, own illustration

Figure 25 breaks down the development by gender and confirms the findings, we already found for Austria. The clear increase in labour force participation is to a large part driven by women entering the workforce. Furthermore, women reduced their unemployment rate faster before the crisis in 2007 and experienced a slower increase after the crisis. Overall, therefore, the gender gap in Spain decreased over the period observed.

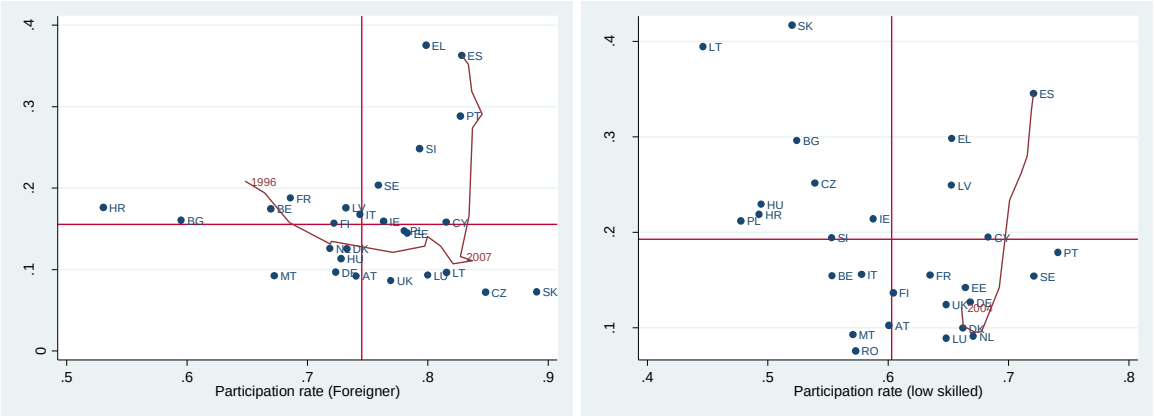
Figure 26: Unemployment rate, participation rate, by age class, Spain



Source: LFS, own illustration

The breakdown by age categories in Figure 26 shows a similar development with sinking unemployment and increased participation until 2007. Then the participation rate for the young reduced while their unemployment rate increased very strongly. In contrast the elderly did not reduce their participation at the labour market, but so a very strong increase in unemployment. In fact the unemployment rate for the age group 55 to 64 years old reached 20 % in 2013, which is the highest value in all Member States. For foreigners and low-skilled workers, as depicted in Figure 27, the labour situation is very much comparable to the one of the elderly. After a period of steady improvement until 2007, the situation change dramatically and especially unemployment rate increased very strongly.

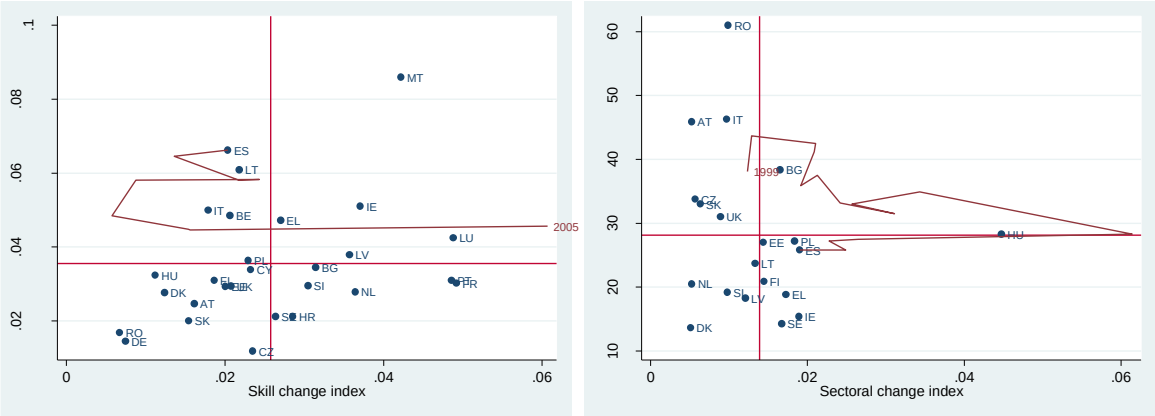
Figure 27: Unemployment rate, participation rate, foreigners and low-skilled, Spain



Source: LFS, own illustration

The mismatch and change indicators in Figure 28 show a plausible explanation for this strong change in the labour market in Spain. Both the skill and the sectoral change index indicate a very strong shift. The strong shift in the skill levels of the workforce are followed by a marked increase in the skill-mismatch indicator. This increase coincides with the strong sectoral change, which highlights a shift in employment between the sectors. The falling regional mismatch indicator shows that either previously booming regions fell back or that the increase in unemployment was evenly distributed across Spain.

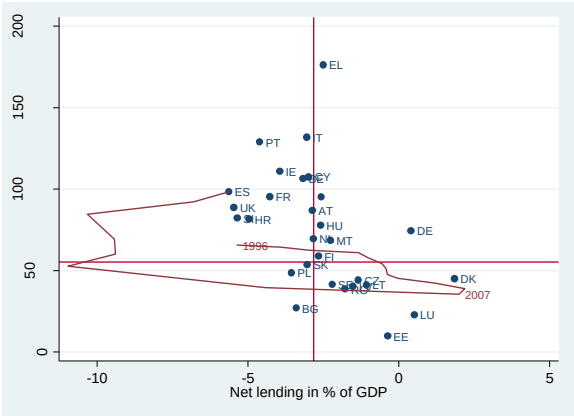
Figure 28: Skill, regional and sectoral changes and mismatches, Spain



Source: AMECO, LFS, own calculation

In Figure 29 the overall situation of the public sector is depicted. Unlike Austria, Spain has a surplus before the crisis in 2007. However, the crisis led to a massive deterioration of the public sector finances and resulted in high levels of net lending and an increasing debt level, reaching almost 100 % of GDP in 2014. Therefore, the overall tax space in Spain is limited and eventual labour tax cuts need to be financed with other tax increases.

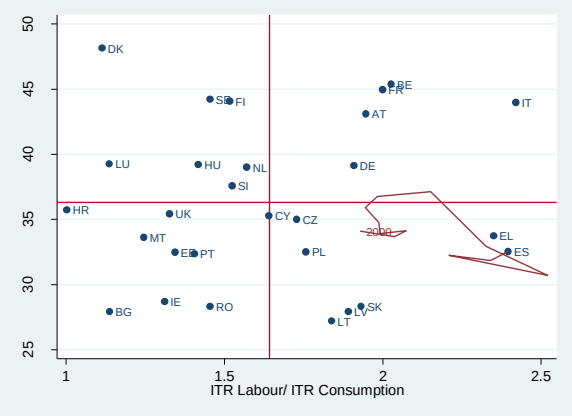
Figure 29: Debt and net lending, Spain



Source: AMECO, own illustration

Looking at the overall structure of taxation in Spain in Figure 30 one can see a relatively high tax burden on labour with the ITR on labour being more than twice as high as the ITR on consumption. Nevertheless there has been an overall drop in the tax-to-GDP-ratio in the recent years.

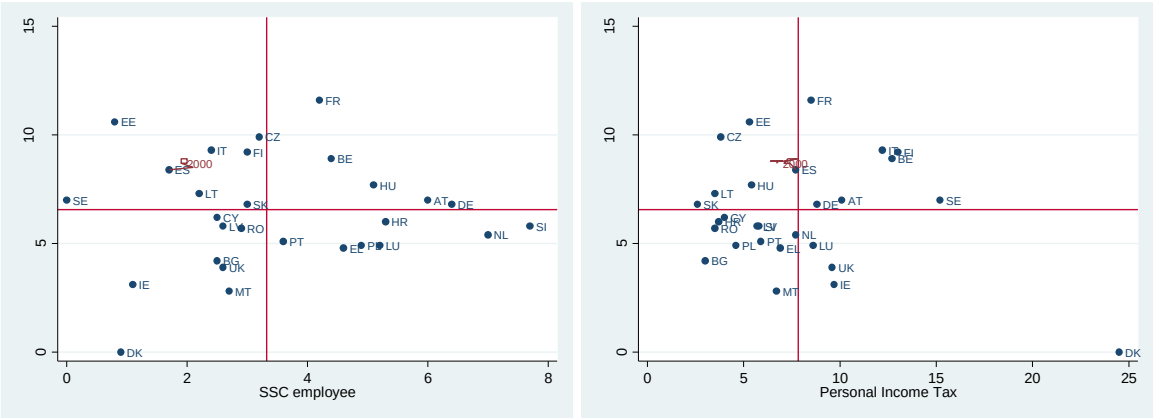
Figure 30: Overall tax structure, Spain



Source: AMECO, Taxation Trends in Europe, own illustration

Digging deeper into the structure of labour taxation in Spain Figure 31 reveals that there has been very little change in the implicit rate components. Overall, similar to the case in Austria, the SSC of the employer make up a large part of the total tax burden.

Figure 31: Structure of labour tax burden, Spain



Source: Taxation Trends in Europe, own illustration

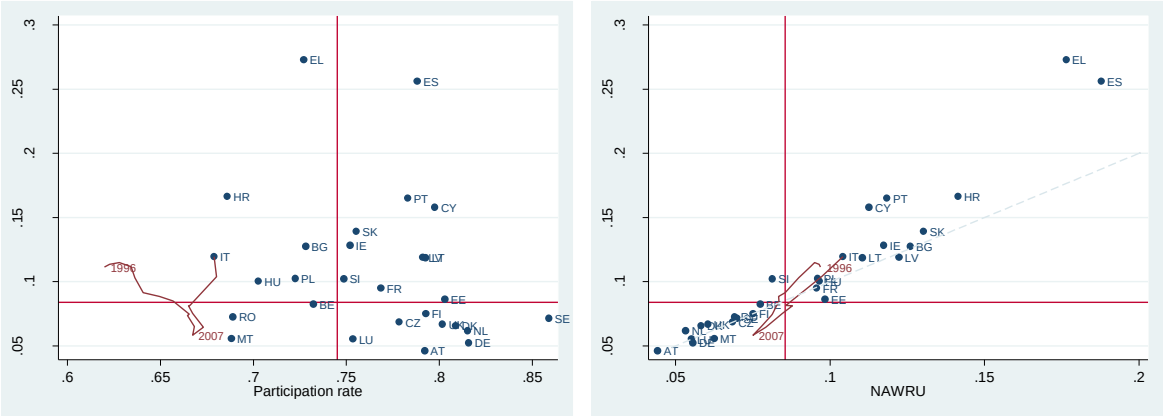
Looking at the statutory structure of labour taxation in Spain in Figure 23 the employers' part of the SSC stands out with a high tax burden and a low progressivity (strong regressivity). This could further contribute to the labour demand problem identified above because it gives further incentives for paying efficiency wages.

In terms of centralisation of bargaining and minimum wage legislation, the relatively central wage bargaining should result in a larger part of the tax incidence on the workers' side. In contrast the strong government intervention and the national wide minimum wage should shift part of the tax burden the employers' side. In sum, it will not be clear where the larger share of tax burden falls, but there should still be a case to reform the employer SSC. Overall, however, the employment problems seem to be largely driven through a labour demand problem. Partly because of cyclical aspects and partly because of a strong sectoral shift after the bursting of the housing bubble.

6.3. Italy

The overall picture at the labour market in Italy in Figure 32 looks broadly similar to Spain but less alarming. The participation rate increase from very low levels in 1996 up to the crisis in 2007. Following the crisis the participation rate fluctuated a little, but the primary change was a strong increase in unemployment. The right panel in Figure 32 shows that Italy experienced a rather fast decline in unemployment up to 2007 and a sharp increase afterwards. The result is that at least part of the current unemployment can be attributed to cyclical reasons.

Figure 32: Unemployment rate, participation rate and NAWRU, Italy



Source: LFS, own illustration

The breakdown by gender in Figure 33 shows that the strong increase in the participation rate is purely driven by a stronger workforce attachment of women. The recession in 2007 did not reverse the trend of increasing female workforce participation in Italy, but resulted in increasing unemployment for both men and women. Despite the significant increase in work force participation of women in Italy, the labour force attachment of women is still weak with a participation rate below 60 % in 2013.

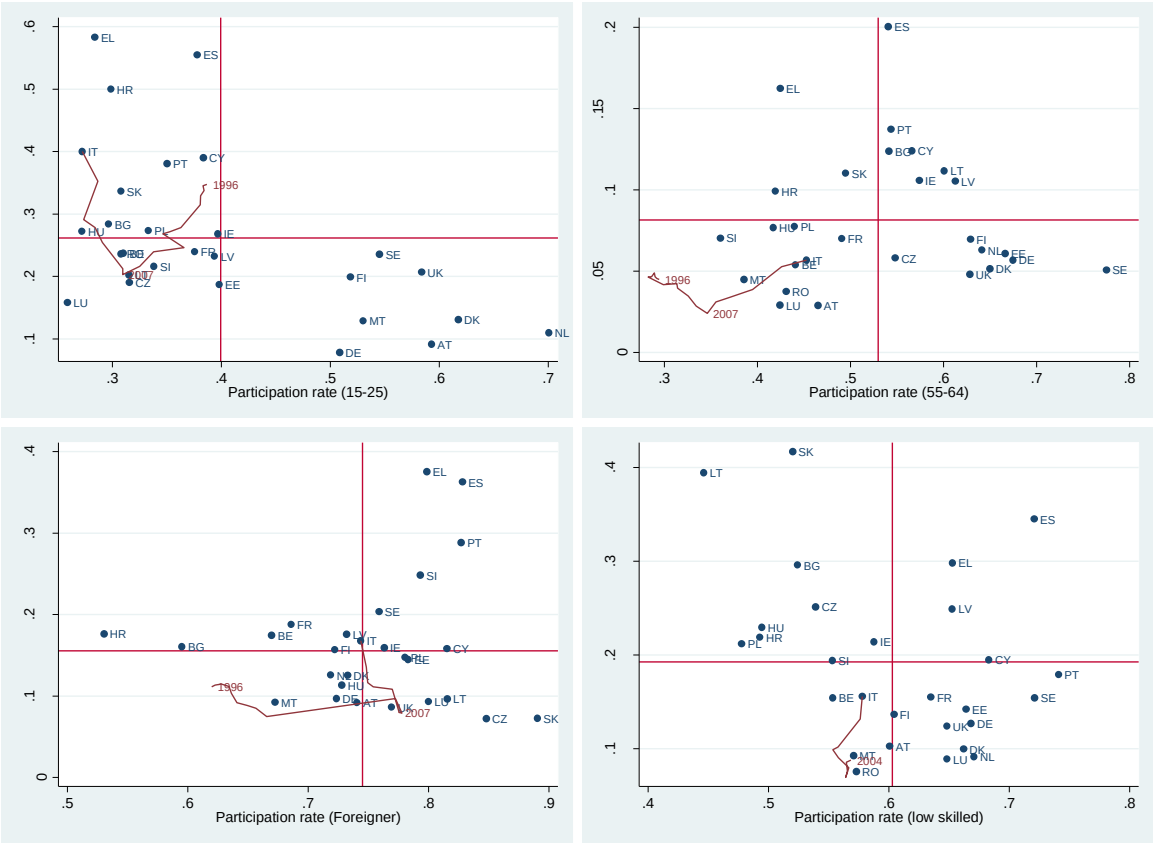
Figure 33: Unemployment rate, participation rate, by gender, Italy

Source: LFS, own illustration

The breakdown by age categories in the top half of Figure 34 shows that the young population is increasingly withdrawing from the labour force, while the elderly are

increasingly participating. Unemployment is increasing in both groups since 2007. However, while for the elderly the unemployment rate is still at moderate levels, the unemployment rate for the youth is reaching 40 % in 2013. The lower part of Figure 34 shows the labour market situation for migrants and low-skilled. While migrants made progress in terms of their participation rate prior to the crisis, their situation became worse starting in 2007. The time series for the low-skilled is too short to mirror this picture, but it is not unlikely that their situation at the labour market followed a very similar pattern.

Figure 34: Unemployment rate, participation rate, by age class, foreigners and low-skilled, Italy

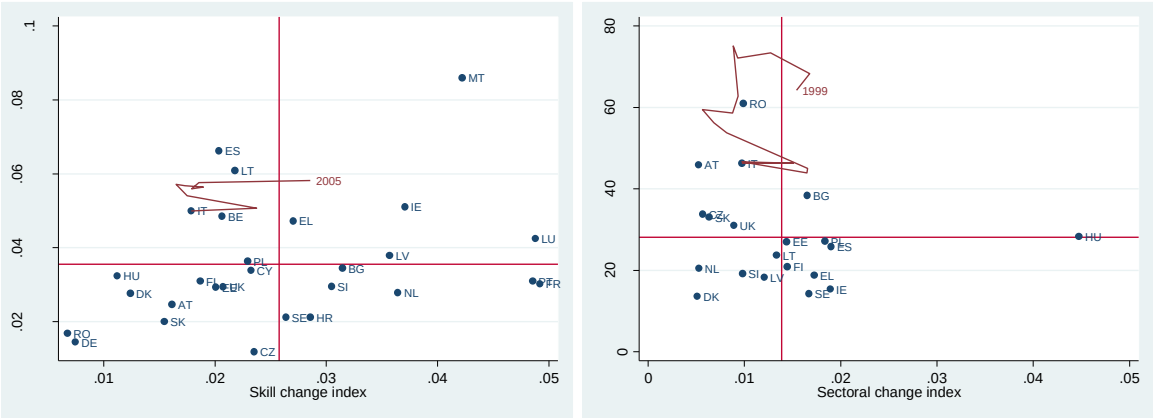


Source: LFS, own illustration

Investigating skill-mismatches, sectoral and skill shifts and regional dispersion of unemployment Figure 35 shows that these aspects are likely to play a minor role in Italy. Over the period observed the skill composition of the Italian labour market changes little and the skill-mismatch indicator declined. The right part of Figure 35 further shows that the regional dispersion of unemployment in Italy reduced quite markedly since 1999.

Hence overall the labour market in Italy seems to be characterised by both labour supply problems, in particular by women and the youth and even more so by labour demand problems. However, the latter are partly due to cyclical reasons, and no support for a sectoral shift or skill-mismatch can be found.

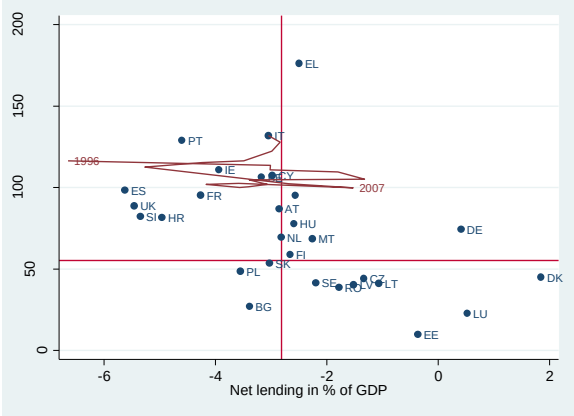
Figure 35: Skill, regional and sectoral changes and mismatches, Italy



Source: AMECO, LFS, own calculation

The public finance situation as depicted in Figure 36 shows persistent deficits which have been fluctuating between -1 and more than -6 % of GDP. The result is a constantly increase level of public debt reaching 131.8 % in 2014. Hence there is no "tax space" for a reduction of labour taxation without another tax increase to finance it.

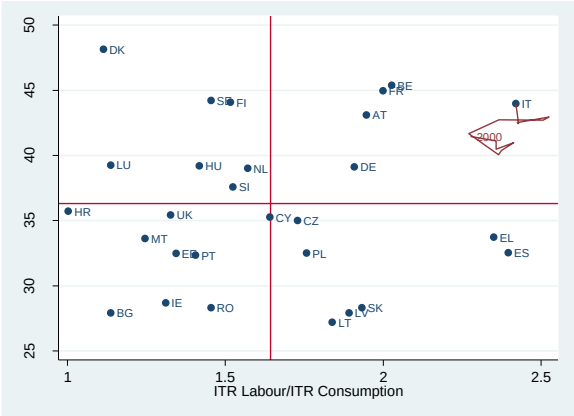
Figure 36: Debt and net lending, Italy



Source: AMECO, own illustration

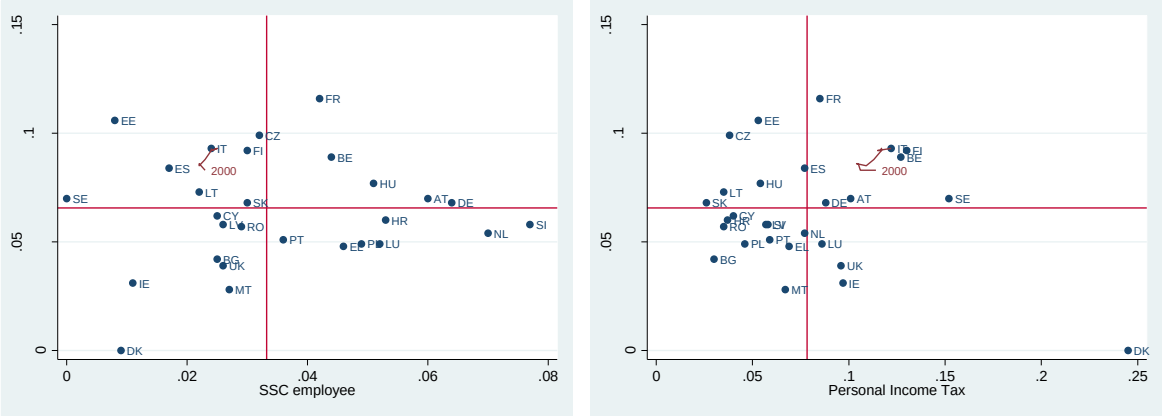
Looking further into the overall tax structure in Figure 37 one can see that Italy has a high overall tax-to-GDP ratio and one of the highest ratios between the ITR on labour and the ITR on consumption. The overall trend in the last years was still increasing the total tax burden. The look into the components of the ITR on labour in Figure 38 shows that SSC for the employer and the PIT part are above the unweighted European average, while the SSC for the employees is only moderate. The statutory situation in Figure 23 shows that Italy is characterised by a relatively high overall tax wedge for the average workers income. At the same time the personal income tax is only moderate progressive. Together with a proportional SSC system for both employers and employees this results in a only moderately progressive tax system.

Figure 37: Structure of labour tax burden, Italy



Source: AMECO, Taxation Trends in Europe, own illustration

Figure 38: Structure of labour tax burden, Spain



Source: Taxation Trends in Europe, own illustration

The institutional feature of Italy as described in Appendix Table 7 respectively Appendix Table 8 show that there is no national minimum wage and wage bargaining is taking place at an intermediate level. Especially the latter points towards a reduction of the SSC on the employer since the tax incidence should not fall fully on the worker.

Regarding the labour supply side problems of the youth and women, the inactivity trap indicator does not suggest that this is a problem of taxation. The discussion in section 4 would also argue that the availability of part time work and the benefits in kind like child care facilities are a better approach to increase the workforce attachment of Italian women.

6.4. Conclusion

This section uses the developed framework of indicators for Austria, Spain and Italy. All three countries have a comparatively high tax burden on labour but differ widely in terms of their labour market outcome. Austria has a low level of unemployment and a slightly above average participation rate. Italy has an unemployment rate somewhat above average but also one of the lowest participation rates. Spain in contrast has a very high unemployment rate but an above average participation rate. So from the

outset, there seems to be a strong labour demand problem in Spain and a moderate labour demand and labour supply problem in Italy. Taking into account cyclical aspects of the unemployment rate confirms that at least part of the labour demand problem in Spain and Italy is due to business cycle reasons.

Looking into the development of the labour market situation, one can see a clear increase in female workforce participation, which is, however, still not reducing the significant gender gap in Italy. The participation rate of elderly has been increasing steadily in all three countries, but while in Austria this did not increase the unemployment rate, the unemployment rate rose since 2007 in Italy and Spain. Especially for the latter this indicates a labour demand problem for the elderly. Youth unemployment is high in both Italy and Spain. The constantly dropping participation rate in Italy points in addition to the apparent labour demand problem also to problems in labour supply by Italians youth. Unemployment rates for foreigners and low-skilled workers have increased dramatically in Spain since the crisis in 2007. This indicates a labour demand problem for these groups.

The mismatch and change indicators pin identify a strong sectoral change and an increasing skill mismatch as labour demand side sources of the employment problems for Spain. For Austria and Italy there seems to be relevant regional variation in the level of unemployment, but the development is not clearly identifying whether the regional mismatch is contributing to the employment problems.

The general fiscal situation in all three countries is such that all of them are struggling with increasing debt levels and persistent deficits, which limit the tax space to enact tax reforms which reduce the tax burden on labour. All three countries have a high ITR on labour relative to the ITR on consumption and Italy and Austria additionally have very high tax-to-GDP ratio. This further strengthens the point that an overall reduction of the tax burden is likely to contribute positively to the aggregate demand via an increasing private consumption due to increase net household incomes.

Dissecting the tax burden of labour into its components one finds that SSC of employees make up a large part of the ITR on labour in Austria while the SSC of employers contributes more in Spain and Italy. This is also reflected in a high statutory total tax wedge for an average workers income in Austria and Italy. Contrasting this with our measure of the statutory progressivity one finds that Austria and Spain have clearly regressive SSC for both employers and employees. According to the search and matching theory a ceteris paribus less progressive tax burden should result more unemployment. This argument should be even strong since the tax burden in question is levied on the employers' side. Hence the statutory structure of the tax burden indicates a contribution of labour taxation to demand side problems, especially for Austria and Spain. The high statutory tax burden in Italy will also contribute to the labour demand problem.

In Italy the wage bargaining at the industry level is expected to result in shifting the tax incidence only partially to labour further contributing to the labour demand problem. A more – but not fully – centralized wage bargaining in Austria and Spain should result in more tax burden shifted to workers and therefore reduce the labour employment effects of the high tax labour burden. Additionally the link between the SSC contributions should contribute to the tax incidence of employees SSC falling on labour. The challenge in Austria is therefore more to maintain the link between

benefits and entitlement in the pay-as-you-go system with a continuing low participation rate of the elderly.

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Appendix

Appendix Table 1: Short description of studies directly investigating tax incidence

Study	Countries and time covered	Empirical approach	Conclusion
OECD (1990)	16 OECD countries; 1974-1986 (Cross-section analysis) 1955-1986 (time-series analysis)	***Cross-section analysis:*** Taking simple 12-year differences ***Time-series analysis:*** Estimation of annual time-series statistics for 1955 1986 for all countries individually, then taking simple averages of the 16 ordinary least squares (OLS) regressions:	***Cross-section analysis:*** In the long-run, the employer tax has a stat. significant negative impact on the wage level (gross wages) of close to -1. This is consistent with full tax shifting to employees. ***Time-series analysis:*** In the short run, a 1 % increase in total taxes increases real product wages by roughly 0.5 % in the short run (no full shifting to the employees).
Tyrväinen (1995)	10 OECD countries); 1972-1992; only private sector	Estimation of an unrestricted vector autoregressive (VAR) model estimated by maximum likelihood (ML) estimation procedure for each country individually	The effect of the total tax wedge (employer SSC, consumption and income tax) on real wages in the long run differs for each country and varies between full shifting to the employee and full shifting to the employer. Full-shifting of the tax burden to employers is found for Germany and Canada; full-shifting to employees for Sweden and the US. For the rest of the country sample results are somewhere in between indicating a burden sharing between employees and employers.
Alesina and Perotti (1997)	14 OECD countries; 1965-1990 (some countries shorter); Annual data on the manufacturing sector,	Static panel model with country fixed effects (FE). All variables are log differenced due to high persistence of the data.	1. A 1 % increase in taxes on labour (at sample average of 25 %) leads to an increase in unit labour costs in countries with an intermediate degree of centralisation increase by up to 2.5 % relative to competitors. 2. Tax burden on employees if wage bargaining is either highly and lowly centralised; if intermediate, the employers bear 2/3 of the tax burden.

Appendix Table 1: Short description of studies directly investigating tax incidence (continued)

Study	Countries and time covered	Empirical approach	Conclusion
Daveri and Tabellini (2000)	14 OECD countries; 1965 – 1995; sample size is dictated by availability of data on tax rates.	Panel estimates with country FE; 2SLS. Five-year averages are taken to remove cyclical fluctuations and first differences used due to high persistence in the data	Higher labour taxes increase real wages for countries with intermediate degree of centralisation: a 1 % increase in labour taxes increase real wages by around 0.4 %. No stat. significant effect is found for countries with high or low centralisation.
Ooghe, Schokkaert and Flechet (2003)	6 EU countries; Sectoral panel data 1978, 1981, 1984, 1988	Static panel model with country and sector FE	Positive effect on labour costs. Share of burden on employees increases if link between contributions and benefits gets stronger
Arpaia and Carone (2004)	15 EU countries; 1979 – 2000	Dynamic panel model by (system) GMM, with taking the first lag of the RL; also first difference GMM.	1. Short-run: (very modest) positive effect on labour costs for countries with a high or low degree of centralisation category, but not for those with an intermediate degree of centralisation. Contradicts previous findings by Alesina and Perotti (1997) and Daveri and Tabellini (2000). 2. Symmetry result: same coefficients irrespective of whether the tax wedge increases or decreases.
Nunziata (2005)	20 OECD countries; 1960 - 1994	Dynamic AR(1) panel model, estimated using GLS with country FE. Equilibrium correction model (ECM) for long-run estimates (includes lagged measures of taxes too)	Significant positive effect of taxes on labour costs, while coordination has a negative effect, both in levels and through interaction with taxes.

Appendix Table 2: Indicator group 1c: Values for 2013

Country	Skill mismatch	Regional mismatch[1]	Sectoral change	Skill change
Austria	2.47	45.9	0.52	1.61
Belgium	4.86	n.a.	0.90	2.06
Bulgaria	3.45	38.4	1.65	3.14
Croatia	2.12	n.a.	n.a.	2.86
Cyprus	3.39	n.a.	3.03	2.32
Czech Republic	1.19	33.8	0.57	2.35
Denmark	2.77	13.6	0.51	1.24
Estonia	2.94	27.0	1.44	2.01
Finland	3.10	20.9	1.44	1.87
France	3.02	n.a.	0.55	4.92
Germany	1.45	n.a.	0.29	0.74
Greece	4.72	18.8	1.72	2.70
Hungary	3.24	28.3	4.47	1.12
Ireland	5.11	15.4	1.89	3.71
Italy	4.99	46.3	0.97	1.79
Latvia	3.79	18.3	1.21	3.57
Lithuania	6.09	23.7	1.33	2.18
Luxembourg	4.25	n.a.	1.57	4.88
Malta	8.60	n.a.	2.00	4.22
Netherlands	2.78	20.5	0.53	3.64
Poland	3.64	27.2	1.86	2.29
Portugal	3.09	n.a.	3.33	4.85
Romania	1.69	61.0	0.99	0.67
Slovak Republic	2.00	33.0	0.63	1.54
Slovenia	2.95	19.2	0.98	3.05
Spain	6.62	25.8	1.90	2.04
Sweden	2.12	14.3	1.67	2.64
United Kingdom	2.95	31.0	0.89	2.07

[1]) The values for the regional mismatch are for 2012.

Source: AMECO and LFS, own calculations

Appendix Table 3: Indicator group 2a: Values for 2014

Country	Net lending in % of GDP	Debt level in % of GDP	Total Tax-to-GDP ratio
Austria	-2.86	86.77	43.11
Belgium	-3.17	106.43	45.39
Bulgaria	-3.39	27.03	27.91
Croatia	-4.96	81.45	35.72
Cyprus	-2.98	107.46	35.27
Czech Republic	-1.34	44.11	35.01
Denmark	1.85	44.96	48.14
Estonia	-0.37	9.85	32.50
Finland	-2.66	58.88	44.08
France	-4.27	95.28	44.95
Germany	0.41	74.23	39.12
Greece	-2.50	176.31	33.73
Hungary	-2.59	77.70	39.20
Ireland	-3.94	110.76	28.69
Italy	-3.05	131.87	43.99
Latvia	-1.52	40.43	27.93
Lithuania	-1.07	41.10	27.21
Luxembourg	0.52	22.69	39.27
Malta	-2.26	68.56	33.63
Netherlands	-2.82	69.46	39.01
Poland	-3.55	48.63	32.51
Portugal	-4.60	128.93	32.36
Romania	-1.78	38.74	28.31
Slovak Republic	-3.03	53.58	28.32
Slovenia	-5.35	82.19	37.59
Spain	-5.63	98.30	32.54
Sweden	-2.20	41.44	44.21
United Kingdom	-5.46	88.70	35.44

Source: AMECO database

Appendix Table 4: Indicator group 2b: Implicit tax rates, values for 2012

Country	Ratio implicit tax rate on labour and consumption	SSC employer in % of GDP	SSC employee in % of GDP	Personal income tax in % of GDP
Austria	1.95	7.0	6.0	10.1
Belgium	2.03	8.9	4.4	12.7
Bulgaria	1.14	4.2	2.5	3.0
Croatia	1.00	6.0	5.3	3.7
Cyprus	1.64	6.2	2.5	4.0
Czech Republic	1.73	9.9	3.2	3.8
Denmark	1.11	0	0.9	24.5
Estonia	1.34	10.6	0.8	5.3
Finland	1.52	9.2	3.0	13
France	2.00	11.6	4.2	8.5
Germany	1.91	6.8	6.4	8.8
Greece	2.35	4.8	4.6	6.9
Hungary	1.42	7.7	5.1	5.4
Ireland	1.31	3.1	1.1	9.7
Italy	2.42	9.3	2.4	12.2
Latvia	1.89	5.8	2.6	5.7
Lithuania	1.84	7.3	2.2	3.5
Luxembourg	1.14	4.9	5.2	8.6
Malta	1.25	2.8	2.7	6.7
Netherlands	1.57	5.4	7.0	7.7
Poland	1.76	4.9	4.9	4.6
Portugal	1.41	5.1	3.6	5.9
Romania	1.45	5.7	2.9	3.5
Slovakia	1.93	6.8	3.0	2.6
Slovenia	1.52	5.8	7.7	5.8
Spain	2.40	8.4	1.7	7.7
Sweden	1.45	7.0	0.0	15.2
United Kingdom	1.33	3.9	2.6	9.6

Source: AMECO database

Appendix Table 5: Indicator group 2b: Statutory tax burden, values for 2013

Country	Average tax burden				Marginal tax burden			
	Total tax wedge	SSC employer	SSC employee	Personal income tax	Total tax wedge	SSC employer	SSC employee	Personal income tax
Austria	49.1	22.6	14.0	12.6	60.6	22.6	14.0	24.0
Belgium	55.8	23.0	10.8	22.0	69.7	25.2	10.6	33.9
Czech Republic	42.4	25.4	8.2	8.8	48.6	25.4	8.2	15.0
Denmark	38.2	0.0	2.7	35.5	49.4	0.0	0.0	49.4
Estonia	39.9	25.4	1.5	13.0	42.2	25.4	1.5	15.4
Finland	43.1	18.6	6.2	18.4	57.6	18.6	6.3	32.7
France	48.9	28.7	9.9	10.4	58.8	28.3	8.9	21.6
Germany	49.3	16.2	17.1	16.0	60.1	16.2	17.1	26.8
Greece	41.6	21.5	13.0	7.1	49.6	21.5	13.0	15.1
Hungary	49.0	22.2	14.4	12.5	49.0	22.2	14.4	12.5
Ireland	26.6	9.7	3.6	13.3	37.7	9.7	3.6	24.4
Italy	47.8	24.3	7.2	16.3	54.1	24.3	7.2	22.7
Luxembourg	37.0	11.0	11.0	15.1	57.2	11.0	11.1	35.1
Netherlands	36.9	8.4	14.2	14.3	48.6	8.8	2.9	36.9
Poland	35.6	14.4	15.3	5.9	37.2	14.4	15.3	7.6
Portugal	41.2	19.2	8.9	13.1	53.9	19.2	8.9	25.9
Slovak Republic	41.1	23.8	10.2	7.1	46.5	23.8	10.2	12.5
Slovenia	42.3	13.9	19.0	9.4	51.0	13.9	19.0	18.1
Spain	40.7	23.0	4.9	12.8	49.5	23.0	4.9	21.6
Sweden	42.9	23.9	5.3	13.7	48.5	23.9	5.8	18.8
United Kingdom	31.5	9.8	8.5	13.3	40.3	12.1	10.5	17.6

Source: OECD Taxing Wages database

Appendix Table 6: Indicator group 2b: Progressivity index, values for 2013

Country	Progressivity Index			
	Total tax wedge	SSC employer	SSC employee	Personal income tax
Austria	1.06	0.68	0.51	1.99
Belgium	1.19	1.01	1.11	1.39
Czech Republic	1.12	1.00	1.00	1.67
Denmark	1.21	n.a.	0.00	1.29
Estonia	1.05	1.00	1.00	1.14
Finland	1.26	1.00	1.02	1.58
France	1.17	1.13	0.91	1.50
Germany	1.03	0.43	0.42	1.75
Greece	1.25	1.00	1.00	3.39
Hungary	1.00	1.01	1.00	1.00
Ireland	1.67	1.03	1.00	2.16
Italy	1.17	1.00	1.04	1.46
Luxembourg	1.28	0.81	0.84	1.90
Netherlands	1.24	0.32	0.24	2.19
Poland	1.05	1.00	1.00	1.29
Portugal	1.30	1.00	1.00	1.85
Slovak Republic	1.12	1.00	1.00	1.78
Slovenia	1.24	1.00	1.00	2.58
Spain	1.12	0.54	0.54	2.00
Sweden	1.25	1.00	0.33	1.71
United Kingdom	1.33	1.20	0.64	1.64

Source: OECD Taxing Wages Database, own calculations

Appendix Table 7: Indicator group 3b: Link between contribution and benefits, values for 2013

Country	Pension benefits entitlement link indicator[1]	Inactivity trap[2]	Unemployment trap[2]
Austria	0.21	91.73	65.70
Belgium	0.10	74.89	86.84
Bulgaria	n.a.	50.33	81.61
Croatia	n.a.	55.27	90.00
Czech Republic	0.20	78.70	68.85
Denmark	0.24	133.93	122.61
Estonia	0.32	71.00	63.66
Finland	0.37	87.09	72.36
France	0.26	64.90	88.32
Germany	0.22	75.59	68.73
Greece	0.28	16.50	79.54
Hungary	0.38	64.75	88.44
Ireland	0.00	128.41	59.87
Italy	0.38	14.83	89.83
Latvia	n.a.	79.02	86.35
Lithuania	n.a.	62.19	102.19
Luxembourg	0.34	83.11	82.85
Malta	n.a.	91.28	76.03
Netherlands	0.37	86.23	102.41
Poland	0.37	42.15	56.88
Portugal	0.36	47.72	97.42
Romania	n.a.	24.23	67.36
Slovak Republic	0.33	55.11	37.10
Slovenia	0.19	69.85	84.42
Spain	0.23	59.15	76.68
Sweden	0.44	100.00	77.96
United Kingdom	0.04	70.70	34.71

1) The values for the pension benefits link indicator are for 2012.
2) For a single person without childern at 33 percent of average workers earnings.

Source: OECD Pensions at a glance, OECD tax benefits database

Appendix Table 8: Indicator group 3c: Bargaining and minimum wages, values for 2011

Country	Centralization of bargaining[1]	Union density[2]	Minimum wage setting[3]	Monthly minimum wage[4]
Austria	4	27.9	2	n.a.
Belgium	5	50.4	3	1501.8
Bulgaria	2	19.8	5	184.1
Croatia	n.a.	n.a.	n.a.	395.6
Cyprus	2	49.0	7	n.a.
Czech Republic	2	13.9	8	331.7
Denmark	4	66.4	1	n.a.
Estonia	1	6.8	3	390.0
Finland	5	68.4	1	n.a.
France	2	7.7	8	1457.5
Germany	4	18.0	3	1473.0
Greece	5	25.4	3	683.8
Hungary	2	11.4	4	332.8
Ireland	3	36.1	6	1461.9
Italy	3	35.2	1	n.a.
Latvia	1	14.8	8	360.0
Lithuania	1	10.0	5	300.0
Luxembourg	4	33.9	7	1923.0
Malta	2	48.6	7	720.5
Netherlands	3	19.0	7	1501.8
Poland	1	13.5	8	409.5
Portugal	3	19.5	8	589.2
Romania	2	32.8	8	217.5
Slovak Republic	2	16.7	8	380.0
Slovenia	3	24.4	7	790.7
Spain	4	17.2	5	756.7
Sweden	4	67.5	1	n.a.
United Kingdom	1	25.6	6	1378.9

1) The values for Bulgaria and Romania are for 2010.
2) The value for Malta is for 2010, for Bulgaria 2009 and for Latvia and Romania for 2008.
3) The values for Bulgaria and Romania are for 2010. We would reclassify the current value for Cyprus to 2, since there are not national wide minimum wages of 924 Euros, similar to Austria.
4) The values are for 1.1.2015, Germany introduced national minimum wage in 2015.

Source: ICTWSS, Eurostat

Appendix Table 9: Indicator group 3c: Earnings distribution, values for 2013

Country	Median Earnings (Structure of Earnings)	2nd decile EU-SILC	5th decile EU-SILC	8th decile EU-SILC
Austria	26,957	14,974	22,073	31,368
Belgium	34,154	14,030	21,483	30,573
Bulgaria	3,162	1,713	2,924	4,717
Croatia	9,922	3,077	5,078	8,028
Cyprus	19,448	10,380	15,873	25,071
Czech Republic	9,235	5,734	7,694	10,883
Denmark	51,938	18,556	26,897	37,564
Estonia	8,507	4,071	6,579	11,027
Finland	33,197	16,210	23,272	33,111
France	28,579	14,252	20,954	30,809
Germany	32,011	12,837	19,582	29,372
Greece	n.a.	4,667	8,371	12,693
Hungary	7,155	3,077	4,529	6,607
Ireland	37,960	12,573	19,078	29,603
Italy	24,690	9,642	15,733	23,879
Latvia	5,928	2,853	4,702	8,081
Lithuania	5,595	2,780	4,698	7,621
Luxembourg	37,086	21,337	33,301	50,283
Malta	15,642	7,763	12,093	17,644
Netherlands	31,866	14,881	20,839	29,336
Poland	8,216	3,288	5,164	7,955
Portugal	10,525	5,116	8,170	13,098
Romania	4,077	1,152	2,066	3,356
Slovak Republic	8,174	4,813	6,737	9,520
Slovenia	14,976	8,115	11,852	16,418
Spain	19,573	8,052	13,524	21,926
Sweden	31,013	17,842	26,414	36,336
United Kingdom	26,250	12,107	18,694	29,132

Source: Structure of Earnings Survey, EU-SILC

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