Projektbericht

Research Report

Extension of the Empirical Stock-Flow Consistent (SFC) Model for Austria

Implementation of Several Asset Classes, a Detailed Tax System and Exploratory Scenarios

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Final Report

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Abstract

This study presents the current status in the development of a novel empirical stock-flow consistent (SFC) model for Austria. SFC models are macroeconomic accounting models that feature several aggregated heterogeneous agents (sectors) and different classes of financial assets and liabilities. Stocks of assets/liabilities and financial flows of and between the sectors are depicted in a consistent and rigid accounting structure based on the logic of national annual sectoral accounts (flow of funds). The modelling approach allows complex interactions between agents as well as between the real and financial economy. Here, the SFC approach is used to construct an empirical model for the Austrian national economy that features endogenous economic dynamics (not necessarily close to a steady state) based on trends derived from national accounting data. The model is then used in exemplary policy simulations to derive tax and spending multipliers to situate it within comparable literature. The main scientific contribution is the inclusion of (1) the interaction between financial markets and the real economy and (2) the SFC method in a macroeconomic forecasting framework. A medium-term target of this work in progress is to develop a tool which is fit for medium to long-term forecasting, scenario-based policy evaluation/simulation, and can thus be the basis for policy advice. In a longer-term perspective, the aim is to construct a modeling framework performing better than usual forecasting models and which is scalable onto the European level.

Nomenclature

BANK	Commercial Banking Sector and MMFs
BAU	Business as Usual
BS	Balance Sheet
BSM	Balance Sheet Matrix
CB	Central Bank
CPI	Consumer Price Index
DS	Debt Securities
dum	Label in graphs due to technical reasons, please ignore
FC	Financial Corporations
FOC	Other Changes in Volume Account
FTR	Financial Transactions
GDP	Gross Domestic Product
Govt	Government
HH	Households
ICPF	Insurance Corporations and Pension Funds
IFU	Non-MMF Investment Funds
MMF	Money Market Funds
NASA	National Annual Sectoral Accounts
NFC	Non-financial Corporations
NFTR	Non-financial Transactions
NLNB	Net Lending/Net Borrowing
NPISHs	Non-profit Institutions Serving Households
NW	Net Worth
OFI	Other Financial Institutions
OS	Operating Surplus
RECV	Received
REV	Revaluation Account
SDRs	Special Drawing Rights
SFC	Stock-flow Consistent
TFM	Transaction Flow Matrix
VA	Value Added
VAT	Value Added Tax

1 Introduction

This project report documents a work-in-progress version of what is termed in the literature as a "fully empirical" (Caverzasi and Godin, 2014) stock-flow consistent (SFC) model, calibrated to the Austrian economy. In fully empirical SFC models, not only are the model parameters estimated from empirical data, they are also used to predict variations of endogenous model variables in a scenario analysis. We follow this approach by both deriving a business as usual (BAU) scenario from national accounting data and by conducting exploratory scenarios regarding changes in the Austrian tax system and government expenditures.

This model is the first of its kind for Austria, and among few empirical SFC models internationally. Specifically, Caverzasi and Godin (2014) restrict research in this area to two groups that work with this kind of fully empirical SFC models: one set of authors at the Levy institute, who constructed fully empirical models for the U.S. (Papadimitriou et al., 2011) and Greek economies (Papadimitriou et al., 2013). The other group can be found at the University of Limerick, see Kinsella and Tiou-Tagba Aliti (2012), where an empirical model of the Irish economy is still work in progress.

One of the main strengths of SFC models in general is their explicit depiction of heterogeneous aggregated agents interacting in a financial economy featuring several asset classes and their different rates of return. These interactions usually involve portfolio choice of agents between these assets, endogenous creation of money in the financial system, and a system of endogenous nominal flows constituting economic relations in a consistent accounting framework. These flows are related both to behavioural decisions of agents within a period, but also to their holdings of assets and liabilities and the implied flows of revenues and payments.

Empirical SFC models in specific have the decisive property that they can incorporate dynamics of the economy based on empirical evidence, and not necessarily presuppose a steady state growth path. Especially, our model is designed to project trends that we take from sectoral national accounting data into the future for the BAU scenario. In this framework, we can incorporate policy simulations leading to a new development of the economy. The economic effect of the policy measure is obtained by comparison of this new development due to the policy measure to the BAU scenario. This model, while yet preliminary in nature, is an extended and improved version of the empirical SFC model for Austria put forth in Schmelzer (2015). We have concentrated on the following issues:

1. The inclusion of several asset classes and types of financial corporations to reach a better depiction of the Austrian financial system.
2. A clear connection of the non-financial within-period flows in the economy between different agents and the resulting effects on the accumulation of financial assets/liabilities.
3. A simple mechanism of portfolio choice determining the composition of agents' balance sheets.
4. Inclusion of a detailed depiction of the Austrian tax system, including taxes on wages, mixed income of self-employed, firm income (profit), products, production, and capital, and a basic depiction of the government transfer system (government consumption, social and other transfers).
5. Several exploratory scenarios to test the properties of the model.

The inclusion of several asset classes was primarily motivated by the fact that by implementing a more detailed financial structure in our model from the first stages of model building onwards,

we can cater to the specific strength of SFC models in the comprehensive depiction of the financial system. While we are aware that many of the behavioural equations, as well as the projections of the multitude of parameters and (exogenous or endogenous) variables still deserve a closer look and comprehensive empirical work, we believe that the basic logic of this model can offer a convincing case for the possibilities this framework is able to open up for future applications. Especially, the effects of different policy measures on growth and distribution - but also the composition and length of agents' balance sheets as well as on rates of return to different asset classes - can be effectively evaluated with empirical SFC models. Fiscal and monetary policy can be evaluated separately, but also jointly and in mutual interaction - especially in later, more developed versions of the model. By using standardised national accounting data from Eurostat - based on the framework put forth in Eurostat (2013) - and implementing the construction of our underlying datasets in computer code, we can potentially replicate this framework for several countries of the European Union (given sufficient time and resources).

The structure of this report is as follows: Firstly, the reader is introduced into the underlying data framework in section 2. After a preliminary exposition of principles of the National Annual Sectoral Accounts (NASA) data in section 2.1, we set out how we constructed the stock-flow consistent matrices for the model in section 2.2. This involves the compilation of a transaction flow matrix (TFM), section 2.2.1, a balance sheet matrix (BSM), section 2.2.2, as well as a flow-of-funds and a revaluation account, section 2.2.3. We describe some important aspects of the data structure and how the data are compiled, and relate to the main aggregations and disaggregations of flows, assets, and liabilities we undertook. Then we illustrate how we achieved consistency in these data sets individually, and elaborate how they interlink in the SFC framework. Some trends in balance sheet data are shown in section 2.2.4

Secondly, we describe the structure of our model in section 3. The model is composed of two major blocks, the first of which regards non-financial transaction (NFTR) flows, section 3.1, the second relates to financial transaction (FTR) flows, section 3.2. Each of these blocks features endogenous behavioural decisions of agents, exogenous variables forecast according to trends in the data, 'implied' stock-flow relations, and primary outcomes due to the interaction of these different flows. NFTR depict economic flows within an accounting period between agents resulting from various economic activities, while FTR show the accumulation of financial assets/and liabilities, and the transition of balance sheets from one year to the next. One major focus of the model extension set forth in this report is to achieve a link between the NFTR and FTR block of the model. Selected past developments as well as projections of both parameters and variables in the model are shown in this section to illustrate the endogenous dynamics - still preliminary in nature - implemented in this model to constitute the BAU scenario.

Thirdly, we demonstrate the functionality of this model by implementing selected exploratory scenarios in section 5. There, we simulate changes in various tax rates (wage tax, capital tax, firm income tax), as well as different changes in government expenditure (government consumption or social transfers), often in combination with each other. We show the results of these scenarios regarding main economic variables such as GDP, consumption, household income, investment, and operating surplus. Furthermore, we derive multipliers for each scenario to enable consistent comparison between them.

Lastly, section 6 concludes and offers an outlook on further extensions, possible work and improvements of the modelling framework.

As the model described and applied below is still a preliminary work in progress, this project report is intended to show the basic logic of the modelling framework, forming a base for discussion. Points that are especially open for further discussion are labelled by (to be discussed), and might deserve special attention regarding future work on the model.

2 Data

2.1 Preliminaries on National Annual Sectoral Accounts (NASA) Data

The European System of Accounts[1] as laid down in Eurostat (2013) provides a consistent framework to compile annual data on

1. Assets, liabilities, net worth;
2. Financial and non-financial transactions of and between all agents;
3. In the disaggregation necessary for our model;
4. for all EU countries, 1995-2014.

The datasets are constructed for Austria by Statistik Austria (non-financial transactions, government sector) and the Austrian National bank (financial assets and liabilities, financial transactions, revaluation account). They relate to the annual nominal flows between and stocks of different assets/liabilities held by so-called "institutional units" (sectors of the economy), for different years, economic activities, and regarding different asset classes.

The major **institutional units** are as following, Eurostat (2013)[chapter 2]:[2]

1. S1: Total economy
2. S11: Non-financial corporations (NFC)
3. S12: Financial corporations (FC)
4. S13: General government (Govt)
5. S14: Households
6. S15: Non-profit institutions serving households (NPISH)[3]
7. S2: Rest of World (Row)

In our model aggregation, 3. financial corporations will be disaggregated into sub-units due to the focus of the SFC model on the financial side of the economy (see section 2.2.1), while 5. households and 6. NPISH are aggregated in one household sector.

Essentially, there are five **main data sets** provided by Eurostat that form the basis of our model dataset:

A. Balance sheet (BS) data for all agents, 1995 - 2014: These data document the yearly stocks of assets and liabilities for the institutional units. They are valued at market prices. The creation of a financial asset by one agent is always accompanied by the assumption of a respective liability by another agent, thus the sum over financial assets and liabilities of one asset class is always zero. Agents' net worth is the residual (balancing item) on the liabilities side of the

[1] The reader already familiar with NASA data may choose to skip this introductory chapter.

[2] Similar to Input-Output tables, each digit signifies a sub-grouping of an existing group. For example, S11 is as subgroup of S1.

[3] NPISHs are private legal entities which serve households and which are private non-market producsers, see Eurostat (2013)[pp. 46]. Their principal source of revenue are voluntary contributions by households in cash or in kind, from payments by the government and from property income. The main kinds of entities included in this sector are trade unions, professional or learned societies, consumers' associations, political parties, churches and other religious societies, as well as charities, aid and relief organisations.

balance sheet. The differences in the amount of assets and liabilities held between balance sheets of different years give us information on the necessary adding up requirements that we have to meet with the annual flow data from sectoral accounts to replicate these year-to-year differences of the balance sheets. The following major asset classes are considered in NASA data:

1. F1: Monetary gold and special drawing rights (SDRs)
2. F2: Currency and deposits
3. F3: Debt Securities
4. F4: Loans
5. F5: Equity and investment fund share units
6. F6: Insurance, pension and standardised guarantee schemes
7. F7: Financial derivatives and employee stock options
8. F8: Other accounts receivable/payable

Balance sheet data can either be given in consolidated or non-consolidated form, i.e. showing net or gross positions by sector. Generally, in NASA data asset positions are obtained gross, and we stick to this form since it reveals the interrelations of debt in this economy that are of major interest for a SFC model. The interested reader is referred to Eurostat (2013)[Chapter 5] for further detail. We will set the assets in our model aggregation, and refer to the definitions of these asset classes shortly in section 2.2.2.

B. Non-financial transactions (NFTR), 1995 - 2014: comprise transactions in products and non-produced assets, as well as distributive transactions.

As defined in Eurostat (2013)[Chapter 3], **transactions in products and non-produced assets** are all products and services created in Austria by the inputs of labour, capital, as well as goods and services to produce outputs of goods and services. Supplies of products are valued at basic prices, i.e. net of taxes and subsidies as well as transport charges and holding gains. Uses are recorded at purchaser's prices, including the latter surcharges. They are either resources or uses of funds.

The main categories of transactions are distinguished at follows (resources and uses):

1. P.1: Output (resource)
2. P.2: Intermediate consumption (use)
3. P.3: Final consumption expenditure (use)
4. P.4: Actual final consumption (use)
5. P.5: Gross capital formation (use in capital account)
6. P.6: Exports of goods and services (use)
7. P.7: Imports of goods and services (resource)

Distributive transactions are transactions whereby the value added generated by production is distributed to labour, capital and government, as well as transactions redistributing income and wealth, Eurostat (2013)[chapter 4]. They are at the same time sources of funds for some agents, and a corresponding use for other agents as recorded in the transaction flow matrix, see section 2.2.1. Distributive transactions include:

1. D1: Compensation of employees

2. D2: Taxes on production and imports
3. D3: Subsidies
4. D4: Property income
5. D5: Current taxes on income, wealth, etc.
6. D6: Social contributions and benefits
7. D7: Other current transfers
8. D8: Adjustments for the change in pension entitlements
9. D9: Capital transfers

The challenge is to create a stock-flow consistent transaction flow matrix from these accounts, since in the production account, sources of funds are generally not recorded as uses of funds for other agents, unlike in the distributive transactions account.

C. Financial Transactions (FTR), 1995 - 2014 Financial transactions between institutional units record the (Eurostat, 2013)[chapter 5]:

1. Simultaneous creation or liquidation of a financial asset and the counterpart liability, or a
2. Change in the ownership of a financial asset, or
3. The assumption of a financial liability.

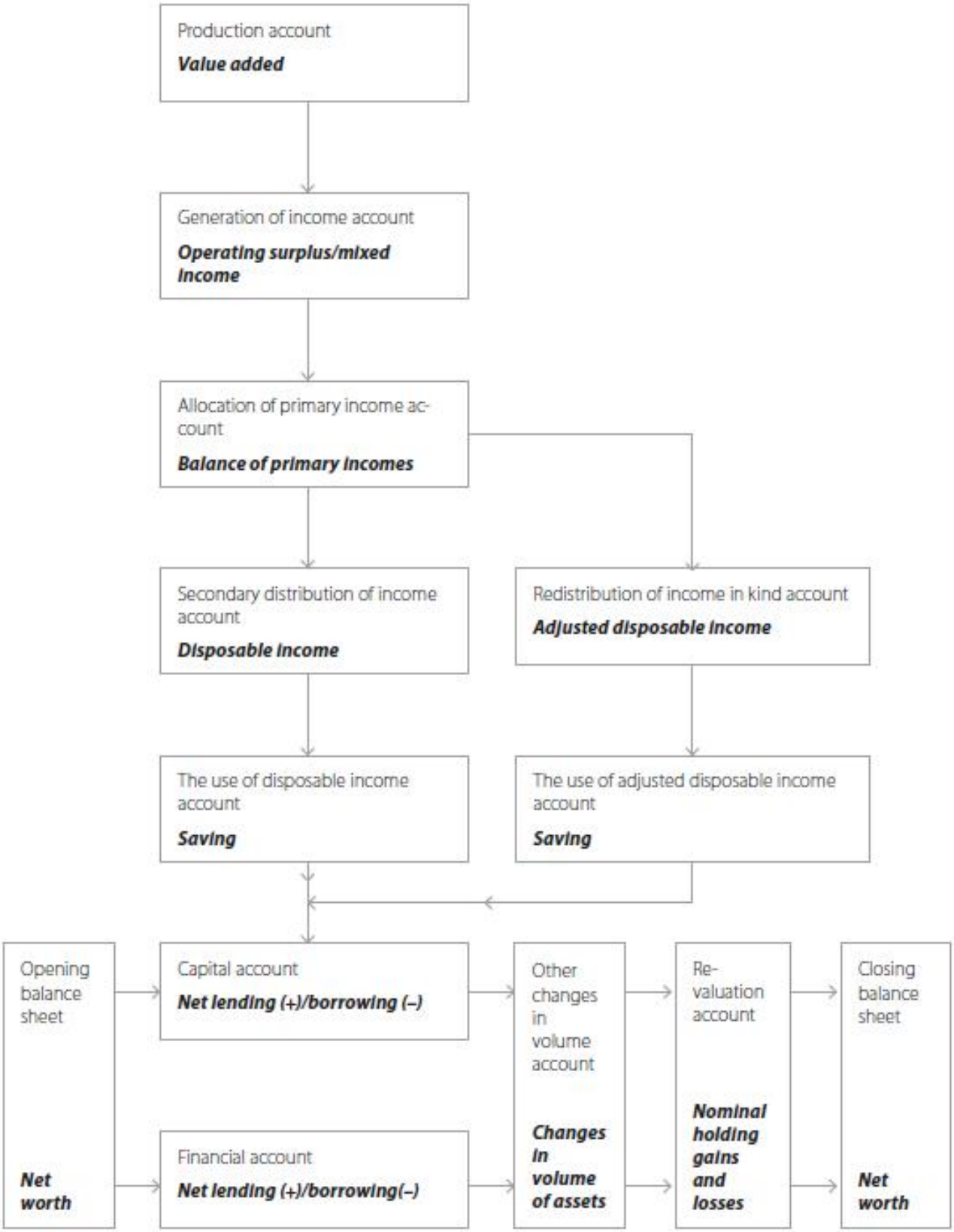
They are classified in the same categories as financial assets/liabilities described above.

D. Revaluation (REV) and F. other changes in volume (FOC) accounts, 2012 - 2014 These accounts show

1. the revaluation effects resulting from price changes for financial assets and liabilities, as well as
2. Other changes in volume resulting from events not part of the economy (e.g. catastrophic losses) or other financial losses (e.g. write-offs of debt due to default, currency losses).

Since the REV and FOC accounts are available only for a shorter time period than balance sheets (only from the year 2012 onwards) from Eurostat data sources than non-financial and financial transactions data, we have to compensate for this fact in our modelling procedure, see section 2.2.3.

Figure 1: The Sequence of Accounts as in ESA 2010



Source: Eurostat (2013)[p. 20]
Remark: For each account, the **balancing item** is given in bold letters.

2.1.1 The Sequence of Accounts

The sequence of accounts, figure 1, is the basic logic of NASA data that has to be reconciled with the stock-flow logic of our SFC model.

This is the core of the ESA 2010 system, see Eurostat (2013)[pp. 18 - 22 (summary); chapter 8 (details)]. The interconnected accounts trace the

1. production, generation, distribution and redistribution of income, as well as the use of this income in the form of final consumption (current accounts), and
2. changes in assets/liabilities and net worth (accumulation accounts).

By adding these economic flows to the opening balance sheet of this period (last period's balance sheet), the closing balance sheet is obtained (this period's balance sheet, the opening balance sheet for next period). Each account has a balancing item, which is obtained by subtracting the total value of one side of an account (expenditures/liabilities) from the other (revenues/assets). One could say that these balancing items carry most of the economic information incorporated in these accounts, and are one of the primary goals in constructing them from begin with.

Current accounts - non-financial transactions The sequence starts at the **production account**. Subtracting inputs in the production process from outputs leaves *value added* as the balancing item. Taking value added forward to the **generation of income account**, compensation for employees (wages) in the production process and taxes to the government due to production are subtracted, leaving the productions sector's *operating surplus* (*mixed income* for self-employed) as the balancing item.

Next, value added - already broken down into wages, taxes and operating surplus/mixed income - is taken forward to the **allocation of primary income account**. Here, factor income is allocated to the receiving sector as opposed to the producing sector. This means that e.g. wages are allocated to the household and rest of world sectors, while operating surplus remains in the producing sector where it was generated. Furthermore, property income flowing in and out of a sector is recorded. The balancing item is then the *balance of primary incomes* flowing into a sector. The **secondary distribution of incomes account** then tracks the redistribution of incomes through transfers. The major instruments of redistribution are government taxes on and social benefits for the household sector. *Disposable income* is the balancing item.

Then, disposable income is carried forward to the **use of disposable income account**, recording final household expenditure, and leaving household *saving* as the balancing item.

In parallel, the **redistribution of income in kind** account is generated, which also records social transfers in kind received by the household sector (primarily health and education services, but also e.g. cultural and recreational services). These social transfers in kind are financed by taxes, social security contributions, other government income (government), and out of donations or property income (NPISHs), and are obtained by the household for free or at non-market prices. Here, these transfers in kind are recorded as income for the household sector. The balancing item is *adjusted disposable income*. In the **use of adjusted disposable income account**, these social benefits in kind are recorded as a *use* of income by households, obtaining again household *saving* as a balancing income, equal to the parallel use of disposable income account.

Accumulation accounts - financial transactions Saving is then carried on to the **capital account**. There, it is used to fund capital formation, recording capital transfers in and out of the sectors. Overspending or underspending on the acquisition of real financial assets leads to either a financial surplus or deficit by a sector. The balancing item is *net lending (+)/net borrowing (-)*. Net lending is to loan out a surplus, net borrowing is to finance a deficit.

The **financial accounts** observe the detailed lending and borrowing of the institutional units in financial assets. Again, *net lending/net borrowing (NLNB)* is the balancing item, this time viewed from the financial side of the economy to see how a surplus was loaned out or how a deficit was financed. In theory, net lending/net borrowing viewed from the real and the financial side should exactly match. In practice, this generally is not the case. Any discrepancy that occurs, however, is due to differences in statistical measuring. For Austrian data, this is especially relevant for the sectors non-financial corporations, financial corporations and rest of world, see figure 2.

Changes in balance sheets In absence of other effects, changes in balance sheets due to transactions in real or financial assets - the capital and financial account, respectively - would enable to calculate changes in holdings of assets and liabilities by sectors and to obtain a closing balance sheet.

However, other changes in volume as well as revaluation effects also determine the value of agents' balance sheet positions at the end of the accounting period. The **other changes in volume account** treats events outside the economy such as catastrophic losses or government seizures, but also financial losses due to default or currency risks. The balancing item is *changes in volume of assets*. The **revaluation account** records price effects that result from a change in market prices for assets or liabilities. The balancing item are *nominal holding gains and losses*. In the context of our SFC model, we refer to these effects as *capital gains/losses*, and they comprise a vital part of our analysis, especially for future work.

Considering financial transactions, other changes in volume as well as revaluation effects, the closing balance sheet is obtained by adding the total changes in assets/liabilities to the opening balance sheet.

2.2 Matrices

2.2.1 Transaction Flow Matrix (TFM)

Table 1 shows the large non-financial transaction flow matrix directly from NASA data.

The first step in constructing this matrix was to achieve flow consistency between sectors in order to attribute a flow as expenditure/receipt for each sector, i.e. paid and received funds have to add to zero for each line. The complication that arises here is that for variables stemming from the production account, i.e. final consumption expenditure (P3), net value added (B1N), gross investment (P51G), change in inventories (P52), acquisition/disposal of valuables (P53), exports (P6), and imports (P7) below, there is no counterpart receiving the flow specified in NASA data. We constructed the matrix below to obtain net lending/net borrowing as specified in the non-financial accounts, to aim for consistency with the financial side of the data (flow of funds and differences between balance sheets), since net lending/net borrowing equals the net acquisition of financial assets/liabilities of a sector.

Table 1: The Large Non-financial Transaction Flow Matrix for Austria (2012, in million Euro)

Flow		NFC (S11)		FC (S12)		Gov't (S13)		HHs,NPISHs (S14_S15)		RoW (S2)	
Name	**Number**	**RECV**	**PAID**	**RECV**	**PAID**	**RECV**	**PAID**	**RECV**	**PAID**	**RECV**	**PAID**
Wages	D11	0	78,901	0	6,200	0	27,520	124,267	11,420	1,754	1,981
Social cont.	D12	0	15,868	0	1,877	0	6,283	26,096	2,274	380	174
VAT on products	D211	0	0	0	0	24,563	0	0	24,563	0	0
Imp tax on products	D212	0	344	0	0	0	0	0	0	344	0
Tax on products (other)	D214	0	10,895	0	0	10,858	0	0	0	37	0
Other tax on production	D29	0	6,722	0	1,154	10,534	1,470	0	1,188	0	0
Subsidies on products	D31	640	0	0	0	0	558	0	0	0	82
Other subs production	D39	3,134	0	143	0	0	4,181	2,052	0	0	1,149
Net interest payments	D41	2,212	5,295	23,438	20,356	1,709	8,624	5,095	1,968	16,731	12,942
Distr. income corp.	D42	16,779	25,397	1,657	7,476	1,603	0	18,696	0	8,852	14,714
Reinvested earnings fdi	D43	-867	1,334	2,621	3,592	0	0	61	0	4,926	1,816
Other inv. inc. To Insur. holders	D441	286	0	4	2,824	0	0	2,534	0	0	0
to pension holders	D442	0	287	0	643	0	0	931	0	0	0
to IF shareholders	D443	157	0	1,853	2,497	123	0	853	0	269	757
Rents	D45	0	211	0	0	211	0	0	0	0	0
Wage income tax	D51A C04, C08, D51E	0	0	0	0	26,032	37	0	26,024	150	121
Tax on Mixed Income HH	D51 C01, C02, C03, C05	0	0	0	0	4,621	0	0	4,621	0	
Capital Income Tax HH	D51A C06,C07; D59A	0	0	0	0	1,917	0	0	1,917	0	0
Firm Income Taxes	D51B		5,688	0	955	6,643	0	0	0	0	0
Other current taxes	D59 - D59A	0	13	0	0	1,841	0	0	1,828	0	0
Employers actual sc	D611	544	0	2,637	0	21,158	0	0	24,132	174	380
Employers imputed sc	D612	0	0	0	0	1,964	0	0	1,964	0	0
HH actual sc	D613	0	0	0	0	24,210	0	0	24,210	301	301
HH sc supplements	D614	287	0	643	0	0	0	0	931	0	0
Social transfers in cash	D62	0	847	0	1,602	0	59,728	62,096	0	768	689
Non life ins. Premiums	D71	0	1,882	6,482	55	0	0	0	4,262	32	314
Non life ins. Claims	D72	1,902	0	31	6,617	0	0	4,316	0	376	8
Current internaltional cooperation	D74	0	0	0	0	326	391	0	0	391	326
Misc. Current trfs	D75	16	482	109	330	2,479	5,244	5,582	2,676	1,009	463
EU own resources	D76	0	0	0	0	0	2,654	0	0	2,654	0
Pension enttlmts adjustments	D8	0	-16	0	1,564	0	0	1,549	0	0	0
Capital taxes	D91	0	0	0	0	32	0	0	32	0	0
Investment grants	D92	647	0	138	0	0	1,336	530	0	1	-20
Other capital trfs	D99	364	507	1,555	18	663	2,412	173	47	262	34
Net consumption + NET VA	P3, B1N	98,244	0	12,044	0	43,827	62,661	54,041	145,495	0	0
Gross investment	P51G	71,866	43,631	0	1,969	0	9,190	0	17,076	0	0
Depreciation	P51C	33,903	33,903	1,908	1,908	8,353	8,353	11,547	11,547	0	0
Change Inventories	P52	2,492	2,349	0	0	0	5	0	138	0	0
Acquis./disp. of valuables	P53	1,756	41	0	14	0	1	0	1,700	0	0
Exports	P6	170,599	0	0	0	0	0	0	0	0	170,599
Imports	P7	0	162,374	0	0	0	0	0	0	162,374	0
NLNB	recv - paid	8,006	8,006	-6,388	-6,388	-6,981	-6,981	10,406	10,406	-5,045	-5,045

We reached this flow consistency by mixing the distributive transactions accounts with the production account. The crucial line is net consumption (P3) + net value added (B1N), where net final consumption in the household and government sectors is attributed to net value added (VA) generated by the non-financial corporations sector (NFC), financial corporations (FC), as well as the government and household sector itself. Value added tax (VAT) on products was subtracted from gross household consumption, and assigned as a payment flow from the household to the government sector based on information obtained from Austrian Input-Output (I/O) tables, which are available until the year 2012.[4]

Net value added generated in the household sector is composed of NPISHs as well as output produced by self-employed. For the NFC sector, net value added can be obtained by subtracting paid from received funds by the NFC sector in the production account below. This is the entry that achieves consistency in this matrix, since the net VA for the NFC sector as obtained from our matrix closely matches net VA from accounting data. Furthermore, revenues resulting from exports were assigned to the NFC sector, as well as expenditures due to imports. Other taxes on products (D214) were also assigned to the firm sector according to figures in the Austrian I/O tables.

The operating surplus (which is needed later on for model applications and only implicitly given in the matrix above) for each sector is calculated by net VA - expenditure on labour (D1) - other taxes on production (D29) + subsidies on production (D3).

From this large matrix, in order to achieve a parsimonious structure manageable for model construction, we aggregated several of the accounts above to obtain the matrix denoted in table 2. While we have aggregated several flows, we split the financial corporations sector into sub-units as classified in the balance sheet data, where the aggregation of the financial corporations sector is finer, see section 2.2.2.

Taxes To achieve a more detailed exposition of taxes, we used information from Statistik Austria on taxes and social contributions by the government.[5] Specifically, the total income tax D51 was divided into taxes on wage - wage tax (Lohnsteuer, D51A C08) and other taxes accruing to labour income (employees' contribution to chambers D51 A C04, other taxes on income D51 E) - and taxes on capital income paid by the household, made up of the tax on capital yields (D51A C06, Kapitalertragssteuer) tax on interest (Kapitalertragssteuer auf Zinsen, D51A C07), and current taxes on capital (D59A, Vermögenssteuern). Since taxes paid by self-employed are not taxes on wages as such but on the operating surplus of own production in the household sector, we introduced a tax on mixed income, made up of income tax (veranlagte Einkommenssteuer, D51A C01), EU withholding tax (EU Quellensteuer, D51A C02), tax on industry and trade (Gewerbesteuer, D51A C03), and contributions to chambers by self-employed (D51A C05).

Additionally, we introduced a tax on firm income (D51 B - taxes on the income or profits of corporations, most of all 'Körperschaftssteuer'), and a value added tax on household consumption (D211).

Disaggregation of Financial Corporations (FC) Sector We have used the level of aggregation available from balance sheet data to split up FCs, see Eurostat (2013)[pp. 37 - 44]. In

[4]See `http://www.statistik.at/web_en/statistics/Economy/national_accounts/input_output_statistics/index.html` for more information on I/O tables. The availability of I/O data until the year 2012 is the reason why we chose to construct the TFM first for this year from the data, before implementing the TFM structure in computer code for all years 1995 - 2014.

[5]See `http://www.statistik.at/web_de/statistiken/wirtschaft/oeffentliche_finanzen_und_steuern/oeffentliche_finanzen/steuereinnahmen/index.html` (German) or `http://www.statistik.at/web_en/statistics/Economy/Public_finance_taxes/public_finance/tax_revenue/index.html` (English).

our model, special focus is placed on the financial sector since the explicit depiction of different financial assets emitted by various financial sub-sectors is one of primary strengths of SFC models. We want to cater to this strength by including these sub-sectors already in our basic modelling structure from begin with. Therefore, these institutions are described in higher detail below than the other sectors for a better understanding of what is comprised in the FC sector.

CB: Central Bank - the Austrian National Bank.

BANK: Deposit-taking corporations except the central bank (S122) and Money Market Funds (MMF, S123)

- S122. commercial, savings, credit, post, mortgage, etc. banks, i.e. all FCs principally engaged in financial intermediation and whose business is to receive deposits and/or close substitutes for deposits (but not only from other banks), and to grant loans and to make investment in securities for their own account.
- S123. MMFs are units that are principally engaged in financial intermediation and whose business is to issue investment fund shares or units as close substitutes for deposits, and to make investments on financial markets (MMF shares, short-term debt securities, and/or deposits) for their own account. This sector includes all collective investment schemes whose shares or units are close substitutes for deposits.

IFU: Non-MMF Investment Funds (S124) all collective investment schemes (except MMFs) engaged in financial intermediation who issue investment fund shares and that are not close substitutes for deposits and who, on their own account, make investments primarily in financial assets (not short-term) and in non-financial assets (primary real estate). These are institutions such as open- or closed-ended IFU, real estate IFU, IFU investing in other funds ('funds of funds'), hedge funds, etc.

OFI: Other Financial Institutions except ICPF (S125), Financial Auxiliaries (S126), captive financial institutions and money lenders (127)

- S125. all FCs engaged in financial intermediation by incurring liabilities other than currency, deposits or investment fund shares and that are not in relation to insurance or pension fund schemes. These are entities such as financial vehicle corporations (FVC) engaged in securitisation, security and derivative dealers, FC engaged in lending, or specialised financial corporations.
- S126. FC engaged in activities closely related to financial intermediation, but who are not financial intermediaries themselves. This includes insurance, loan or securities brokers; flotation corporations that manage the issue of securities; corporations that provide guarantees for different financial instruments; corporations arranging derivative and hedging instruments such as swaps, options and futures; corporations providing infrastructure for financial markets, central supervisory authorities of financial intermediaries if they are separate institutional units, etc.
- S127. FC that are neither engaged in financial intermediation nor in providing financial auxiliary services, and where most of their assets are not transacted on open markets. This comprises units as legal entities such as trusts, estates or agencies or "brass plate" ("name-in-only") companies, holding companies that hold equity but do not administer or manage other units; FVCs raising funds in open markets that shall be used by their parent corporation, etc.

Table 2: The Transaction Flow Matrix for the SFC model for Austria (year 2012, in million Euro)

Sector	NFC	NFC	CB	CB	BANK	BANK	IFU	IFU	OFI	OFI	ICPF	ICPF	Govt	Govt	HH	HH	row	row
Flow	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID
Wages		-94,225				-3,495		-556		-897		-492		-33,803	147,162	-13,694		
Consumption	98,244				7,738		1,231		1,986		1,088		43,827	-62,661	54,041	-145,495		
SubTrans	3,288					-697		-111		-179		-98		-8,285	3,832		2,250	
Interest	2,212	-5,295	1,848	-1,876	17,699	-17,101	1,853	-29	783	-1,176	1,256	-173	1,709	-8,624	5,095	-1,968	16,731	-12,942
F_{DIV}	15,912	-26,731	19	-560	1,124	-3,216	278	0	2,646	-6,703	211	-589	1,603		18,758		13,778	-16,530
$ICPF_{DIV}$	286	-287		-57		-148					4	-3,262			3,464			
IFU_{DIV}	157		106		122		657	-2,497	160		807		123		852		269	-757
SocTrans														-59,728	59,728			
Investment	76,114	-46,021				-1,274		-203		-327		-179		-9,196		-18,914		
Exports	170,599																	-170,599
Imports		-162,374															162,374	
T_{va}													24,563			-24,563		
T_o		-18,185				-741		-118		-190		-104	23,444	-1,470		-3,016	381	
T_w													65,630			-65,630		
$T_{inc,se}$													7,294			-7,294		
T_{cap}													1,916			-1,916		
T_{firm}		-5,688				-614		-98		-158		-86	6,643					
Res		-7,113	1,272		118			-1,367	5,583		2,383			-242		-459		-176
NLNB	894		751			-486		-959	1,528		766			-7,257	9,984			-5,221

ICPF: Insurance Corporations (S128) and Pension Funds (S129)

- S128. all FCs engaged in financial intermediation as a consequence of the pooling of risk, mainly in the form of direct insurance or reinsurace. This includes all life and non-life insurance as well as reinsurance services by insurance corporations, but excludes social insurance services as provided by law/regulation and/or managed by the general government.
- S129. all FCs engaged in financial intermediation as a consequence of the pooling of social risk and needs of the insured persons (social insurance). They provide income in retirement and often include benefits for death or disability. Again, social insurance provided by the government sector is excluded.

Aggregation and Disaggregation of Flows To fit our model structure, we have constructed the following aggregate flows, subsuming several types of flows under one category. On the other hand, since we split up FC sector into sub-units, we had to take care of the issue that for non-financial transactions data, FC are only denoted as an aggregate. Flows thus had to be disaggregated concerning the institutional dimension to obtain flows to and from sub-units of the FC sector when applicable.

Aggregation according to type of flow: The following flows were aggregated with respect to NASA data.

- **Wages:** All wage income for the households including employers' social contributions (D11 + D12) was denoted as one aggregate flow of wages, i.e. households receive gross wages from NFC, FC, government and from their own sector (self employed and NPISH), and then pay an aggregate wage tax T_w, see below.
- **Consumption:** is the line comprising net consumption and own value added generated in the FC, government and household sector. The remainder of consumption not covered by own production of a sector is attributed to the NFC sector, creating consistency in the matrix as described above.
- **SubTrans** comprises subsidies on products (D3), all other current transfers (D7), adjustments for pension entitlements (D8), investments grants (D92) and other capital transfers (D99). It is treated in the model as an exogenous variable, the trend of which is taken from the data.
- F_{DIV} is an aggregate of distributed income of corporations (D42) and reinvested earnings on foreign direct investment (D43).
- $ICPF_{DIV}$ is property income due to holders of insurance papers (D441) and to holders of pension funds (D442).
- **Investment** is an aggregate of gross investment including depreciation (P51G), change in inventories (P52), as well as acquisition and disposition of valuables (P53). All investment is assumed to be carried out by the NFC sector, thus gross investment by all sectors is accounted in the received (RECV) entry of NFC, i.e. its current account, as an inflow of funds. Expenditure on NFC investment and depreciation are given in the paid column of NFC, i.e. the capital account of NFC, as an outflow of funds (financing of investment). Depreciation of investment by other sectors is contained in their gross investment, and does not need to be accounted for separately.

Taxes After disaggregating certain taxes from NASA data for the large matrix above, we aggregated other taxes to obtain the most important taxes in Austria in a form that can be implemented in our model. The tax rates, which are calculated directly from data for each year of the past, are given for the year 2012.

- **VAT tax (T_{va}):** This is the value added tax on products (D211), endogenously related household consumption in our model by a fixed rate. The average tax rate we calculate from NASA data here is about 16.9 %.
- **Other taxes (T_o):** This is an aggregate of all taxes on products other than VAT, all taxes on production, and a residual of other taxes that cannot be clearly attributed to a variable in our model. It comprises the import tax on products (D212), other taxes on products (D214), rents paid by firms to the government (D45), and other current taxes (D59). The largest part of this tax is paid by the NFC sector to the government, a smaller one by the household sector related to its own production. The endogenous tax base is the level of production by each sector, i.e. net VA produced by each sector (plus exports for the NFC sector). This tax rate is specific for each sector, and ranges from about 10.2 % for the NFC sector to ca. 5.2 % for households.
- **Wage tax (T_w):** As mentioned before, this is the total tax rate paid on wages including wage tax (Lohnsteuer and other taxes accruing to labour income, i.e. D51A C04, C08; D51E), and all social contributions by employers and employees (D12, D611 and D613). The tax rate applied to wage payments to households is about 44.6 %.
- **Tax on income of self-employed ($T_{inc,se}$):** This is a tax on the operating surplus/mixed income of the household sector, relating to income from the economic activities by self-employed. The corresponding tax rate is about 32.8 %.
- **Capital tax (T_{cap}):** Capital tax is paid on interest and dividend income by the household sector. The tax rate here as calculated from data is about 6.8 % (to be discussed).
- **Firm income tax (T_{firm}):** This is a tax on the operating surplus (profit, income) of the producing sectors (NFC, and all sub-sectors of the FC sector). The tax rate varies more for each year than for other taxes, since operating surlus (OS) by a producing sector is a rather volatile variable. The tax rate thus ranges between slightly above 20 % for the NFC sector, as well as between 15 % and 40 % for the FC sub-sectors (to be discussed)

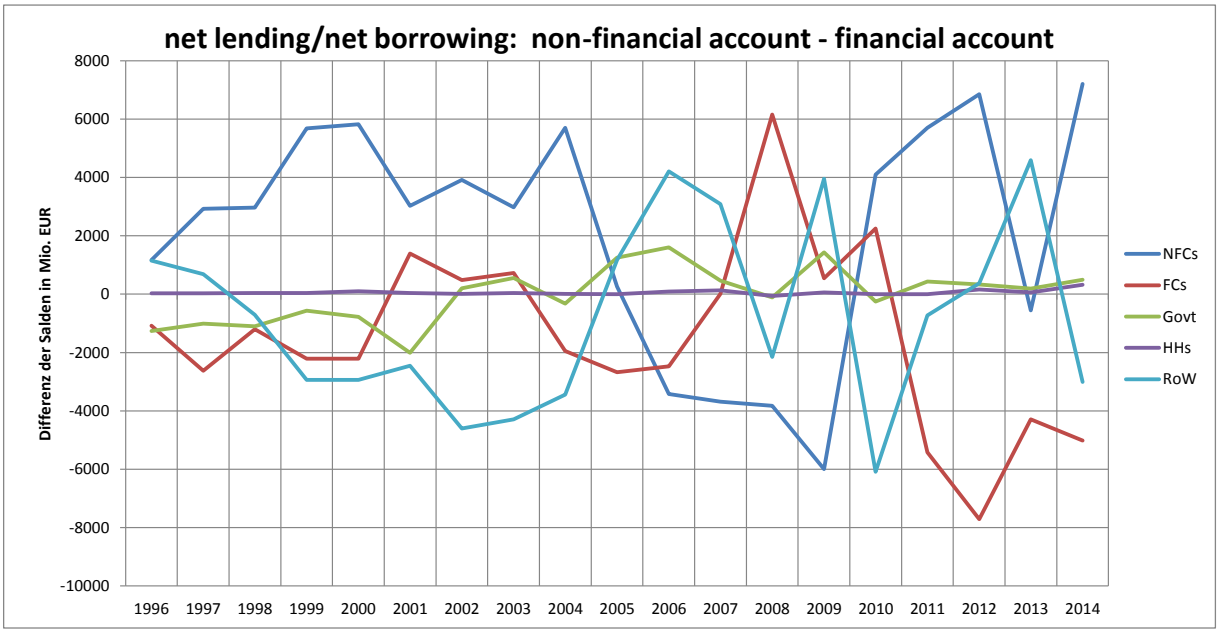
All other flows have remained the same as in NASA data as regarding the type of flow:

- **Interest** payments by sector are net interest payments (D41), related to the stock of the respective asset/liability held by a sector.
- IFU_{DIV} is investment income (D443) to IFU shareholders, related to the stock of IFU shares held by a sector.
- **SocTrans** constitute social transfers from the government to the household sector (D62), and are treated as exogenous.
- **Exports (P6), Imports (P7)** are directly taken from NASA data, attributed to NFC, and forecasted as exogenous variables.

Disaggregation of flows to FC sub-sectors Here, we used two different approaches described below.

1. **According to length of balance sheet:** Here, we took the length of the balance sheet as a proxy for the activities of this sector, determining a corresponding amount of flows implied by these FC sub-sectors to carry out these activities (to be discussed). The share of the balance sheet length of the respective sub-unit of the FC sector in the total balance sheet length of the FC sector was used to split the total flow of the FC sector among the respective sub-units. This procedure applies to consumption, wages, investment, exports, imports, social and other transfers (SocTrans, SubTrans), as well as other taxes (T_o) and the firm income tax (T_{firm}).
2. **According to stock of a financial asset/liability held:** In this case, we address a stock-flow relation proper (interest or dividend payment) relating to the size of the stock of a financial asset/liability held. The procedure here was to calculate the interest/dividend rate paid on a stock of assets for the FC sector as a whole. Keeping this interest/dividend rate fixed, we calculated the flow of interest payments to a sub-unit of the FC sector by applying the interest rate to each asset class on the stock of assets held by each FC sub-unit. This method applies to interest payments on loans (interest), as well as distributed income of corporations (F_{DIV}), dividends on insurance and pension fund shares ($ICPF_{DIV}$), as well as dividends on investment fund shares (IFU_{DIV})

Figure 2: Difference of Net Lending/Net Borrowing of Sectors from Non-Financial Transactions (NFTR) Accounting and Financial Accounts (FA) (in Mio. EURO)



Residual (Res) Generally, NLNB differ between the financial and the non-financial accounts. After contacting experts from Austrian National Bank, we decided to take NLNB from the financial account as link between the TFM and the balance sheet matrix (BSM), in order to safeguard consistency with financial account and since the financial accounts seem to rely more on data than assumptions as compared to the non-financial accounts. For constructing the large TFM given in table 1, however, we used NLNB from non-financial accounts as the target variable,

as this amount of NLNB exactly is the result of all non-financial flows as calculated by the Statistik Austria, and we had to stick to the logic of the data here. Now, to avoid inconsistency within our modelling framework, we introduced a residual in the TFM that we keep fixed on its 2014 value for the forecast to avoid distortions of the model dynamics emanating from this parameter. That this residual is a non trivial figure can be seen by figure 2 above. Here, we show the difference between NLNB for the financial and non-financial accounts for the years 1995 - 2014 from the data, i.e $NLNB_{financial\ account} - NLNB_{non-financial\ account}$. While the household sector and the government are agreed on by the institutions gathering these data, the differences for the sectors RoW, NFC and FC seem quite pronounced and follow no clear pattern except for the basic logic that the sum of NLNB over all sectors has to be zero (to be discussed).

2.2.2 Balance Sheet Matrix

Table 3 shows the aggregated balance sheet matrix for the SFC model. While we have kept the finest disaggregation of institutional units with a focus on sub-units of the FC sector, we decided to aggregate financial assets/liabilities to simplify the model structure. The major financial assets/liabilities depicted in our model are given below. For further reference on the types of financial assets, see Eurostat (2013)[Chapter 5, pages 125 - 157]

F1: Monetary gold, SDRs - Monetary gold is gold bullion under effective control of monetary authorities (central bank) and which is held in reserve assets. SDRs are reserve assets created by the International Monetary Fund (IMF) which are allocated to members to supplement existing reserves. Thus, this asset is issued solely by the central bank agent, with the Rest of World (RoW) holding the major counter position as a liability.

F2: Currency and deposits - Currency (F21) is notes and coin issued or authorised by monetary authorities, both national and foreign currencies held by national residents.

Deposits in general are standardised, non-negotiable contracts with the public at large, offered by deposit-taking corporations (in some cases by the central government), allowing placement and later withdrawal of the principal by the creditor. Usually, the debtor gives back the full amount of the principal to the creditor.

More specific, transferable deposits (F22) are exchangeable for currency at par, and directly used for payment without penalty or restriction. This includes payment facilities such as cheque, draft, giro order, direct debit/credit, but also inter-bank positions between FC, deposits held at the central bank by other monetary institutions, or foreign currency deposits under swap arrangements.

Other deposits (F29) are all deposits other than transferable deposits. They cannot be used to make payments except on maturity or after an agreed period, and they are not exchangeable for currency without a significant restriction or penalty. This includes time deposits not immediately available for withdrawal (subject to fixed term or redeemable at notice of withdrawal); savings deposits, books and non-negotiable certificates; deposits resulting from a saving scheme or contract; deposits issues by savings and loans associations, building societies, credit unions etc. redeemable at relatively short notice but not transferable; or short-term repurchase agreements (repos) which are a liability of monetary financial institutions.

In our balance sheet data and thus also the model, deposits are issued as a liability by banks, the central bank, the RoW and the government (the latter to a small extent). The vast majority is issued by banks (more than 592 bln. Euro) as a liability, less by the RoW (ca. 152 bln. Euro) and the central bank (ca. 88 bln. Euro). They are held by all other agents in the economy as an asset, being the primary means of payment. It is interesting to observe that banks hold more

deposits (more than 274 bln. Euro) than households, who keep the majority of their wealth in the form of deposits (about 233 bln. Euro) - indicating the large size of inter-bank positions in the Austrian economy. The net position of Austria to the RoW is small and negative (net debtor).

Debt Securities (F3) are negotiable financial instruments serving as evidence of debt. They have the following characteristics: 1. an issue date 2. an issue price 3. a redemption or maturity date contractually scheduled for repayment 4. a redemption price or face value (the amount to be paid at maturity by the debtor) 5. a remaining or residual maturity until the date of redemption 6. a coupon rate the issuer pays to holders (fixed or variable) 7. coupon dates on which the issuer pays the coupons 8. they are denominated in national or foreign currency 9. they are subject to credit ratings assessing the credit worthiness of individual debt security issues.

In the data, they are classified by maturity: short-term debt securities (F31, less than a year of maturity) and long-term debt securities (F32, more than a year of maturity). The other classification by type of interest rate payment (fixed, variable, or mixed) is not available from NASA data. The most important fixed interest rate debt securities (DS) are those issued at discount or premium to their value, including treasury bills, commercial paper, promissory notes, bill acceptances, bill endorsements, and certificates of deposits. Other forms of DS include deep-discounted bonds having small interest payments but issued at a considerable discount to par value; zero-coupon bonds (single payment, no coupon payments); perpetual, callable or puttable DS; or convertible bonds with the embedded option to be converted into equity of the issuer. Variable interest rate DS can be indexed to a general price index such as the CPI, an interest rate or an asset price. Mixed DS have both a fixed and a variable coupon payment and are classified as variable interest rate DS.

In the BSM given in table 3, the largest amount of DS is issued by the general government (ca. 267 bln. Euro) as the primary financing means of government debt. This is closely followed by banks, who have outstanding liabilities of about 225 bln. Euros in DS. One can see that Austria is a substantial net debtor to the RoW with a net debt of a little less than 160 bln. Euros. Corporate financing by commercial paper in the NFC sector seems to play a rather limited role with a liability position of about 39 bln. Euro in debt securities compared to more than 312 bln. Euro liabilities in loans and other accounts.

Loans (F4), Other accounts receivable/payable (F8) Loans (F4) are created when creditors lend funds to debtors. They are characterised by the following features: 1. They are either fixed by the FC granting the loan or agreed by lender and borrower 2. the initiative of the loan normally lies with the borrower 3. it is an unconditional debt to the creditor to be repaid at maturity and which is interest-bearing. Again, they are classified by maturity (short-term, F41, and long-term, F42). The difference between loans and DS is that loans are non-negotiable financial instruments, while DS are negotiable. Furthermore, loans are usually evidenced by a single document, while DS issues consist of a large number of identical documents, each evidencing a round sum.

Other accounts receivable/payable (F8, 'other accounts' in short) are financial assets and liabilities created as counterparts to transactions where there is a timing difference between the transaction and the corresponding payment. This mostly involves trade credit (F81), which are financial claims arising from the direct extension of credit from suppliers of goods and services to their customers, as well as advances for work yet in progress. Another sub-category (F89) here are financial claims arising from timing differences between distributive transactions or financial transactions on secondary markets, regarding e.g. wages and salaries, taxes and social contributions, dividends, rent, purchase and sale of securities. We include these forms of credit

with loans due to their similar properties as loans from one sector of the economy to the other (to be discussed), and are henceforth jointly referred to as loans.

The major holder of loans as an asset in the Austrian data, naturally, are banks with more than 440 bln. or loans outstanding in the year 2012 (of which not more than 4.2 bln. are other accounts). Major recipient of loans is the corporate sector with liabilities of more than 312 bln. Euro (258 bln. of which are loans proper, 54 bln. are other accounts). However, maybe surprisingly, the corporate sector is also a large creditor with more than 140 bln. in loans as asset (about 100 bln. of which are loans proper, the rest other accounts). It is also interesting to observe the interrelations between the Bank and OFI sector in Austria, with more than 50 bln. in bank loans taken out by OFIs (7 bln. of which are other accounts).

Insurance, pension and standardised guarantee schemes (F6) These are claims that insurance policy holders or pension fund share owners have against the insurance corporations or pension funds in various forms. Hence, the ICPF sector is the main issuer of these liabilities with more than 107 bln. Euro, the vast majority of which are held by the household sector as an asset with a positive position of more than 114 bln. Euros (including some ICPF share issued by the RoW).

Investment fund shares or units (F522) These represent a claim on a portion of the value of an investment fund (other than a MMF). These types of shares are solely issued by investment funds (national and by RoW), and were kept separate because the size of this sector is significant with more than 147 bln. in national and almonst 40 bln. in foreign shares outstanding. On the asset side, this financial instrument is largely held by the ICPF sector (more than 47 bln.), households (more than 41 bln.), and within the IFU sector (more than 38 bln.).

Equity except investment fund share units (F5 w/o F522), Financial derivatives (F7) Equity (F51) is a financial asset that is a claim on the residual value of a corporation, after all other claims have been met, usually evidenced by the ownership of shares and stocks (which have the same meaning in the following). Listed shares (F511) are quoted on a stock exchange, meaning that current market prices are usually readily available. Unlisted shares (F512) are not listed on an exchange, and comprise various forms of participatory shares in unlisted companies, giving their owners different rights in the share of profits, ownership, and dissolution of the company.

Financial derivatives (F7) are financial instruments linked to a specified other financial instrument, indicator or commodity, through which special financial risks can be traded on financial markets. Their size is rather small for the Austrian economy (total gross holdings by FC of not more than 12 bln. Euro), thus they were subsumed under equity (to be discussed).

The major issuer of equity are Austrian NFC with more than 285 bln. Euro, closely followed by the RoW (272 bln. Euro). The OFI sector also has a sizeable liability position in this asset class with more almost 184 bln. in outstanding shares. The RoW is the largest holder of Austrian equity with almost 233 bln. Euro. The OFI sector has the second largest asset position here, potentially indicating large holdings of foreign stocks. Here, it is also interesting to observe the large amount of equity held within the NFC sector as asset (about 186 bln. Euro), possibly pointing to cross-holdings within the NFC sector. Households are other major holders with ca. 108 bln. Euro.

Table 3: The Balance Sheet Matrix (BSM) for Austria, 2012 (in million Euro)

No.	Name	NFC ass	NFC liab	CB ass	CB liab	BANK ass	BANK liab	IFU ass	IFU liab	OFI ass	OFI liab	ICPF ass	ICPF liab	Govt ass	Govt liab	HH ass	HH liab	row ass	row liab
F1	Monetary gold, SDRs			13,302	-2,024														-11,278
F2	Currency and Deposits	58,031		61,673	-88,096	274,382	-592,032	8,083		10,530		4,264		19,518	-3,325	232,686		166,159	-151,873
F3	Debt Securities	10,211	-38,825	25,720		132,404	-225,304	80,788		5,507	-5,698	47,163	-2,510	31,220	-267,462	48,114		351,489	-192,817
F6	Insurance, Pension, guarantee schemes	5,624	-9,552		-1,870		-4,853					6,997	-107,095			114,674		2,230	-6,155
F4F8	Loans, other accounts	141,847	-312,419	1,222	-1,802	442,124	-2,134	15	-1,399	21,514	-50,674	8,813	-5,771	76,091	-76,124	11,840	-166,186	99,789	-186,746
F522	Investment Fund Shares	9,296		6,260		7,192		38,618	-147,355	9,422		47,443		8,148		41,529		18,562	-39,115
F5F7	Other Equity, Derivatives	185,710	-285,166	1,326	-15,341	79,043	-88,121	19,539	-6	186,079	-183,678	14,819	-16,126	68,668	-34,799	108,161	-15	232,875	-272,967
	Net Worth (NW)		-235,244		371		22,701		-1,717		-6,999		-2,004		-178,064		390,802		10,154

Table 4: The Flow of Funds (Financial Transactions) Matrix for Austria, 2012 (in million Euro)

No.	Name	NFC ass	NFC liab	CB ass	CB liab	BANK ass	BANK liab	IFU ass	IFU liab	OFI ass	OFI liab	ICPF ass	ICPF liab	Govt ass	Govt liab	HH ass	HH liab	row ass	row liab
F1	Monetary gold, special drawing rights			18															-18
F2	Currency and Deposits	-4,091		-10,071	8,786	27,072	-23,498	1,336		610		25		1,992	-2,518	-4,399		9,397	-4,642
F3	Debt Securities	92	2,989	1,301		19,449	-25,312	-1,314		198	800	-113	-72	181	9,194	-130		6,094	-13,356
F6	Insurance, Pension, guarantee schemes	-275	-108		46		115					-922	3,159			-2,741		-172	896
F4F8	Loans, other accounts	-5,904	5,215	-26	54	1,885	-16	-1	28	-294	2,913	67	-271	-3,891	2,034	-1,162	507	-4,217	3,078
F522	Investment Fund Shares	-81		-610		1,295		-385	1,159	-1,065		-2,382		210		-967		-408	3,235
F5F7	Other Equity, Derivatives	-854	2,123	-48	-201	1,063	-1,567	-738	874	-13,011	8,320	-23	-236	869	-813	-1,090	-3	-5,552	10,886
	negative change in NW		-893		-752		486		959		-1,528		-766		7,257		-9,984		5,221

Table 5: The Revaluation and Other Changes in Volume Accounts (aggregated) for Austria 2012 (in million Euro)

No.	Name	NFC ass	NFC liab	CB ass	CB liab	BANK ass	BANK liab	IFU ass	IFU liab	OFI ass	OFI liab	ICPF ass	ICPF liab	Govt ass	Govt liab	HH ass	HH liab	row ass	row liab
F1	Monetary gold, special drawing rights			361	37														-398
F2	Currency and Deposits	-137		1	201	-465	409	9		77		1		34		-246		-382	499
F3	Debt Securities	92	-1,235	1,496		5,263	-5,712	5,276		199	-385	3,745	-52	1,632	-14,714	1,294		15,301	-12,200
F6	Insurance, Pension, guarantee schemes	-40			22		-42					-535	-832			1,433		0	-7
F4F8	Loans, other accounts	5,907	-14,124	0	0	1,207	717		1	-170	263	572	-300	12,768	-9,125	-5	656	884	747
F522	Investment Fund Shares	532		480		218		3,020	-9,982	589		3,583		416		2,013		1,430	-2,299
F5F7	Other Equity, Derivatives	2,669	-14,209	18	-837	464	-5,151	1,177	918	11,572	-7,494	-155	-1,989	15,591	-14,012	5,585	-10	14,331	-8,468
	Change NW due to holding gains/losses		-20,544		1,778		-3,093		419		4,652		4,040		-7,410		10,719		9,440

2.2.3 The Flow of Funds Matrix and the Revaluation Account

The Flow of Funds Matrix given in table 4 shows the transactions in financial assets according to the asset classes above. As mentioned before, NLNB from this financial account should match NLNB from the non-financial accounts (the TFM) - which is trivially does, since we introduced a respective residual in the TFM. However, the signs are opposite since an increase in an asset position indicates a use of funds (a rise in assets is denoted with a '-' sign), an increase in liabilities a source of funds (an increase in liabilities is denoted with a '+' sign). Thus, e.g. the -9,984 mln. Euro indicate that the asset position of households has increased by this amount, showing a breakdown of the assets that have been used in the portfolio choice by households as a store of this surplus.

One has to remark, however, that from Eurostat data, a *from-whom-to-whom financial account* is not available. This means that we do not know to whom the flows of financial transactions go - we only observe the change in the asset positions of the respective agents. This is one possible point of extension for later model versions in the medium-term future, as such whom-to-whom accounts are available from the Austrian National Bank from the year 2006 onwards.[6]

As a short note on the data itself, one can see that the bank sector has the highest changes (flows) in financial assets. This might have been expected, in particular for deposits as primary means of payment, but also for debt securities, for which highly liquid markets exist. A similar argument can be made for the OFI sector, which seems the most active national sector in dealing with equity. Furthermore, one might observe the high activity of the Austrian National Bank, possibly related to unconventional monetary policy interventions on financial markets.

The Revaluation and Other Changes in Volume Accounts are shown as an aggregate in table 5. In our model we cannot distinguish between these two, especially since the other changes in volume account is erratic and cannot be explained endogenously within our model. As we are still working on the asset pricing mechanism in our model, nominal capital gains/losses are treated as exogenous in the model, see section 3.2.1. In this matrix, the sign conventions are the same as in the TFM, i.e. a rise in an asset position (a holding gain) is denoted with a '+' sign, the rise of a liability position (a holding loss) with a '-' sign.

What seems to stand out from these data are the large holding losses for the NFC sector in the year 2012 of close to 21 bln. Euro, while households and the RoW seem to have profited from the financial situation in this year. It is clear that when firm equity (stock) prices rise, liabilities of the firm sector are increased. However, this is a nominal holding loss for NFC in name only, since it usually is in the interest of NFC to see their share prices rise, and since the issue of equity by NFC - which is denoted in the data as a liability primarily for reasons of accounting consistency - does not imply an a future repayment of principal for the NFC. Apart from this effect due to accounting conventions, it seems that magnitudes in the revaluation account (at least for the year 2012) are similar or even higher than those in the flow of funds matrix. This can be seen as empirical support for the focus on the pricing of financial assets that we intend to place for the further construction of our SFC model.

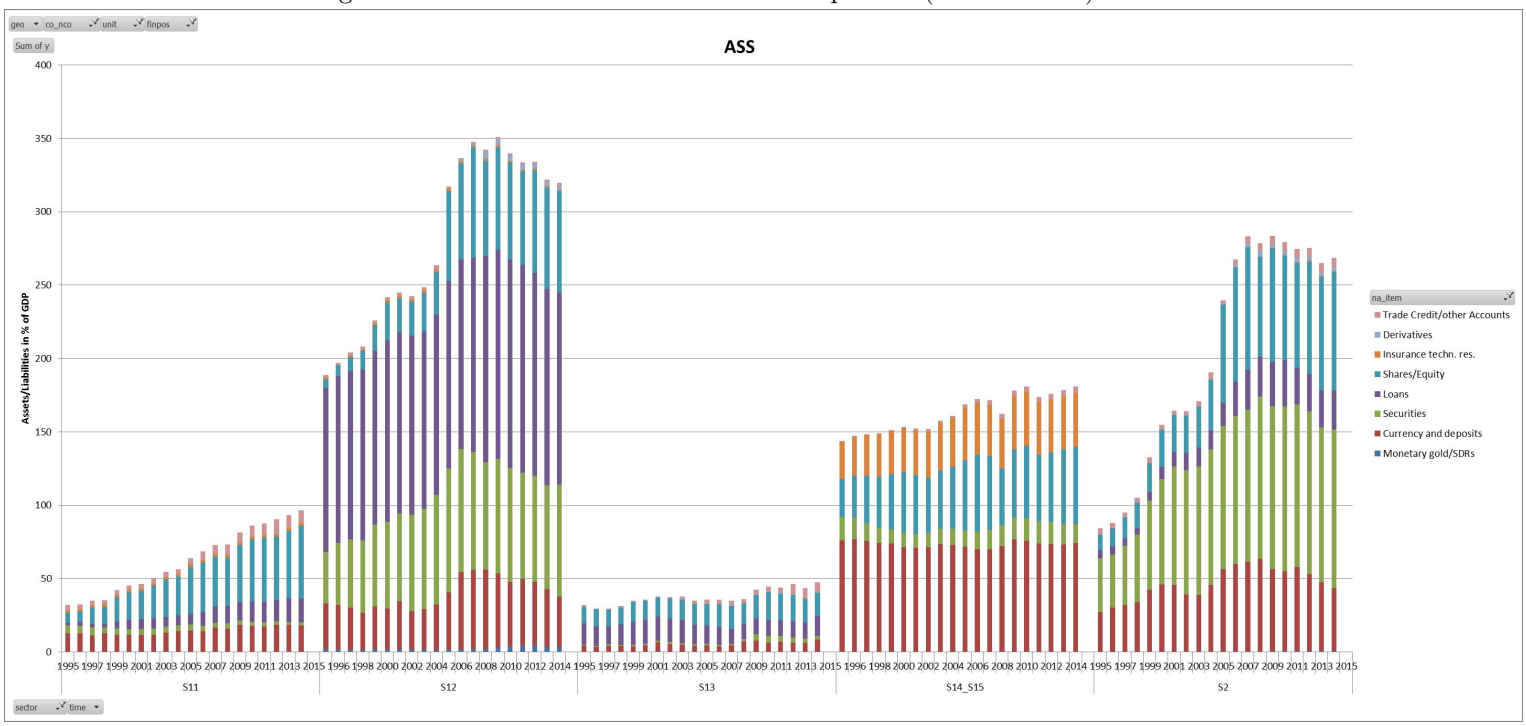
2.2.4 Balance Sheet and Revaluation Data 1995 -2014

Figures 3 - 5 offer an insight on the balance sheet composition of the Sectors of the Austrian economy in comparison in percent of GDP for the time period from 1995-2014.

[6] See `https://www.oenb.at/Statistik/Standardisierte-Tabellen/gesamtwirtschaftliche-finanzierungsrechnung/finanzierungsinstrumente.html` for further reference.

Several developments seem notable in figure 3. Firstly, one can observe the jump in financial assets held by FC (S12) during the period before the financial crisis 2007/2008, and a steady decline since. This picture is similar by the RoW, with the additional development of rising asset holdings by the RoW starting after 1995 to a level just below Austrian FC - potentially indicating increased integration of Austria in international financial markets. The rise before 2007/2008 in the FC sector is mainly driven by an increase of shares and equity (F5F7), see also figure 20 below regarding its portfolio choice. Generally, one can see the loss in asset value of all agents in the year 2008 after the crisis. The collapse of share prices is best visible in the household sector (S14_S15) in 2008, but is also clear for all other sectors. At the same time, asset holdings of the government increase in 2008, suggesting the take-up of financial assets of the government in reaction to the crisis. Lastly, the firm sector (S11) seemed to be the least affected by the crisis as regarding its asset holdings. Figure 4 - the revaluation account from 1995 until 2014 - shows the full extent of the devaluation in stock prices in 2008, and also indicates that securities devalued earlier (in 2007).

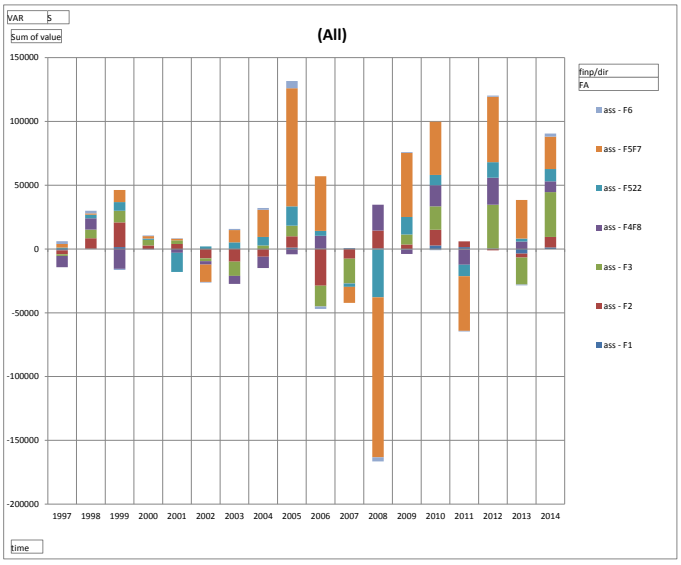
Figure 3: Assets of Austrian Sectors in Comparison (in % of GDP)



Legend - S11: NFC, S12: FC, S13: GOVT, S14_S15: Households and NPISH, S2: RoW

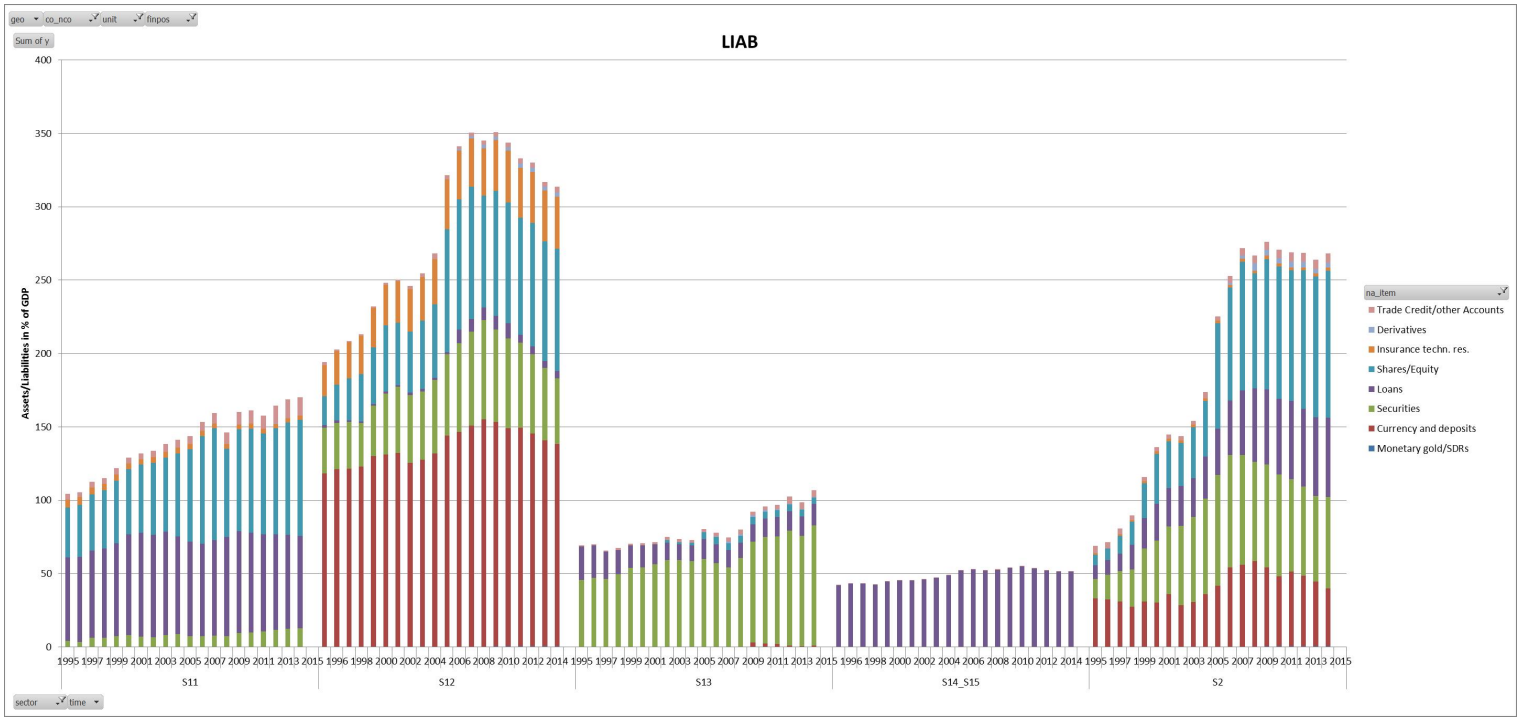
The development of financial liabilities in figure 5 closely mirrors the asset positions of sectors. Again, one can observe the fall in prices of equity, this time as a liability of the sectors themselves. Some deleveraging, i.e. a reduction of liabilities, can be distinguished for FC (S12) and the household sector (S14_S15). The rise in government debt after the crisis can be clearly observed. The shrinking of balance sheets shown in the data is best reflected in our model by the total change in balance sheets of agents, which is shown in figure 19 below.

Figure 4: Revaluation of Assets for all Sectors in Aggregate until 2014 (in mln. Euro)



Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

Figure 5: Liabilities of of Austrian Sectors in Comparison (in % of GDP)



Legend - S11: NFC, S12: FC, S13: GOVT, S14_S15: Households and NPISH, S2: RoW

3 The Model

The model described in the following follows the basic logic of national accounting as put forth in section 2.1.1.

Firstly, non-financial transaction flows (current accounts) are set forth, including flows determined by behavioural equations for agents (e.g. consumption, investment), exogenous variables (e.g. exports, imports), and flows implied by stocks of the previous period (e.g. interest or divident payments). Outcome is primarily observed as change in GDP and NLNB.

Secondly, financial transactions (accumulation accounts) are depicted, including behavioural equations (portfolio choice), and variables exogenous in the model (revaluation of assets, amount of balance sheet extension). Outcome is observed by the actual holdings of different assets by agents, and their net worth at the end of the period, thus obtaining the closing balance sheet for this period (the opening balance sheet for next period).

The method to calibrate the model is as follows: firstly, we reformulate the equations taking the variables as fixed (taken from past NASA data 1995 - 2014) and the parameters as the unknowns. We then calculate parameter values and obtain trends for the parameters for these time series for the past, which are shown for the most important parameters below. We then use past trends to forecast the development of the parameters into the future. In most cases, we have used the simplest possible forecasting method for the parameter - taking the last value available in the data and keeping it fixed. This was due to 1. Time restrictions in the model construction stage due to the large amount of data work we had to manage, but also 2. since we do not want to distort the dynamics of the model too much by strong assumptions on the trends of the parameters. Since the trends in most parameters are very stable, it is possible to get a look at the dynamics of the behavioural assumptions in the model itself, not influenced too strongly by the trends in parameters.

After constructing the business as usual scenario, we obtain the effects of the policy measure by comparing the scenario simulation with the business as usual scenario. Currently, the forecasting horizon of the model runs until 2025.

Notation: below, parameters are denoted by lower case Greek letters, variables by capitalised Latin letters. Index t signifies time, index s economic sectors (institutional units), *direct* means the direction of payment: received (RECV) or paid. The index $finpos$ relates to the financial positions of a sector, i.e. whether the financial instrument is held as an asset (ass) or as a liability (liab). The subscript fa relates to the different classes of financial assets in the model.

3.1 Non-financial Transaction Flows

3.1.1 Behavioural Equations and Parameters

The core behavioural equations that decisively regulate the model behaviour are partly constructed in reference to the literature, mostly based on Godley and Lavoie (2007), or specified according to empirical evidence put forth in Schmelzer (2015). Most importantly, for our empirical SFC model, we obtain the parameter values directly from national accounting data. Since this is a very preliminary version of the model, the extrapolation procedures for parameter trends are work in progress, and are certainly open to discussion.

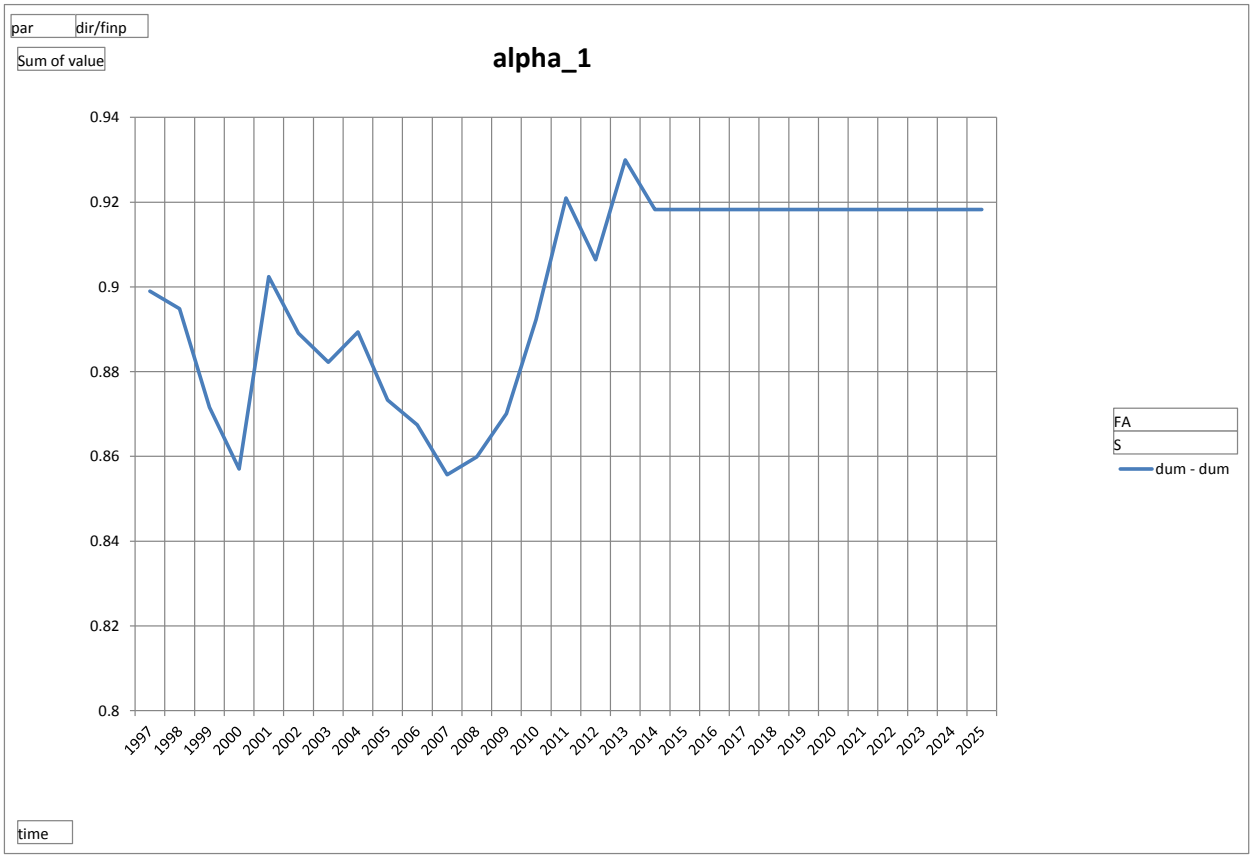
Household Consumption C_t is taken as a fixed fraction $\alpha_{1,t}$ of disposable household income INC_t as determined in equation 16 plus a fixed fraction $\alpha_{2,t}$ of household's last period's holdings of deposits DEP_t (their primary means of payment, and their storage of liquid means for

consumption in our assumption - to be discussed):

$$C_t = \alpha_{1,t} \cdot INC_t + \alpha_{2,t} \cdot DEP_t \tag{1}$$

Figure 6 shows the values of α_1 for different time periods from data. As one can see, even though it varied in the past, the range remains within about 6 percentage points (pp). Since there is no clear trend observable, we assume this parameter to remain stable on the value of the year 2014.[7]

Figure 6: Parameter Choice - Consumption out of Disposable income



Investment I_t is taken to be an exogenous parameter $\beta^0_{t,s}$, which depicts "animal spirits" plus a fixed fraction $\beta_{t,s}$ of last year's GDP, both specific for each sector:

$$I_{t,s} = \beta^0_{t,s} + \beta_{t,s} \cdot GDP_{t-1} \tag{2}$$

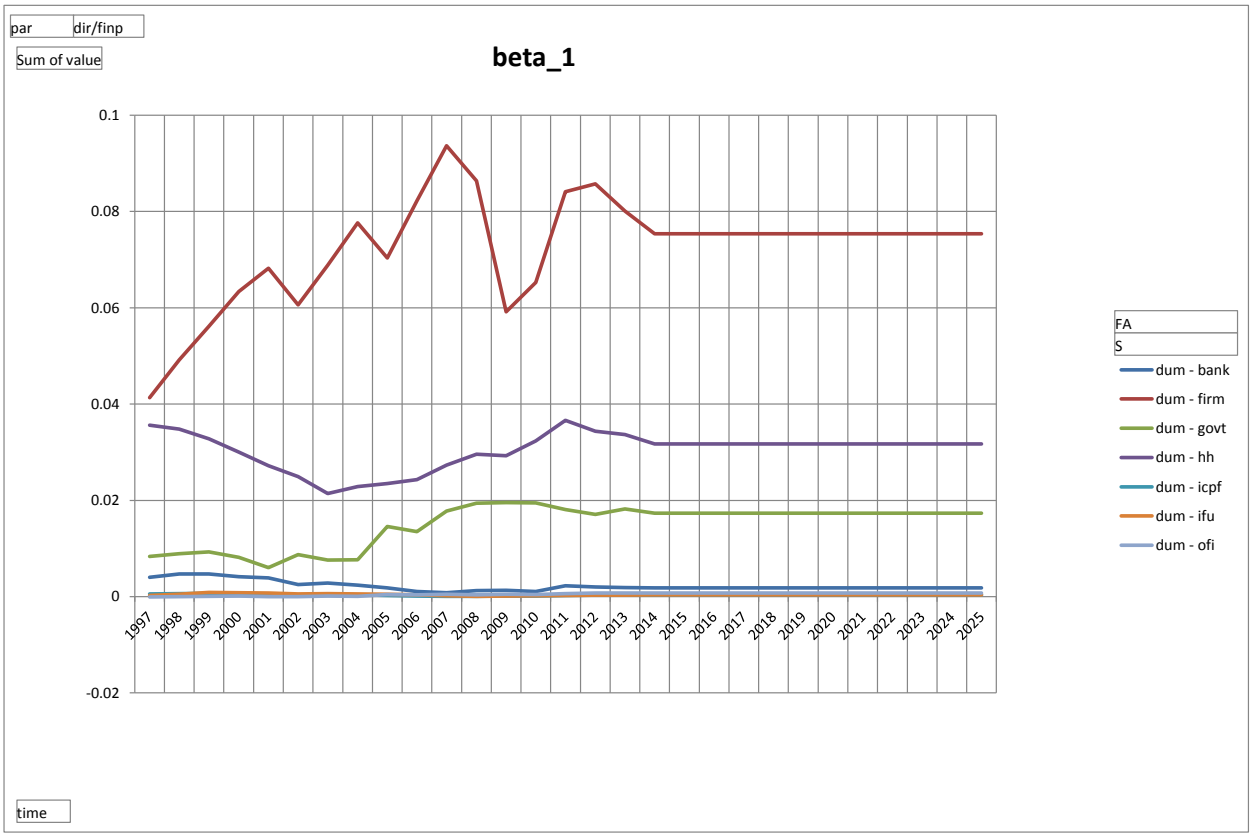
We are aware that this choice of investment function is rather crude at this early stage of model building. However, it is based on the empirical work of Schmelzer (2015) and we plan to improve this function according to the relevant literature. Here, we will primarily refer to

[7]Remark: the "dum" labelling of data series can be ignored by the reader in all of the figures below - this is an artefact due to the construction of the Microsoft Excel pivot table used for the generation of the figures.

existing forecasting models for Austria by IHS, see Hofer and Kunst (2005), and by WIFO, see Baumgartner et al. (2005), and the investment functions specified there.

As for the choice of the parameters in this equation, $\beta^0_{t,s}$ is taken to be the average of past investment as a fraction of GDP for 1995-2014, and is kept fixed. The evolution of $\beta_{t,s}$ is shown in figure 7.

Figure 7: Parameter Choice - Investment as Fraction of Last year's GDP



As was to be expected, investment as a fraction of GDP is highest for the NFC sector (labelled 'firm' above), and seems to be influenced by business cycles the most. The slump after the financial crisis 2007/2008, for example, is clearly visible. Again, the value for the year 2014 was taken as the trend for the period until 2025 (to be discussed).

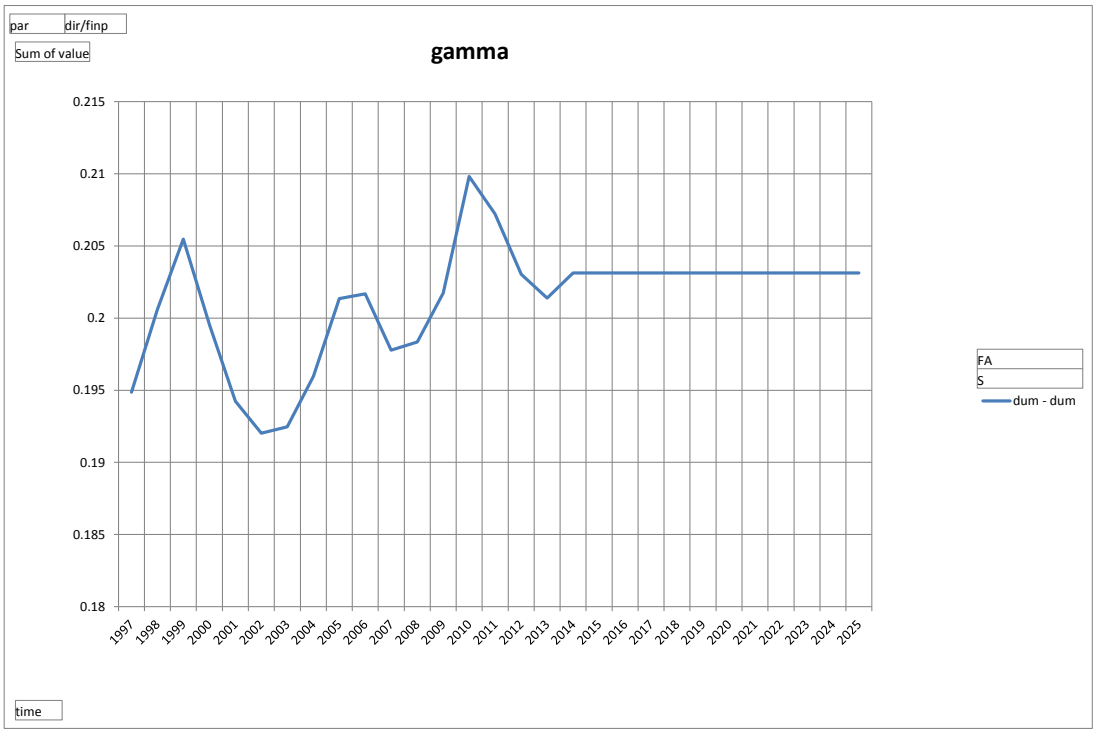
Government Spending G_t is simply related to last year's GDP by the time-dependent parameter γ_t (to be discussed):

$$G_t = \gamma_t \cdot GDP_{t-1} \tag{3}$$

Values for γ through time can be observed from figure 8 below. Political events can be seen clearly: the reduction in government spending as a fraction of GDP after 2000 ("black-blue coalition government" and its "zero-deficit" politics), as well as the increase in government spending after the financial crisis 2007/2008, and renewed reduction after 2010 due to restrictive

national and European government deficit regulations after the European "sovereign debt crises". Again, we take the trend after 2014 as fixed, since this seems to be a good average of past data and since we did not want the dynamic of our model to be driven too much by this influential parameter.

Figure 8: Parameter Choice - Government Spending as Fraction of Last year's GDP



Sectoral Consumption Goods Production $Y_{t,s}$ other than investment is attributed to sectors according to a share $\zeta_{t,s}$ of household consumption and government spending that we take from the data. This is necessary since we had to allocate some consumption to own production (net VA produced within a sector) as a source of funds to achieve consistency in the TFM, see table 2, line 'consumption' in the received columns.

$$Y_{t,s} = \zeta_{t,s} \cdot (C_t + G_t) \tag{4}$$

Figure 9 shows the values for ζ in our time series. Clearly, this parameter appears to be quite stable, justifying our assumption of keeping it fixed at its value for the year 2014.

Wage Payments $W_{t,s}$ are related to the sectoral production by a share $\omega_{t,s}$ specific for each sector. For the NFC (firm) sector, we also include investment and exports, which also require labour as input in their production process.

$$W_{t,s} = \omega_{t,s} \cdot [Y_{t,s} + \sum_{s} I_{t,s} + EXP_t(\text{ if s=firm})] \tag{5}$$

The development of the wage share by sector is documented in figure 10. While it has been falling slightly for all sectors except the NFC (firm) sector from 2011 - 2015 (which seems to be connected to a recovery process after the recession in 2009), the changes are relatively small and assuming it to remain constant after 2014 seems reasonable (to be discussed). Since we had to disaggregate the FC sector according to several assumptions, the wage share is the same for all FC sub-sectors - all lines coincide here, i.e. OFI, BANK, ICPF and IFU share the same line that is coloured in grey.

Figure 9: Parameter Choice - Share of Sectoral Consumption Goods Production

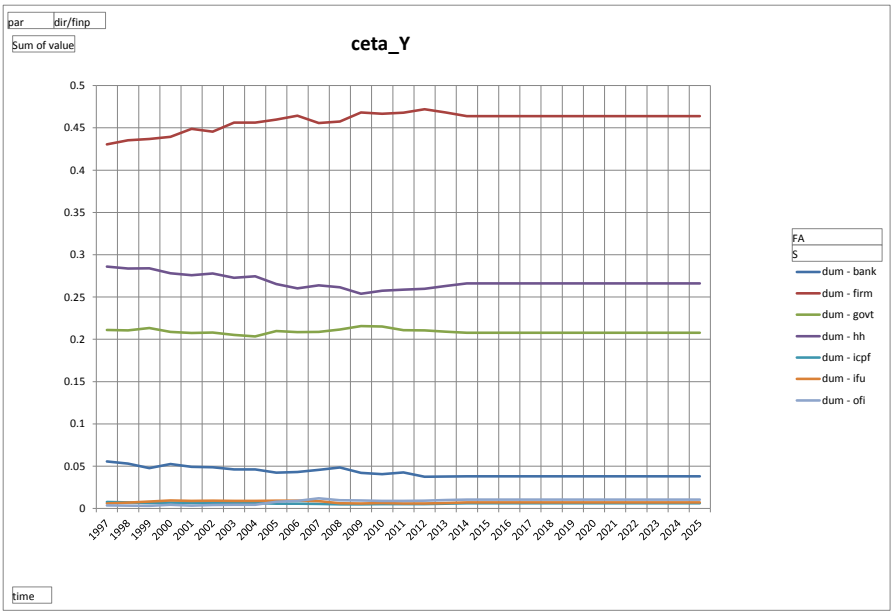
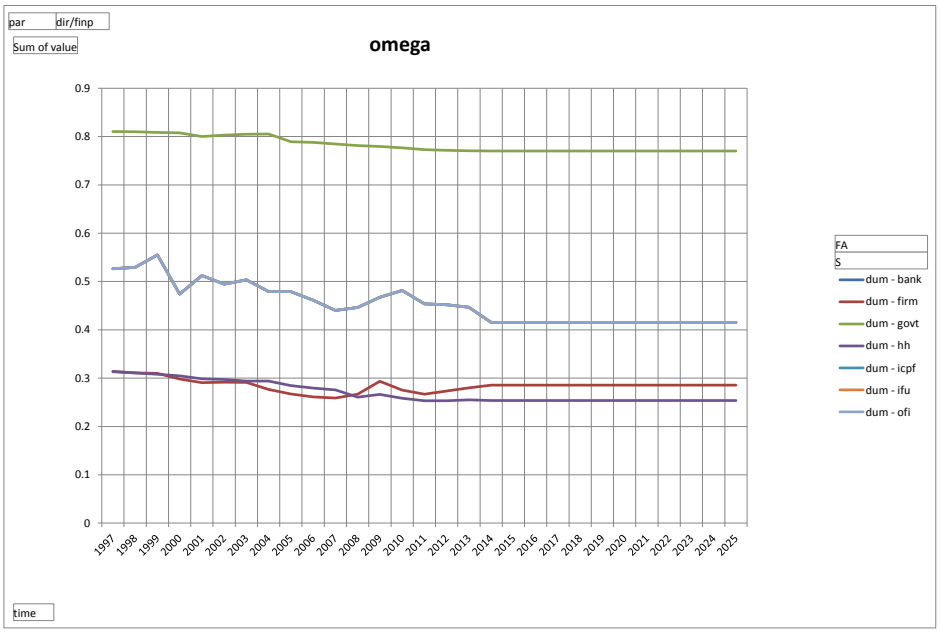


Figure 10: Parameter Choice - Sectoral Wage Share



3.1.2 Taxes

Placing our focus on the Austrian tax system for the model extension, we introduced the following endogenous taxes. The tax rate is fixed and taken from data (value of the year 2014), while the tax flow is endogenous in the model subject to the tax base.

$$
\begin{aligned}
T_{va,t} &= \tau_{va,t} \cdot C_t && (6)\\
T_{o,t,s} &= \tau_{o,t,s} \cdot [Y_{t,s} + \sum_s INV_{t,s}(ifs = firm)] && (7)\\
T_{w,t} &= \tau_{w,t} \cdot \sum_s W_{t,s} && (8)\\
T_{incse,t} &= \tau_{incse,t} \cdot OS_{t,hh} && (9)\\
T_{cap,t} &= \tau_{cap,t} \cdot (Interest_{t,hh,recv} \\
&\qquad + f_{DIV,t,hh,recv} \\
&\qquad + icpf_{DIV,t,hh,recv} \\
&\qquad + ifu_{DIV,t,hh,recv}) && (10)\\
T_{firm,s} &= \tau_{firm} \cdot OS_{t,s} && (11)
\end{aligned}
$$

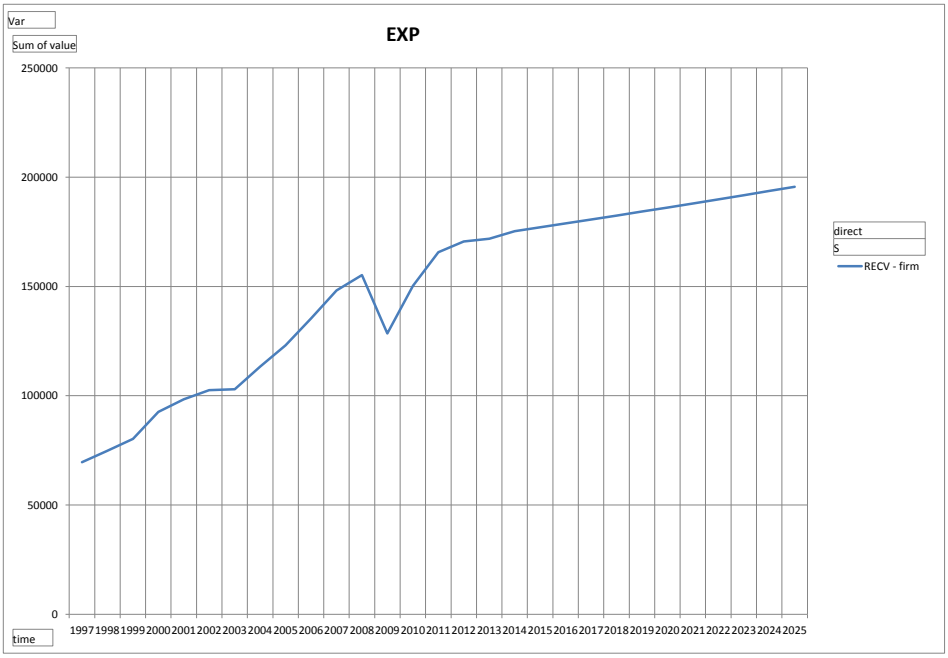
The VAT tax shown in equation (6) is related to household consumption with a fixed tax rate of 16.7 %. The other tax on production depicted in equation (7) is applied to the level of production of a respective sector, and varies between about 3.3 % (govt) and 10.5 % (NFC) for the different sectors. The wage tax as in equation (8) is levied on wage payments to households with a rate of 45.8 %. The tax on the income of self employed in (9) is tied to the operating surplus generated in the household sector with a rate of about 31.9 %. The capital tax as in equation (10) is levied on capital income of households: interest income, dividend income from (NFC) stocks, as well as from ICPF and IFU shares (to be discussed). The tax rate is rather small with about 9.5 %, and varies by some percentage points in the data over time due to the definition of the tax base we chose (to be discussed). The firm income tax as set forth in equation (11) is levied on the operating surplus by NFC and FC. The tax rate ranges from 14 % for FC sub-sectors to 22 % for NFC (to be discussed).

3.1.3 Exogenous Variables

Some variables are taken as exogenous trends from the data, and are not subject to the behavioural choice of any of the agents in the model. The most important of these are described in the following according to their past development and our choice of forecast.

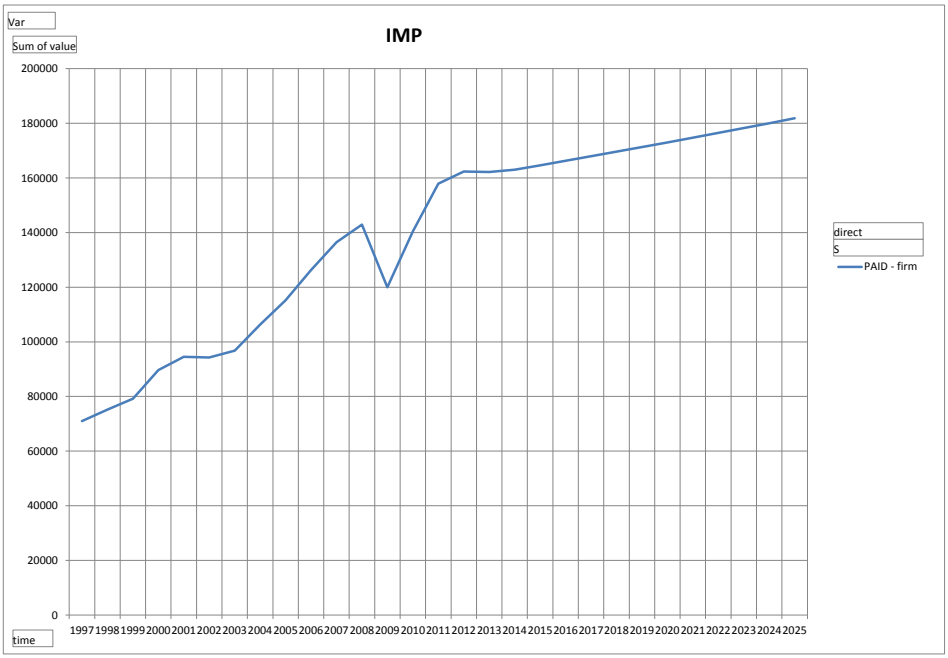
Exports The trend for exports we assume from the data is shown in figure 11. One can clearly see the rising trends of Austrian exports only interrupted by the economic recession in 2009. Starting from a level of about 175 bln. Euro in 2014, we extrapolate this trends by assuming a 1 % growth rate for future modelling periods, which seems to fit the structure of the data rather well (to be discussed).

Figure 11: Exogenous Variables - Exports (in bln. Euro)



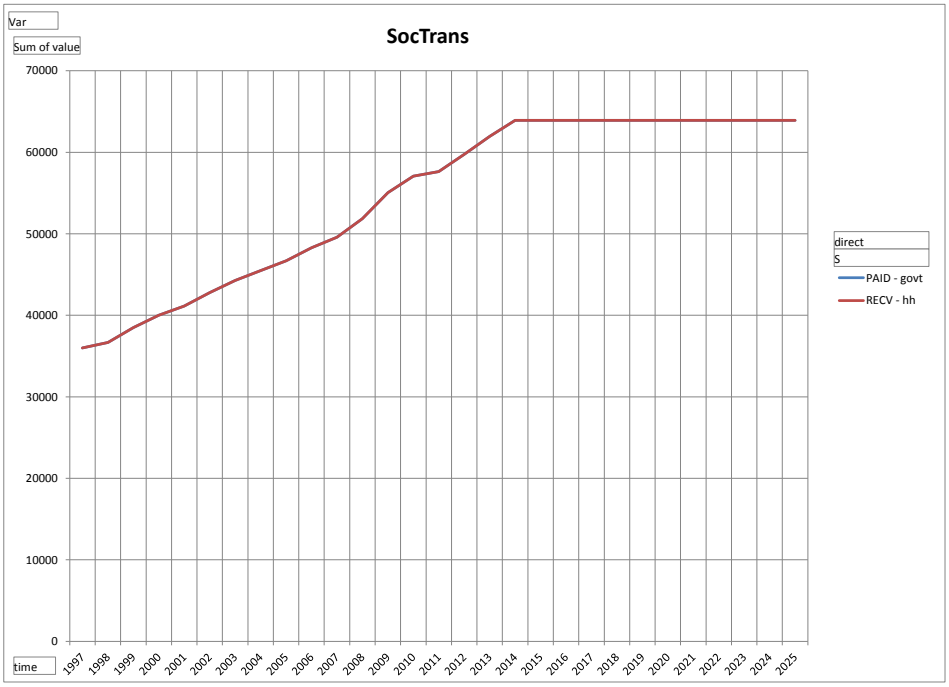
Imports take a similar development as exports. Starting from a slightly lower level of 163 bln. Euro in 2014, we assume a growth rate of 1 % to project their development into the future.

Figure 12: Exogenous Variables - Imports (in bln. Euro)



Social Transfers (Soctrans) are shown in figure 13. Even though they exhibit a rising trend until the year 2014, we assumed the, to remain on their level of 2014 to exclude any additional political measures in the BAU scenario raising these social transfers (to be discussed).

Figure 13: Exogenous Variables - Social Transfers (in bln. Euro)



3.1.4 'Implied' Stock-Flow and Flow-Flow Relations

These are flows of payments that relate to stocks of different asset classes from last period, or are determined by flow decisions within a given period of the model. This involves mostly interest and dividend payments, but also income and operating surplus as a result of economic activities determined by the behavioural equations given in section 3.1.1.

Interest Flows $INT_{t,s,direct}$ are calculated applying an average interest rate $r_{int,t,s,direct}$ to last year's holding of the asset classes that carry interest - deposits (DEP, F2), debt securities (DS, F3), as well as loans and other accounts (LOAN; F4, F8). We had to apply this procedure since interest flows are only accounted for as an aggregate in the NFTR data, see table 1, line net interest payments (D41). However, the interest rate is specific for each sector s, time t, and we have different interest rates for the paid and received columns of the different sectors. Thus, we calculate an asset-class-specific average interest rate both for assets and liabilities for each sector separately. This is a first and rather crude approximation - there is ample space for improvement regarding this aspect of the modell, see also section 6. Interest rates as calculated from the data and projected into the future are shown in figures 14 and 15 below.

$$INT_{t,s,direct} = r_{int,t,s,direct} \sum_{finpos} (DEP_{t-1,s,finpos} + DS_{t-1,s,finpos} + LOAN_{t-1,s,finpos}) \quad (12)$$

Figure 14: Interest Rates - Received for Asset Holdings (in %)

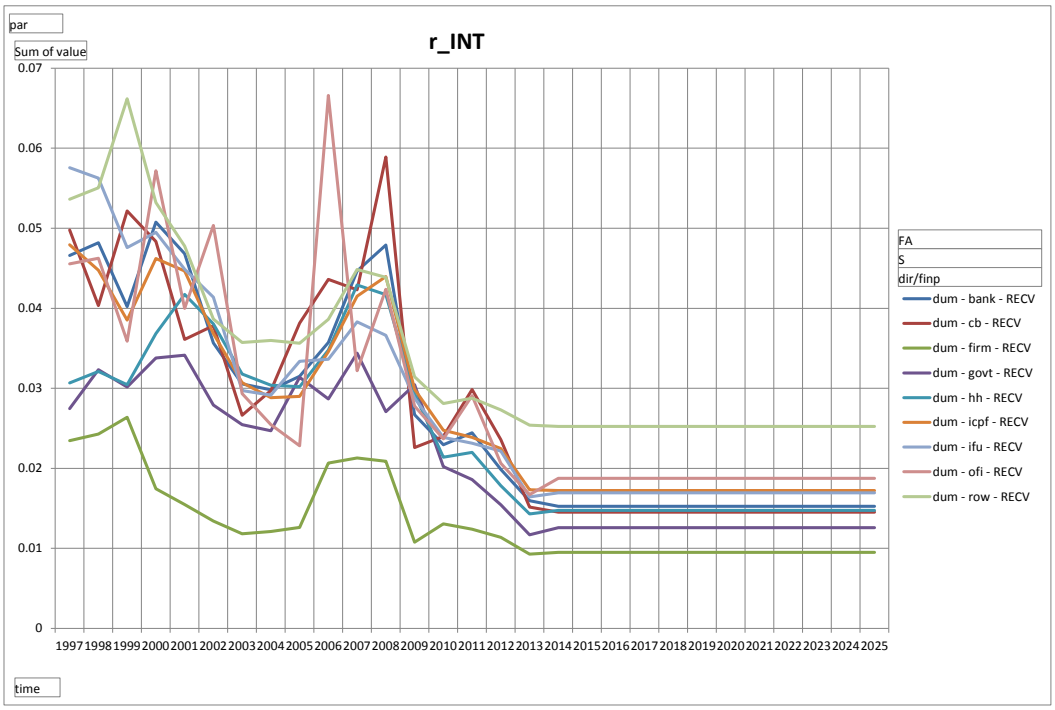
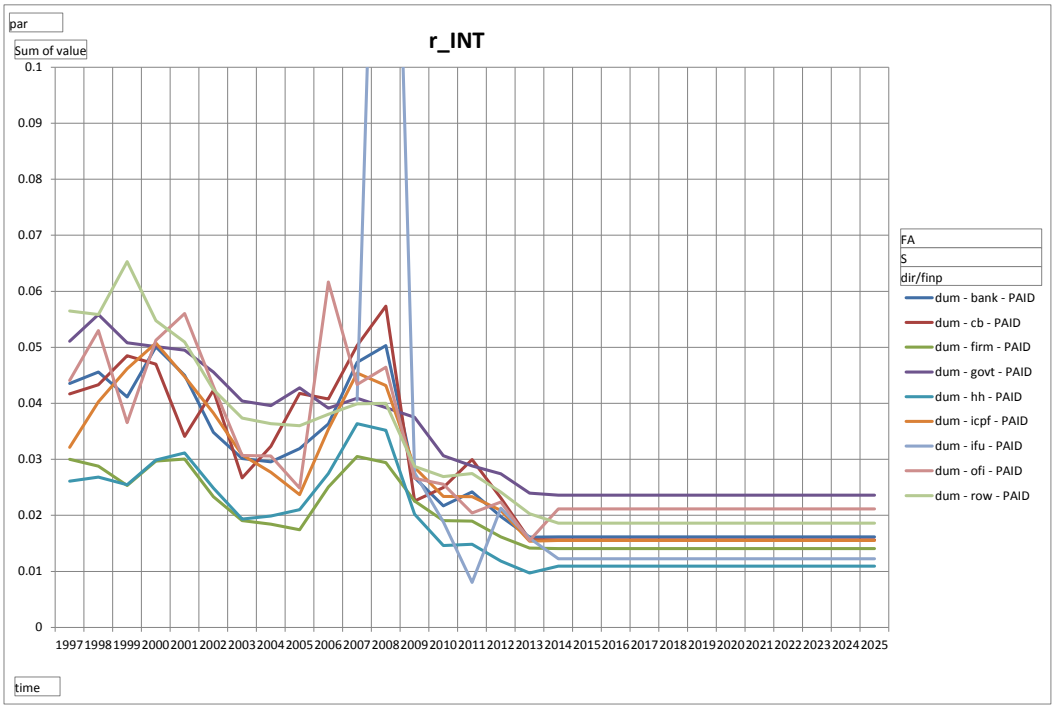


Figure 15: Interest Rates - Paid for Liabilities (in %)



What strikes the eye regarding received interest rates in figure 14 are the high rates received by the OFI sector in the run-up to the financial crisis 2007/2008, which are then taken over by the central bank, probably due to its interventions on financial markets following the crisis. Generally, one can observe the rapid fall of all interest rates after 2007/2008 below 2% for all but one rate as a result of monetary policy and general conditions on financial markets after the crisis. We keep these interest rates at the low level of 2014, since again we do not want to assume an exogenous change in monetary policy or general framework conditions on financial markets (to be discussed).

Interest rates paid on liabilities as depicted in figure 15 show a similar picture to the ones received, with differences for agents due to the composition of their balance sheets. The spike in the interest rates paid by the IFU sector above 20 % - which has been removed from this picture due to reasons of visibility - starts from a very low value of interest payments of 29 mln. Euro. Thus, any revaluation effects e.g. in DS stemming from the financial crisis which have very low absolute effects lead to high relative effects.

Dividend Rates are paid for holdings of firm equity[8] (STOCK), equation (13), ICPF ($SHARE_{icpf}$), equation (14), and IFU ($SHARE_{ifu}$) shares, equation (15). Again, the rates of return to these assets are specific for each sector s, time t, and the direction of payment.

$$F_{DIV,t,s,direct} = r_{f,t,s,direct} \sum_{finpos} STOCK_{t-1,s,finpos} \tag{13}$$

$$ICPF_{DIV,t,s,direct} = r_{icpf,t,s,direct} \sum_{finpos} SHARE_{icpf,t-1,s,finpos} \tag{14}$$

$$IFU_{DIV,t,s,direct} = r_{ifu,t,s,direct} \sum_{finpos} SHARE_{ifu,t-1,s,finpos} \tag{15}$$

Since the focus of these dividends is on the received rate of interest, and cross-issuance of these liabilities is rather small (i.e. they are mostly emitted by one sector), the following figure 16, 17, and 18 show the interest rate received for these assets. As regarding firm divident rates shown in figure 16, they seem to be quite high, especially before the financial crisis 2007/2008, but falling thereafter (to be discussed). The constant level after 2014 seems to be justified for all sectors, except maybe for the household sector, where a falling trend seems likely. Also, ICPF and IFU returns in figures 17 and 18 look reasonable. However, it seems surprising that ICPF shares have a higher return rate than IFU shares, even though one might expect that they are the safer asset. The spike in IFU returns before the financial crisis 2007/2008 seems intuitive, while the high spike in the year 2006 for the ROW seems to be a very particular phenomenon for which the authors have not found an explanation yet.

[8] And derivatives, which are very small in total amount in the economy.

Figure 16: Dividend Rates - Firm Equity (in %, RECV)

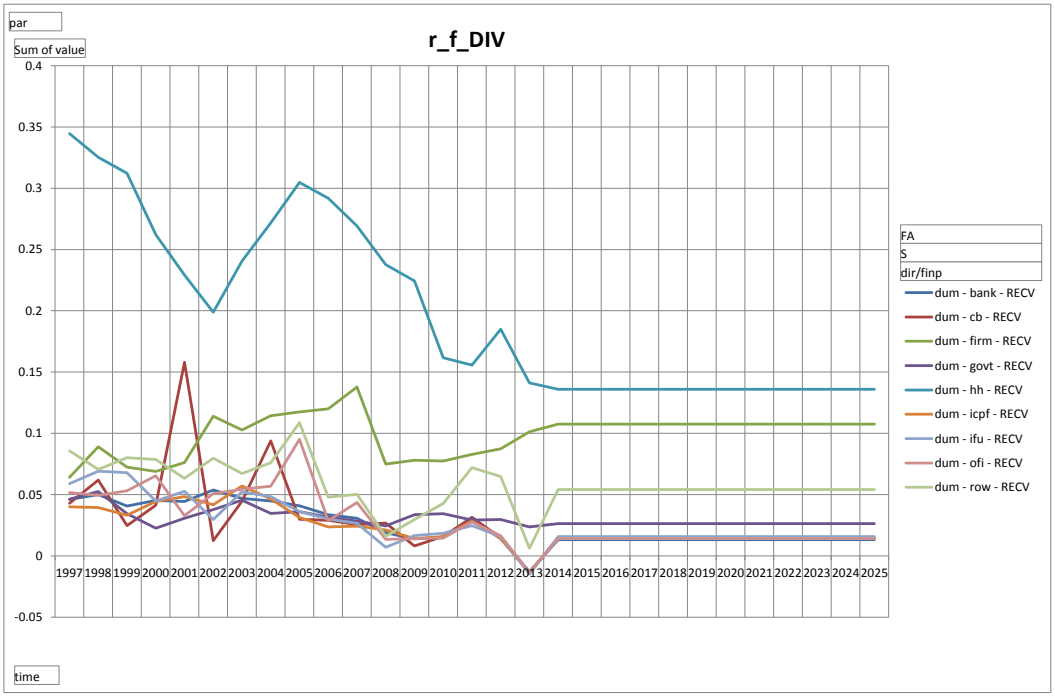


Figure 17: Dividend Rates - ICPF Shares (in %, RECV)

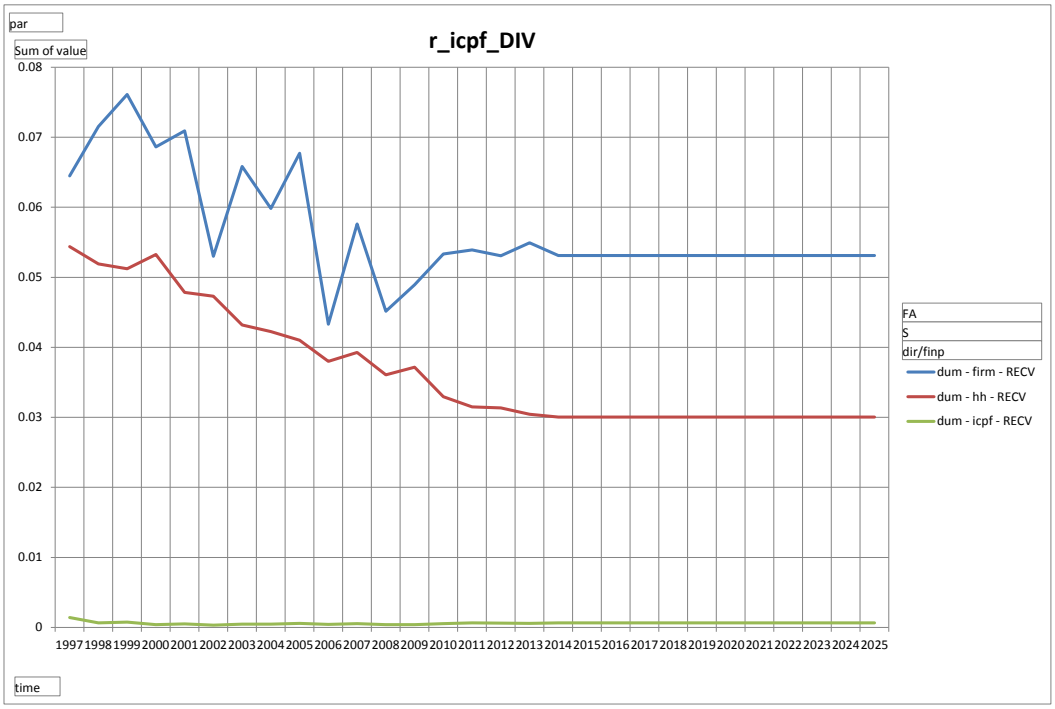
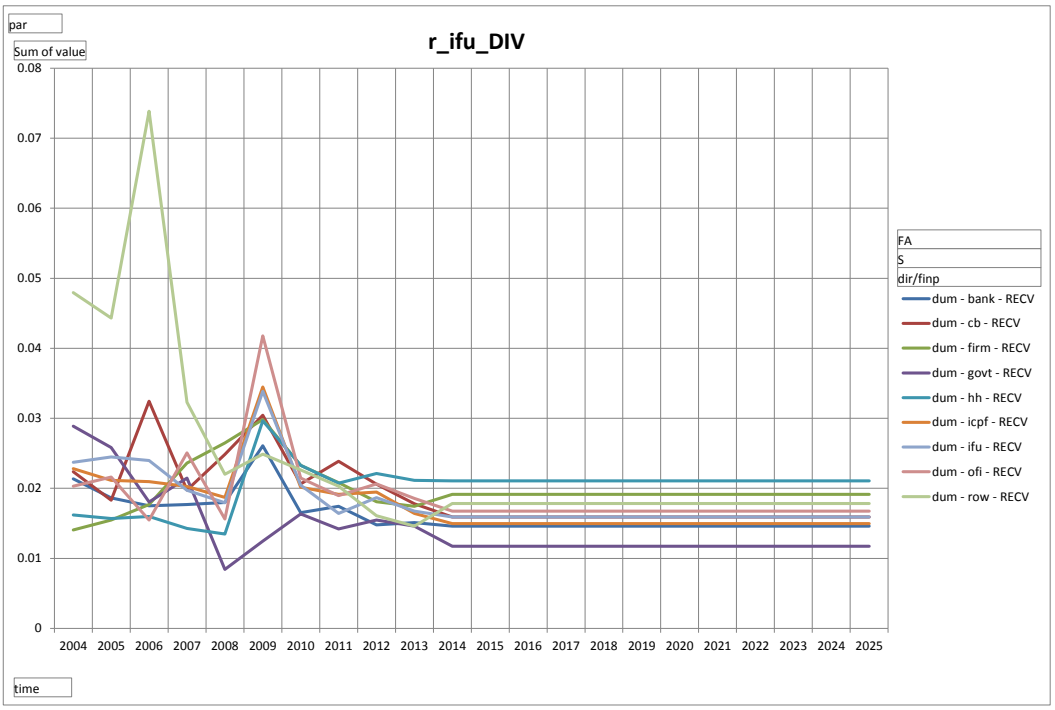


Figure 18: Dividend Rates - IFU Shares (in %, RECV)



Household Income and Operating Surplus The remaining two equations in the 'implied' section of the model result from the intra-period flows in the model, by subtracting expenditures from revenues for a particular sector. Our definition of household income INC is shown in equation (16), the definition of operating surplus OS of different sectors in equation (17). What should be noted is that for household income, wage payments within the household sector as income to self employed and NPISH has to be deducted as an expenditure for the household sector to avoid double counting. For the OS of firms, it has to be noted that investment is a source of revenue for the NFC sector regarding total investment by all sectors including itself, and a source of expenditure only regarding its own investments.

$$INC_t = \sum_s W_{t,s} - W_{t,hh} + Y_{t,hh} + INT_{t,hh,recv} + F_{DIV,t,hh,recv} + ICPF_{DIV,t,hh,recv} + IFU_{DIV,t,hh,recv} - T_{w,t} - T_{va,t} - T_{o,t} - T_{incse,t} - T_{cap,t} - I_{t,hh} + SubTrans_{t,hh,recv} + SocTrans_{t,hh,recv} + res_{t,hh,recv} - res_{t,hh,paid} \quad (16)$$

$$OS_{t,s} = Y_{t,s} - W_{t,s} - I_{t,s} + \sum_s I_{t,s}(\text{if s=firm}) - T_{o,t,s} + SubTrans_{t,s,recv} - SubTrans_{t,s,paid} \quad (17)$$

3.2 Financial Transactions (FTR)

In the financial transactions section of the model, the following issues are treated:

1. The allocation of surplus/financing of a deficit stemming from the NFTR model block (i.e. NLNB) by sectors is related to the acquisition/disposition of financial assets,

2. The amount of extension/shrinking of the total balance sheet, and

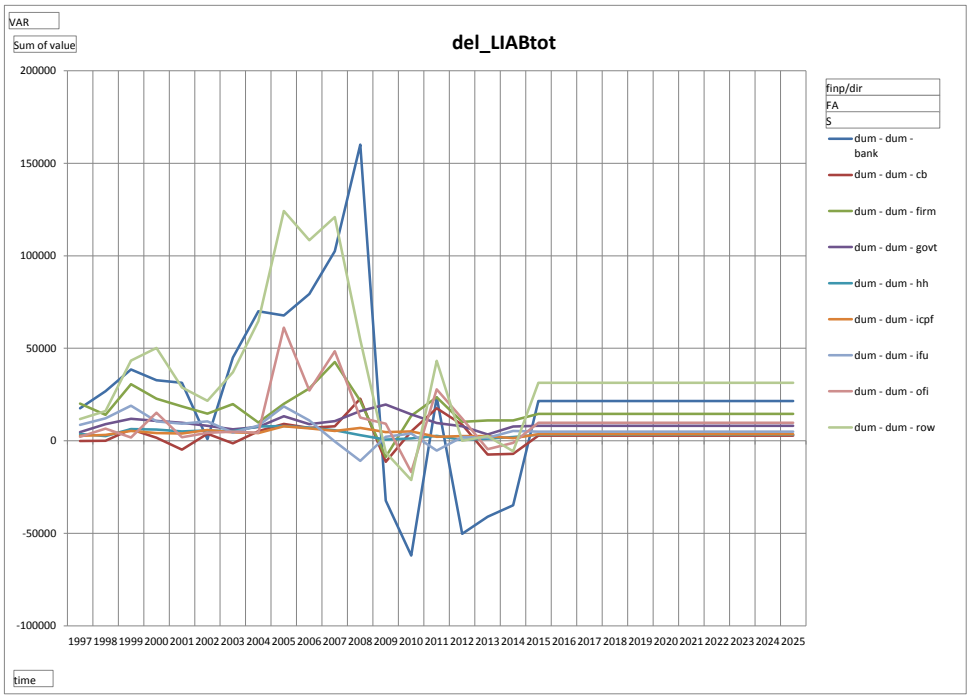
3. The allocation of existing wealth between different asset classes (portfolio choice)

As of now in this early modelling stage, some of these variables are determined by exogenous forecasts from past data, others (at least partly) are determined by behaviour of agents. Especially, NLNB is an endogenous outcome of the NFTR block. The portfolio choice as it is implemented now is only partly subject to choice by the agents, as prices are still exogenous. Furthermore, the extension/shrinking of agents' balance sheets, which is exogenous at the moment, clearly are decisions decisions of agents related to other behavioural choices in the mode. These latter two issues are major areas where more work will be done for this model in the future.

3.2.1 Exogenous FTR

Extension of the Balance Sheet The extension or shrinking of agents' balance sheets depicted in figure 19 below has been kept fixed after the year 2015 for similar reasons as for the forecasts above, especially in order to keep the dynamics of the model as simple as possible. This variable has special influence on model results since it steers the amount of new financial assets entering the system. The extension of liabilities during the run-up to the financial crisis 2007/2008 is especially notable here. The steep decline after 2008 documents how the extension of balance sheets by agents reduced and even became negative for most sectors, especially for the banking agent and the RoW. The forecast after 2015 is chosen as the average of the balance sheet extension of agents of all previous periods (to be discussed).

Figure 19: Extension/Shrinking of Balance Sheets (in mln. Euro)



Revaluation and Other Changes in Volume Another exogenous forecast regards the revaluation account and other changes in volume. For this early model version, we have decided to set all revaluation and other changes in volume to zero for the periods from 2015 - 2025. Naturally, this is another major part of further model improvement due in the future. Especially, we had to take care of the problem that changes in asset positions by agents have to match the changes in total avaibility of asset classes. This could be achieved with the present forecast of assets as shown in figure 28 below for all sectors in aggregate. However, bringing in the revaluation account as another variable here would complicate matters further. We decided to eliminate this additional factor for the time being.

3.2.2 Portfolio Choice

As mentioned before, the portfolio choice is a crucial element of the model, and work in progress at a very early stage. Most importantly, prices are still exogenous, which would be the main variables regulating the portfolio choice of agents, and also determine the amount of price revaluations (capital gains) in the economy.

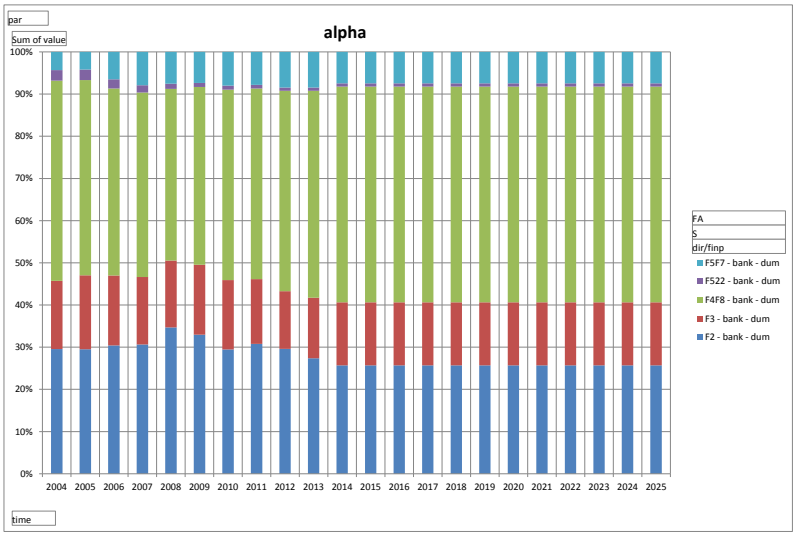
As of now, agents choose their intended level of financial assets $ASS_{t,s,fa}$ and liabilities $LIAB_{t,s,fa}$ subject to portfolio choice parameters taken from the data, which are still exogenous and not connected to prices. They have both a choice of their asset portfolio composition (parameter α, taken before the choice of liabilites), as well as their way of financing, i.e. their liabilities (parameter λ). Both porfolio choice parameters are specific for each asset class, sector and time period. The balance sheet extension ΔBS also has to be allocated between different asset classes fa, as well as the surplus/deficit from the NFTR model block, i.e. NLNB. Furthermore - as the sum of financial assets and liabilities always has to equal zero - and since the choice of assets and liabilities including the amount of balance sheet extension do not automatically match each other, the RoW is assumed to provide the additional/reduce the exceeding liabilities to satisfy accounting consistency (to be discussed).

$$ASS_{t,s,fa} = \alpha_{t,s,fa} \cdot \left(\sum_{fa} ASS_{t-1,s,fa} + \Delta BS + NLNB_{t,s} \right) \tag{18}$$

$$LIAB_{t,s,fa} = \lambda_{t,s,fa} \cdot \left(\sum_{fa} LIAB_{t-1,s,fa} + \Delta BS \right) \tag{19}$$

The parameters α and λ have been set to their 2014 values for simplicity, see figures 20 to 23 below for the portfolio share parameters of selected agents.

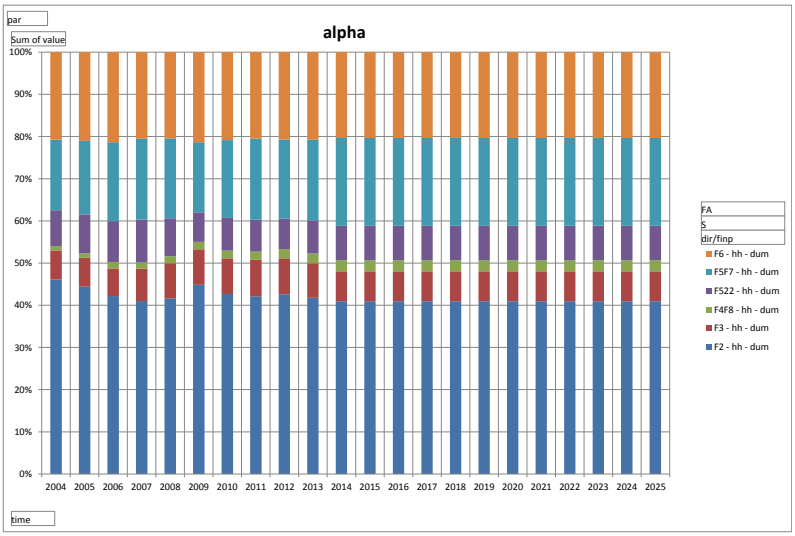
Figure 20: Portfolio Choice of Banks (shares of 100 %)



Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

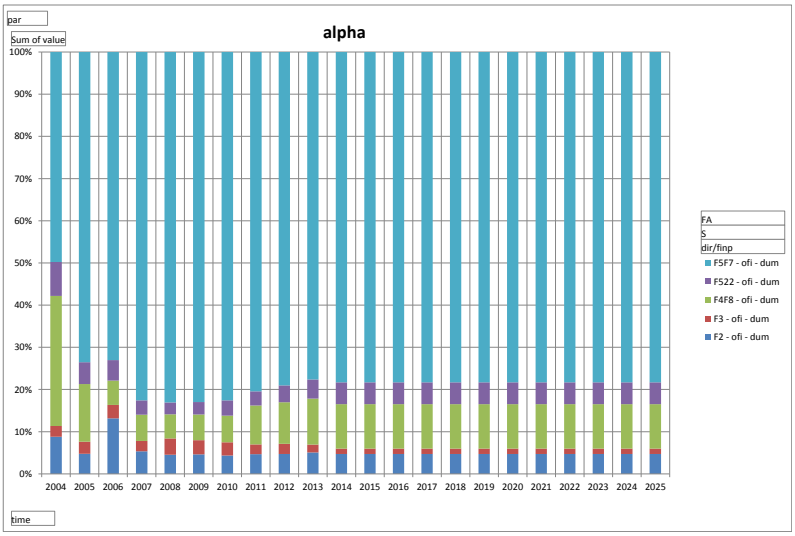
These portfolio choice parameters clearly indicate the different economic activities undertaken by the agents. Banks shown in figure 20 hold the majority of their assets in form of loans. However, as mentioned above in section 2.2.2, they also rely on deposits to a large extent (interbank positions). Securities and stocks take the majority of the remaining share.

Figure 21: Portfolio Choice of Households (shares of 100 %)



Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

Figure 22: Portfolio Choice of OFI Sector (shares of 100 %)

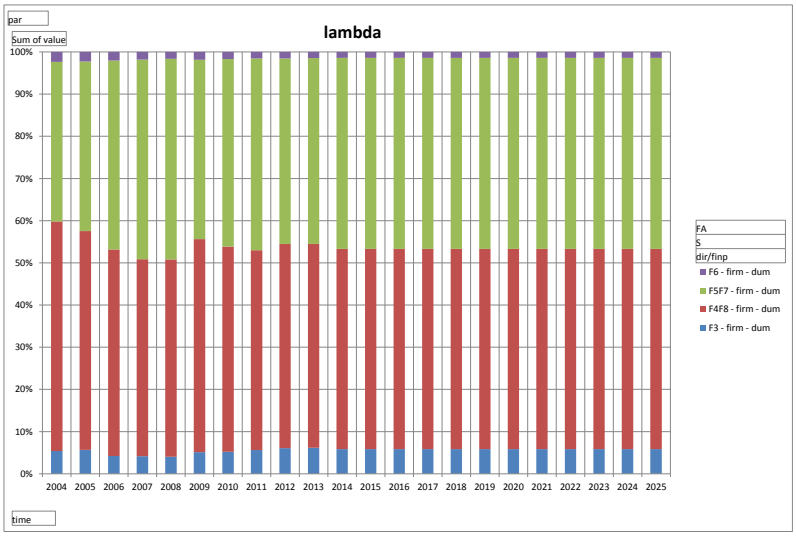


Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

The portfolio choice of households depicted in figure 21 relies on deposits to the largest extent. However, stocks (equity) and insurance papers also take large shares. As an example for a FC sub-unit, it is interesting to see how the OFI sector almost inclusively invests in stocks, see figure 22.

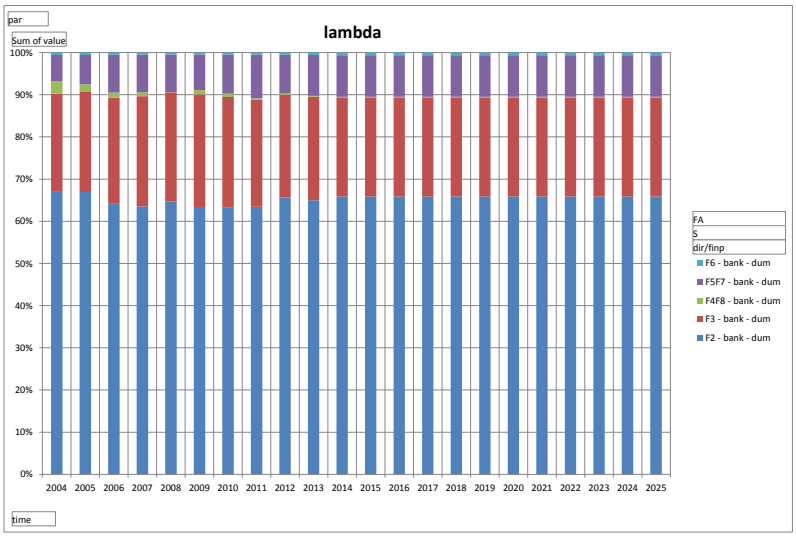
Regarding the choice of liabilities, figure 23 shows the financing structure of Austrian NFC (firms) very well: funds are obtained primarily by issuing equity or taking up loans, less by issuing securities (corporate bonds). As a comparison, figure 24 depicts that Austrian banks finance more than about 65 % of their liabilities by deposits (from households and on inter-bank market), then via securities and in the third place via equity.

Figure 23: Liability Choice of NFC sector (shares of 100 %)



Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

Figure 24: Liability Choice of Banks (shares of 100 %)



Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

4 Business As Usual (BAU) - Results

The business as usual scenario is the simplest forecast the model can produce. All parameters and exogenous variables stay at their constant values as described in the previous section. The result is a trajectory of the economy that depicts a future development if all things stay as they were until now. The results for the most important endogenous variables are shown below. Since the specification of all behavioural equations is still very crude and since prices are still completely missing in the model, these results should be seen (at this stage) not as a realistic forecast. However, they significantly reassure that the model is robust, since the results for all variables, flows and stocks, display a steady projection of the trend of the recent past.

4.1 BAU-Results: Non-Financial Transactions

GDP and Net Lending/Net Borrowing are the main outcomes from the non-financial transactions.

Output GDP_t is completely demand-driven by (gross) consumption incl. VAT, government spending, investment, as well as the trade balance:

$$GDP_t = C_t + G_t + \sum_s I_{t,s} + EXP_t - IMP_t + T_{va,t} \tag{20}$$

Figure 25 shows the Business as Usual (BAU) forecast for the Austrian GDP. The model and the underlying dynamics we supposed for the parameters shown above seems to replicate past dynamics fairly well. In the forecasting period 2015 - 2025, GDP growth seems to slow down - our model version of "secular stagnation" (to be discussed.)

Figure 25: Austrian GDP - Past Data and Model BAU Forecast (in mln. Euro)

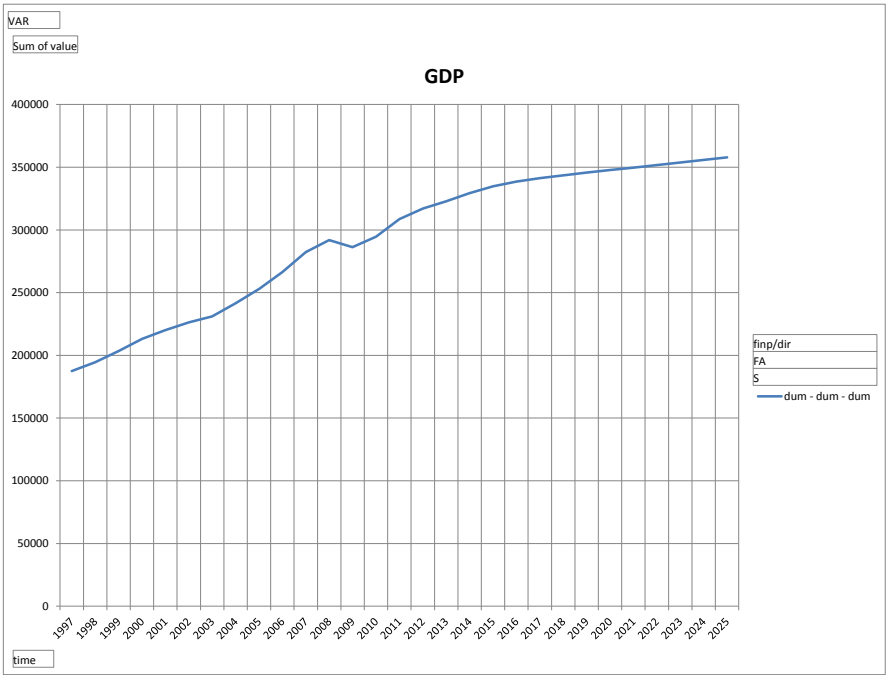


Figure 26 shows important macroeconomic flow-variables for the Business as Usual (BAU) forecast. Specifically private consumption G, public consumption G, household income INC, overall investment INV, overall operating surplus OS, and households' wage income W. Also here, past dynamics continue into the future fairly stable.

Figure 26: Macroeconomic Variables - Past Data and BAU Forecast (in mln. Euro)

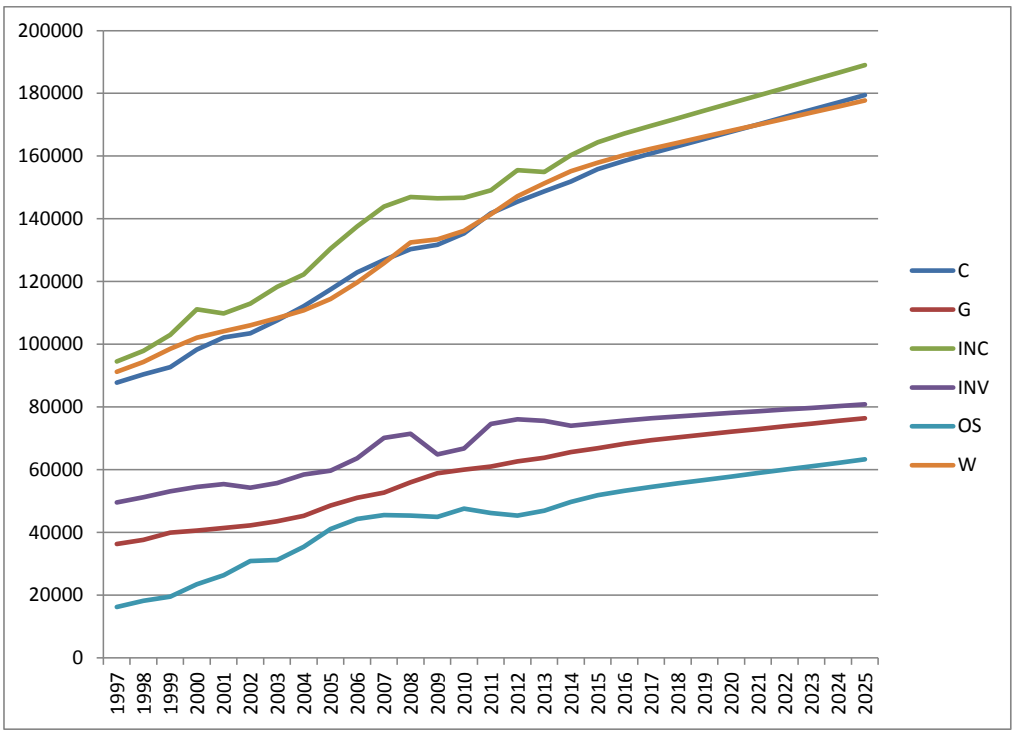
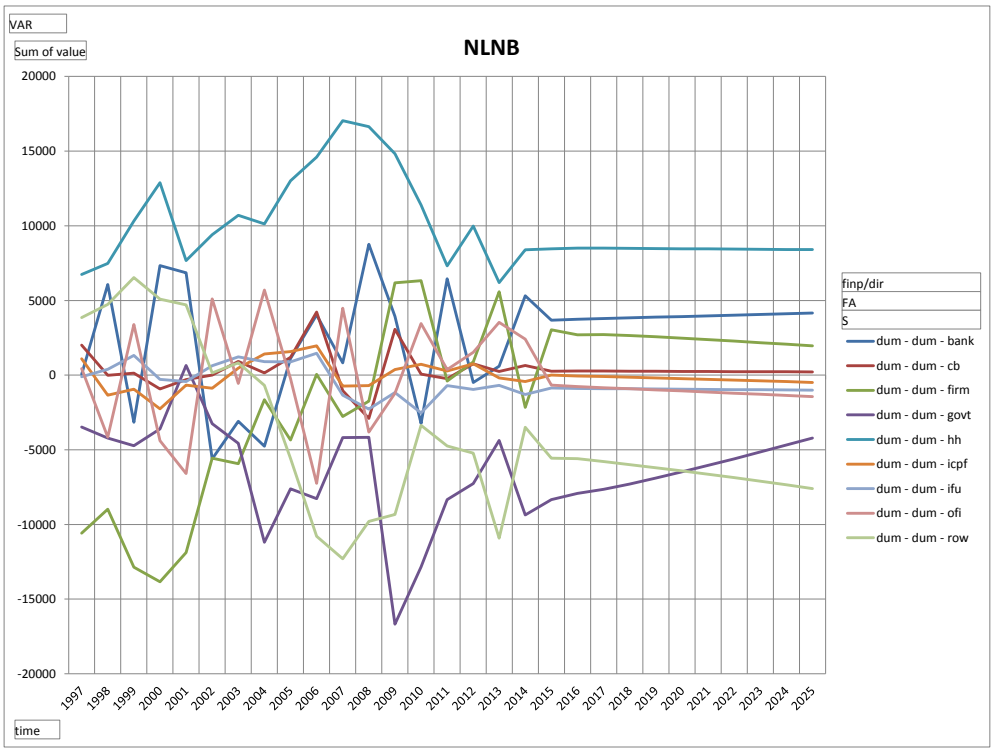


Figure 27 shows NLNB for the different sectors. The data up to 2014, naturally, show very much a different picture than our model forecast, especially for the more volatile sectors NFC (firm), the Rest of World (row), and parts of FC (Banks, CB, OFI, IFU). Again, we kept the development fairly stable in our forecast to avoid distorting our model results. However, since NLNB summed across sectors has to equal zero for reasons of accounting consistency, some developments after 2014 are implied by other projections in our model. Most of all, the deficit of the RoW (light green line at the bottom) increases due to the exogenous developments of exports and imports that we assume as shown in figures 11 and 12. Keeping the surplus of all other private sectors fairly stable, this has implications for the government deficit (purple line at the bottom), which decreases steadily until 2025.

Figure 27: Net Lending/Net Borrowing by Sector - Past Data and BAU Forecast (in mln. Euro)



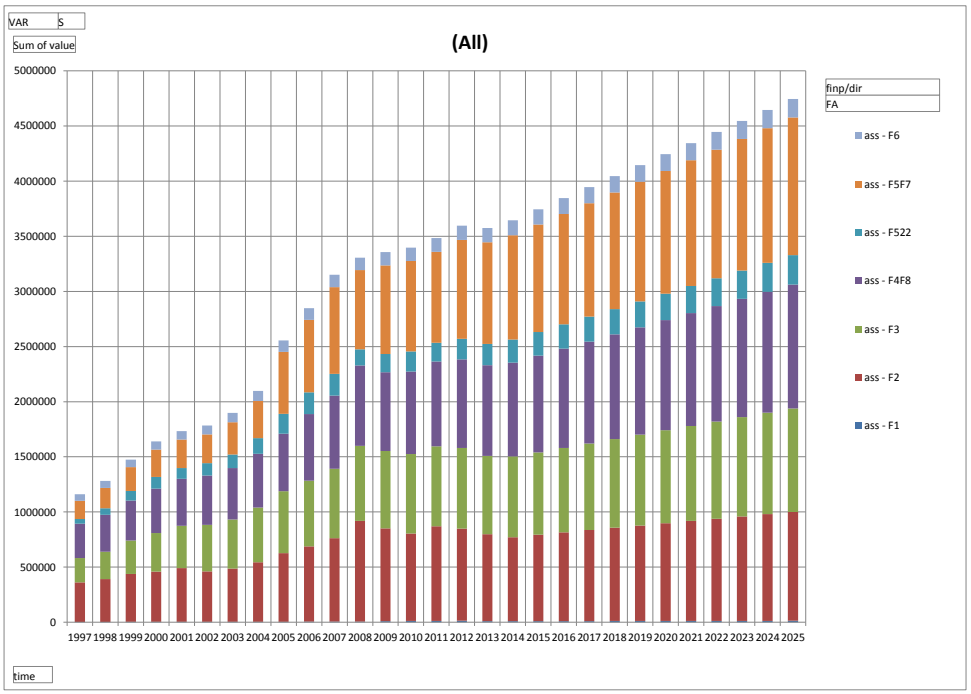
As mentioned before, NLNB is the main outcome of the non-financial transactions in the model that is carried forward to the financial accounts, which are described below.

4.2 BAU-Results: Financial Transactions

Financial Assets After having determined the extension of balance sheets, revaluation and portfolio choice, the actual holdings of financial assets by sectors is one of the two outcomes of the financial transactions block of the model, see figure 28. Their actual holdings of financial assets $FA_{actual,fa,s,finpos}$ will be different from their intended holdings of financial assets $FA_{intend,fa,s,finpos}$, since agents cannot anticipate revaluation and other changes in volume effects. The latter constitute the difference between intended and actually held financial assets. As mentioned above, this is a major point of improvement for later model building (to be discussed).

Taking a closer look at figure 28 depicting past balance sheet developments and our model projections, it becomes clear that - even though total growth of assets in nominal values slowed down considerably after 2007/2008 - the total stock of financial assets in the Austrian economy (including asset holdings of the RoW) has not shrunk. After 2015, our model shows a steady increase in financial assets that can be seen as a smooth continuation of the trend from 2008 - 2014 (to be discussed).

Figure 28: Projections of Total Asset Holdings in the Model (in mln. Euro)

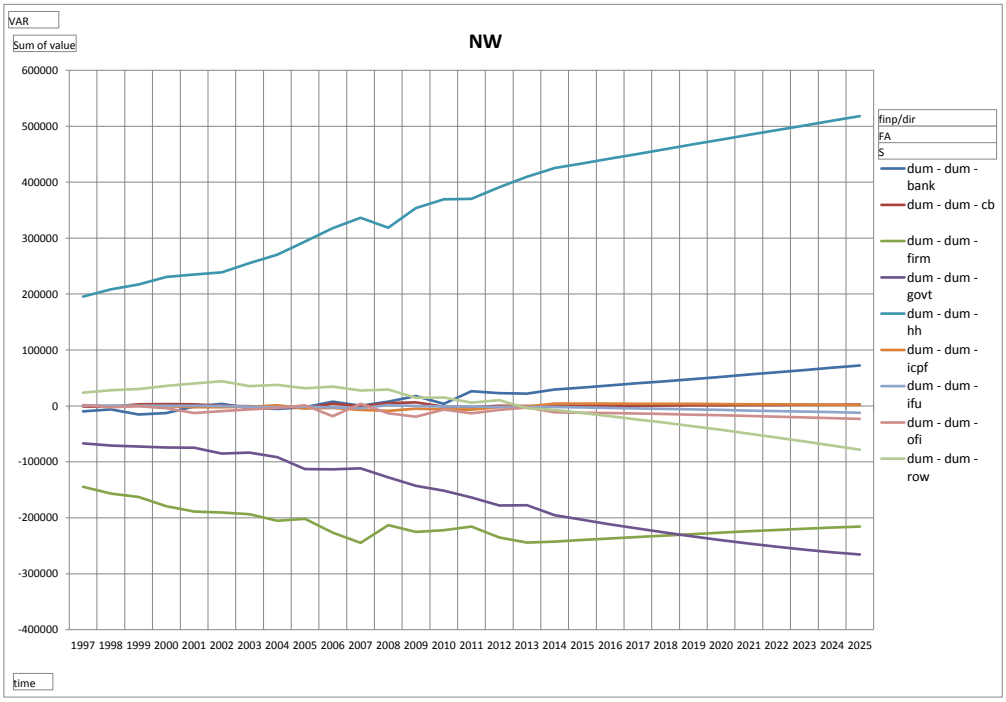


Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

New Worth is the determinant of a sector's financial wealth and is shown in figure 29 below.[9] As to be expected, households have by far the highest net worth, starting with a level of slightly more than 425 bln. Euro in 2014 up to almost 520 bln. Euro in 2025. Banks are second in net worth in the Austrian economy, with a figure of about 22 bln. Euro in 2014. Our model projects a steady increase of banks' NW up to more than 72 bln. Euro in 2025, possibly due to their steady surplus in NLNB that can be observed in figure 27 (to be discussed). Due to its trade deficit that increases due to our exogenous projections of exports and imports from 2015 - 2025, the RoW accumulates a negative NW worth which reaches a value of -78 bln. Euro in 2025 (to be discussed). NFC (firms), who have a positive NLNB as can bee seen from figure 27 above and that start from a considerable negative net worth of almost 243 bln. Euro in 2014, manage to decrease their negative NW -215 bln. Euro in 2025. Lastly, the government shows a steady decrease in its net worth as what could be termed as "borrower of last resort" financing the surpluses of other agents, reaching a negative net worth of close to 266 bln. Euro in 2025. However, the decline slows down in our model projection years due to its negative but rising NLNB as in figure 27.

[9]No real capital is depicted here and is a point of further extension for the model. This especially affects the net worth of firms, which is highly negative in this depiction, but also the net worth of the household sector.

Figure 29: Net Worth by Sector (in mln. Euro)



5 Scenarios

Projections in the business as usual (BAU) scenario have been shown above in section 3 for the most important parameters and variables in the model. For the following exploratory scenarios, a **tax parameter** has been **varied**, showing the effects of this change with respect to model developments in the BAU scenario.

Disclaimer: It has to be noted that the following scenarios are merely exploratory exercises to test the properties of a model in a very early stage of development, and should not be seen as actual policy recommendations. Some of them might are quite pronounced in their extent of change in the Austrian tax or government expenditure structure, and might seem unrealistic for the practitioner.

To test the model, we have initially incorporated the following hypothetical scenarios (an additional scenario is introduced in figure 34):

1. **Increase Government Spending ("G+10"):** Starting from 2017, Government spending (G) is exogenously increased by 10 % compared to the BAU trajectory for each year until 2025. There is no financing for this increased spending, i.e. government debt increases along with this measure.
2. **Decrease Wage Tax, no Decrease Gov't Expenditure ("tau_w-10")** The wage tax rate is cut by 10 % from its initial value starting in 2017, which is about 4.5 percentage points (pp) from 45.6 % down to about 41 %. Again, there is no counteracting measure to reduce the increasing government deficit.
3. **Endogenous Rise Wage Tax, no Increase Gov't expenditure ("T_w+1Mrd")** Wage taxes are increased so that government revenues are increased by 1 bln. Euro. The additional revenues are used to reduce government debts.
4. **End. Rise Wage Tax + Increase Gov't Expenditure ("T_w+1Mrd_Gup")** Wage taxes are increased as in 3. above, but government consumption is increased by the same amount.
5. **End. Rise Capital Tax + Increase Gov't Expenditure ("T_cap+1Mrd_Gup")** The capital tax rate in the model is increased so that government revenues are increased by 1 bln. Euro. The additional revenue is spent on government consumption.
6. **End. Rise Firm Inc. Taxes + Increase Gov't Expenditure ("T_firm+1Mrd_Gup")** The firm income tax rate is raised so that government revenues are increased by 1 bln. Euro. The resulting revenue is spent on government consumption.

Our main instrument of evaluation - besides the rise/fall in GDP induced by the change in the tax rate - is the **multiplier** $MULTI$ of the respective scenario. We define the multiplier as the ratio the change in GDP induced by the tax change divided by change in tax revenue REV_T or government expenditure G in absolute values (EURO). The multiplier is positive in our definition if the tax measure leads to an increase in GDP, and negative in the opposite case. To spell this out:

$$MULTI = \frac{\Delta GDP}{\Delta REV_T} \quad \text{or} \quad \frac{\Delta GDP}{\Delta G} \quad , \quad MULTI > 0 \quad if \quad \Delta GDP > 0 \tag{21}$$

To go straight to the results of these scenarios: figure 30 below shows their effects on GDP growth from 2017 to 2025. An overview of the different tax multipliers is given in table 6 below.

Figure 30: The Effects of Scenarios on GDP in the Model (in mln. Euro)

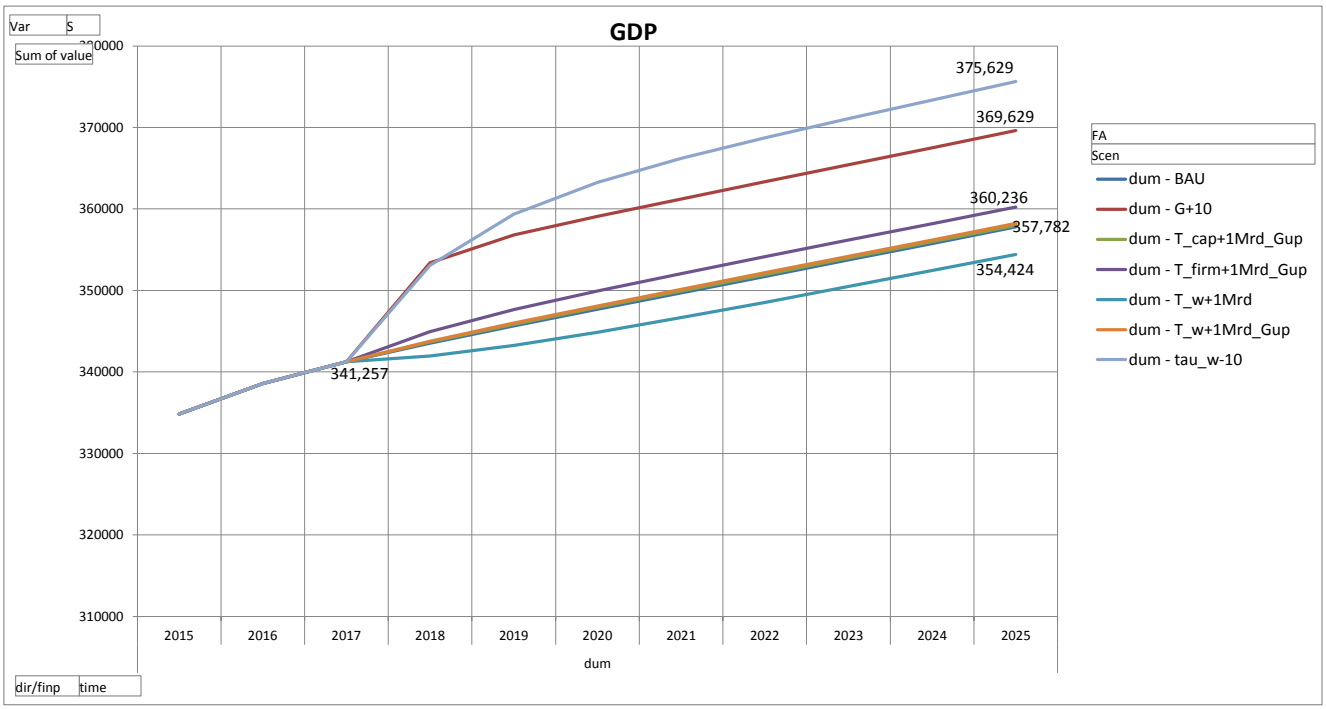


Table 6: Tax Multipliers for the Different Scenarios in Comparison

Scenario	Multiplier
G+10	1.64
tau_w-10	3.357
T_w+1Mrd	-3.357
T_w+1Mrd_Gup	0.431
T_cap+1Mrd_Gup	0.223
T_firm+1Mrd_Gup	2.454
SocTrans+10 (see figure 34)	2.23

'tau_w-10" Taking a look at the total changes in GDP, it becomes obvious that the reduction of the wage tax by 10% "tau_w-10" (light blue line on top) has the highest effects in our model economy. GDP is increased by more than 17.8 bln Euro or 5% of Austrian GDP compared to the BAU GDP value of 357.782 bln. Euro. The **tax multiplier** for the last year 2025 in this case is about 3.36, i.e. the decrease of the tax rate by about 4.5 % (reducing the tax revenue by about 5.3 bln. Euro) leads to an increase in GDP of more than 3-fold this sum. However, please note that this loss in tax revenue from the wage tax is not compensated by raising revenues of other taxes or reducing government spending.

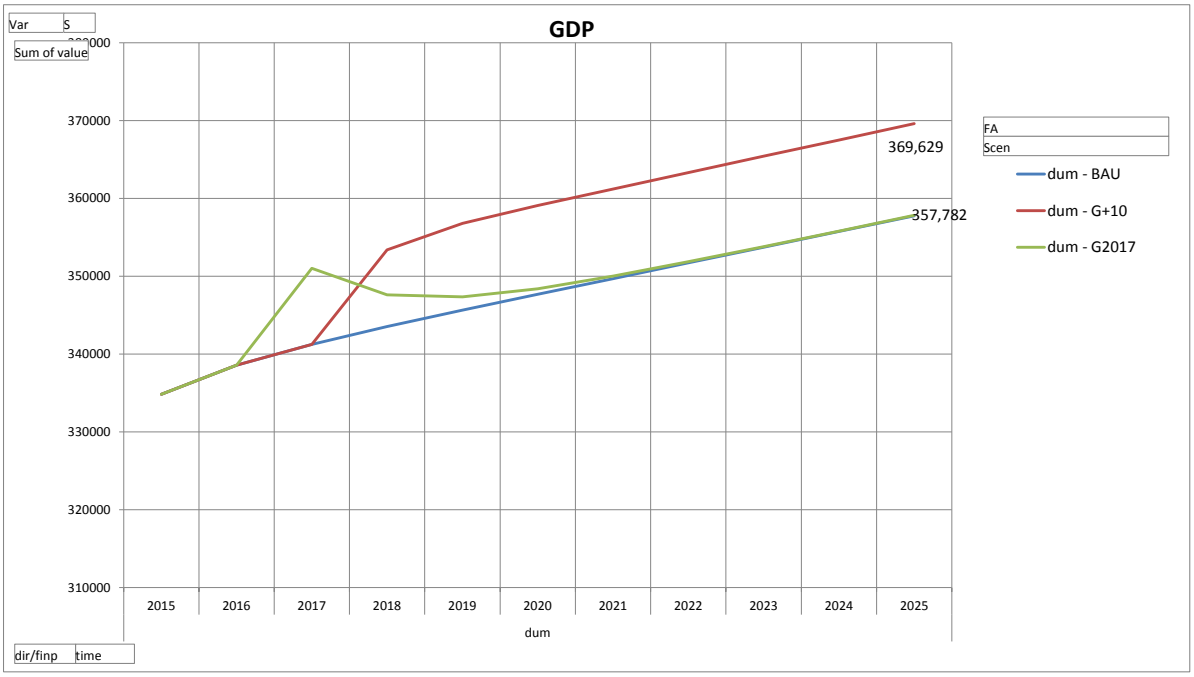
"G+10" The "G+10" scenario (red line) has the second best effects - it raises Austrian GDP by 3.3% as compared to the BAU scenario, and exhibits a multiplier of about 1.64. This implies

that the rise in government expenditure by 10 % (7.224 bln. Euro, which admittedly constitutes a large sum) leads to an increase of Austrian GDP by 11.848 bln. Euro. Please not again that no refinancing measures are taken in this case. Seemingly, the model is almost linear in the dimension of the amount of the tax increase: We tested the effects of a 1 % increase in government expenditure, and the multiplier remains the same until the third place behind the comma (to be discussed).

Interestingly enough, the instantaneous increase in government spending from the G+10 scenario raises operating surplus OS fast in the first year of the policy change, see 37 and figure 38 belwo, and then exhibits an almost flat line. Contrary to this, especially the tau_w-10, but also the T_firm scenario to a smaller extent, exhibit a slower, but longer increase in OS (to be discussed). This development for firm OS is mirrored by the OS of all sectors taken together (including mixed income in the household sector, see figure 38), where OS even falls after the initial steep rise induced by government consumption (to be discussed).

We tested the effects of an increase of government spending for the year 2017 by 10 % only to see how this mechanism works in the model, see figure 31 below, scenario G2017. It is interesting to see how the effects of government expenditure seem to die out in the model - after the initial rise in GDP in 2017, the growth path converges back to the BAU scenario (to be discussed).

Figure 31: The Effects a One-time Increase in Gov't Spending in 2017 (in mln. Euro)



"T_firm+1Mrd_Gup" Third in line as regarding GDP effects is the "T_firm+1Mrd_Gup" scenario. Here, in difference to the scenarios above, the additional tax revenue from the tax has been used to increase government spending. Even though smaller in its effects on GDP with about 0.7 % or 2.455 bln. Euro, it still exhibits a high multiplier of about 2.454. This means that the increase in firm taxes has additional positive external effects in the model. This might have to do with the fact that the operating surplus of the firm sector is not decreased by this tax, see figure 37 below.

"T_w+1Mrd_Gup" and "T_cap+1Mrd_Gup" These scenarios have rather small, but still positive effects as compared to the BAU scenario. In the case of a rise in the wage tax and a simultaneous increase in government spending, this increase amounts to about 0.12 % of GDP each or a rise of 432 mln. Euro. In the analogous case for the capital tax, GDP is increased by about 0.6% or 224 mln. Euro. Thus, they exhibit different multipliers: the capital tax has a smaller multiplier of about 0.223, the wage tax a multiplier of about 0.431. Thus, it seems as if an increase of the capital tax has larger negative effects on the economy in our model (to be discussed).

"T_w+1Mrd" A sole increase of the wage tax, in difference to all other scenarios in the model and as could be expected, has negative effects on the economy. The increase of the wage tax by one bln. Euro leads to a decrease of Austrian GDP of about 0,9 % or by 3.357 bln. Euro. This implies a tax multiplier of -3.357, exactly the same as for the reduction in the wage tax before. Again, we can see that the model is linear in this respect (to be discussed).

Drivers of these results To find out the driving force of the results on GDP growth, the effects on the different scenarios on consumption and income are depicted below in figures 32 and 33. As could be expected, the effect of decrease of the wage tax in the tau_w-10 scenario (light blue line on top) on consumption in figure 32 is by far the largest with an increase to almost 176.1 bln. Euro, i.e. 10.3 bln. Euro or 6.2 % more than in the BAU scenario (165.8 bln. Euro). This almost exactly corresponds to an increase in household income of 6.4 % (11.16 bln. Euro), see figure 33. This makes more transparent why the wage tax decrease scenario has such a high effect in this economy: it directly feeds back to household income and thus consumption, inducing Keynesian multiplier effects generating the high effects on GDP. Furthermore, operating surplus of all sectors is simultaneously increased by the reduction in wage the tax in scenario tau_w-10 (see figure 37) and 38, further improving the GDP effects of this tax measure .

Figure 32: The Effects of Scenarios on Consumption in the Model (in mln. Euro)

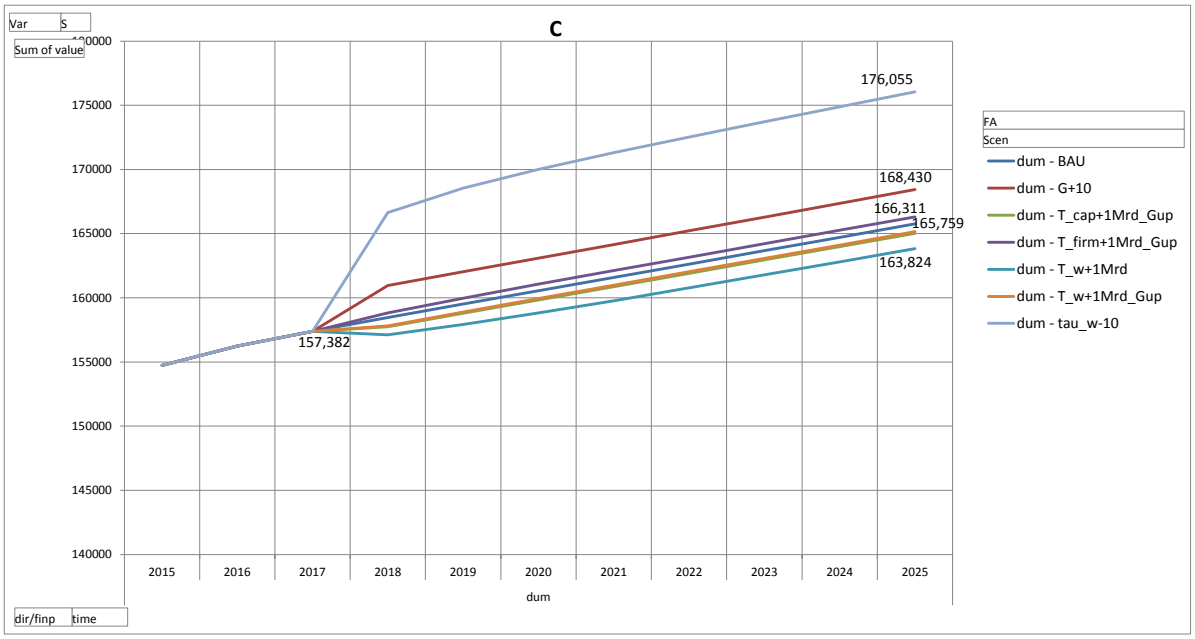


Figure 33: The Effects of Scenarios on Household Income in the Model (in mln. Euro)

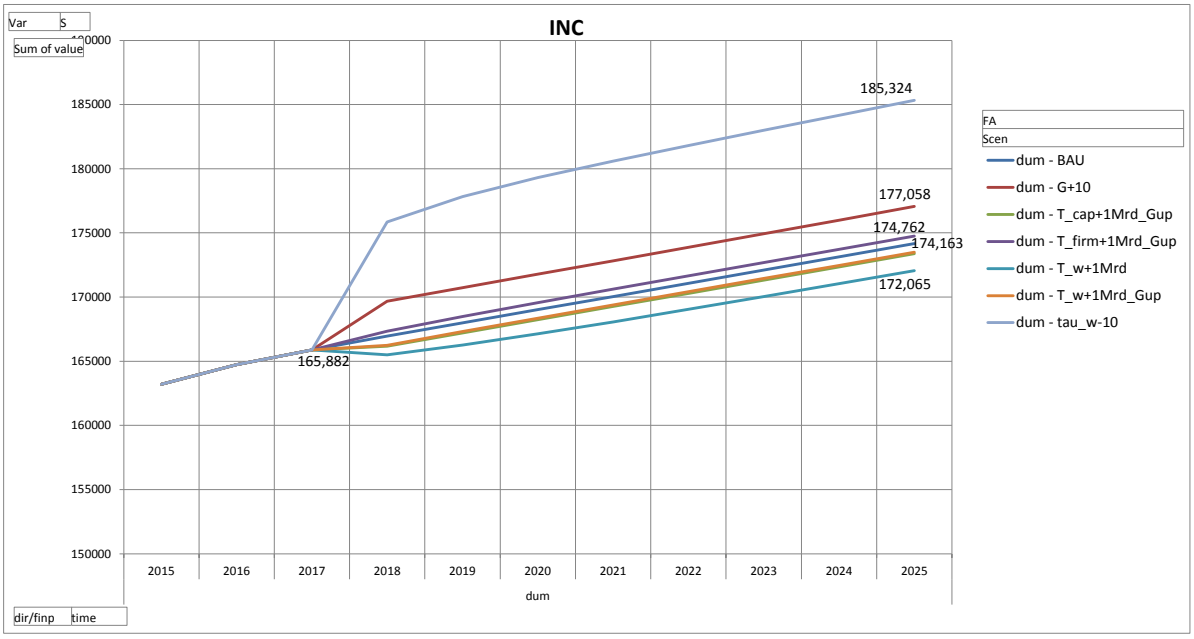
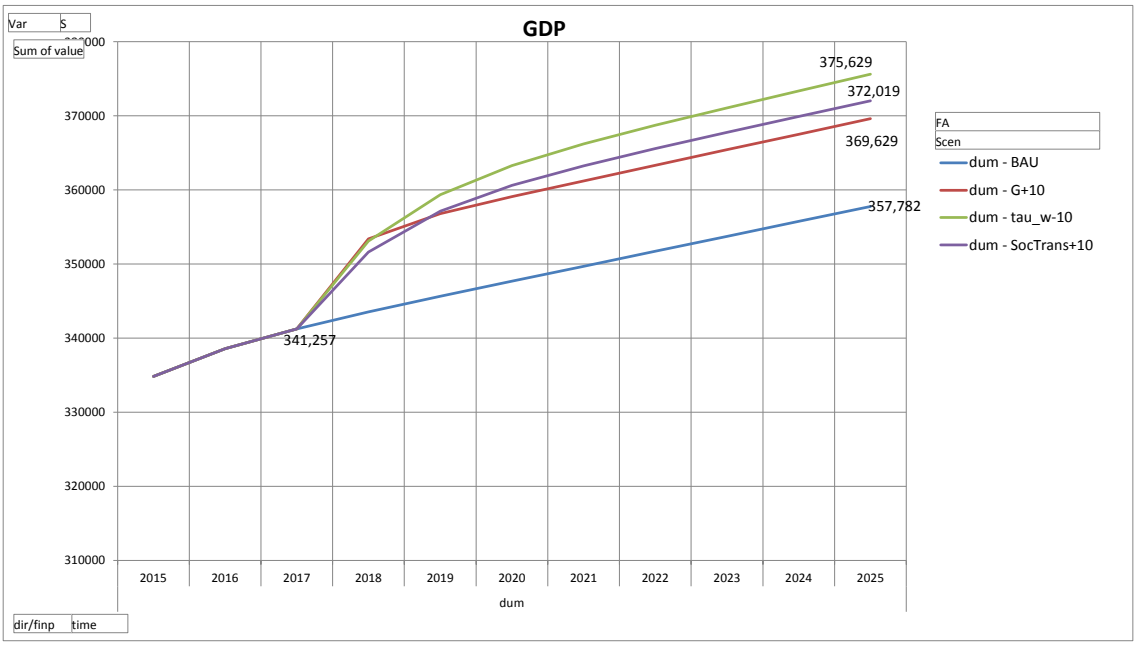


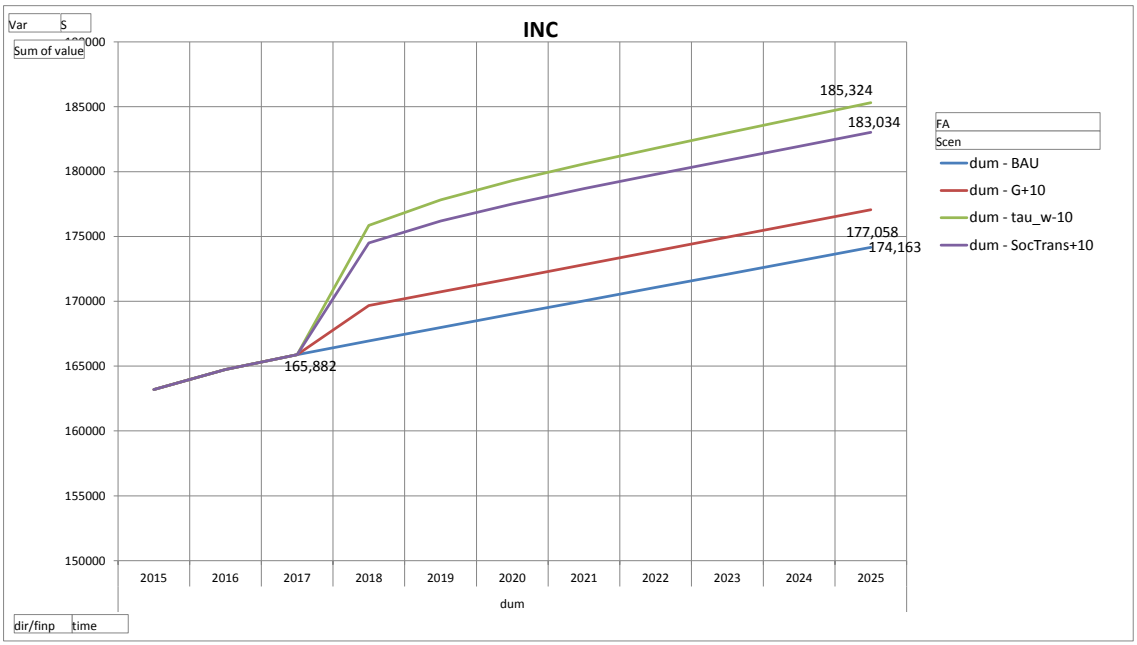
Figure 34: The GDP Effects of Selected Scenarios in Comparison - Including an Increase in Social Transfers (in mln. Euro)



Additional Scenario: "SocTrans+10" The government consumption increase G+10 has much less pronounced effects on the rise in household income and consumption: consumption rises by about 1.6 % or 2.67 bln. Euro, income by about 1.7 % or 2.9 bln. Euro (figures 32

and 33). This sheds light on our channel of government consumption, see table 2, cell in line consumption, row Govt PAID - which is a transfer from the government to the business sector, which does not seem to find its way fully through to the household sector to increase consumption (to be discussed). However, government expenditure can have a higher impact if directly applied to transfers from the government to the household sector, see figure 34 above. Following this train of thought: In the scenario "SocTrans+10", social transfers have been increased by 10 %, i.e. by almost 6.4 bln. Euro starting from the base value in the year 2014. Here, GDP is increased by about 4 % or 14.24 bln. Euro as compared to the BAU scenario. This gives us a multiplier of government expenditure of 2.23. The reason for this higher multiplier is quickly found in the direct impact of an increase in social transfers on household income, see figure 35 below. The increase in household income here is just below that of the tau_w-10 scenario featuring a decrease in the tax rate - even though the increase in government expenditures is higher by about 830 mln. Euro in the G+10 scenario.

Figure 35: The Effects on Household Income - including Increase in Social Transfers (in mln. Euro)



As investment follows last period's GDP, see equation (2), the effects on investment depicted in figure 36 follow the effects of GDP with a lag of one period for all sectors. Also here, the effects of the decrease in wage taxes in the tau_w-10 scenario overtakes the G+10 scenario, just one period later. Thus, a future improvement of the model could be to relate the investment function to the increase in revenue by the business sector, e.g. induced by an increase in government consumption. This would most likely raise the effects of a rise in government consumption in later versions of the model (to be discussed).

The effects on operating surplus of the NFC sector in particular, figure 37 and all sectors, figure 38, shed further light on the workings of the G+10 scenario of an increase in government consumption. While the OS of sectors increases in the first period of the higher government expenditure, they remain on this level, even experiencing a slight slump after the initial steep

rise in figure 38 showing OS for all sectors (to be discussed). Adding in a social transfers scenario in figure 39, we can see that via the additional consumption of households, the OS for all sectors is increased more in this scenario than in the G+10 scenario.

Figure 36: The Effects of Tax Scenarios on Investment in the Model (in mln. Euro, all sectors)

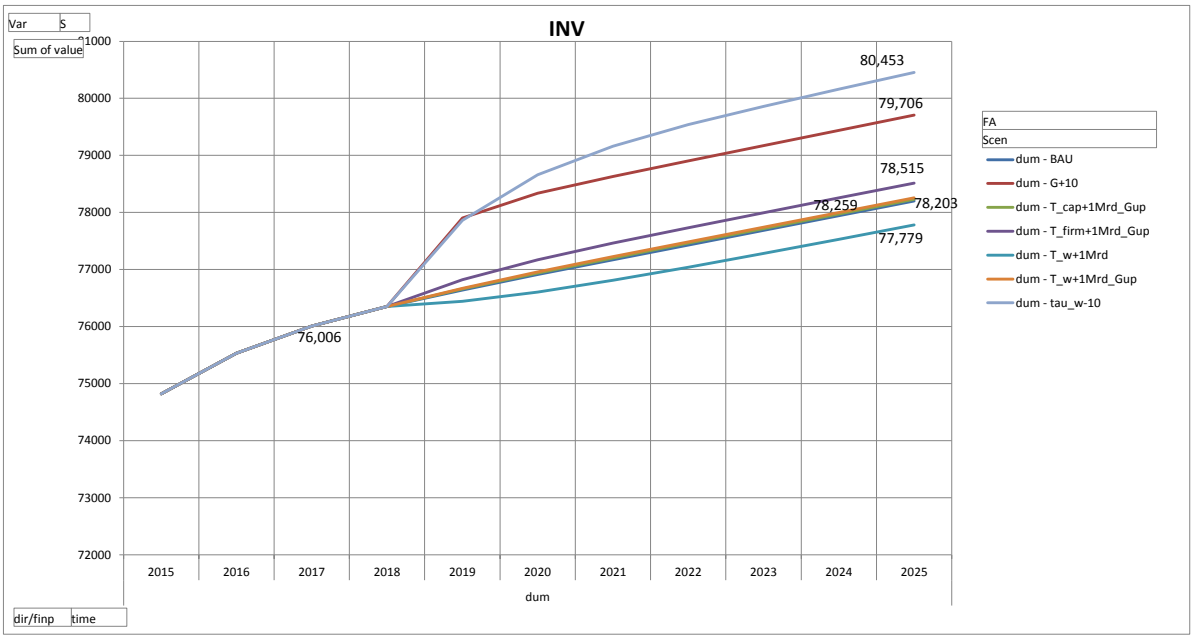


Figure 37: The Effects of Tax Scenarios on Operating Surplus in the NFC (firm) Sector in the Model (in mln. Euro)

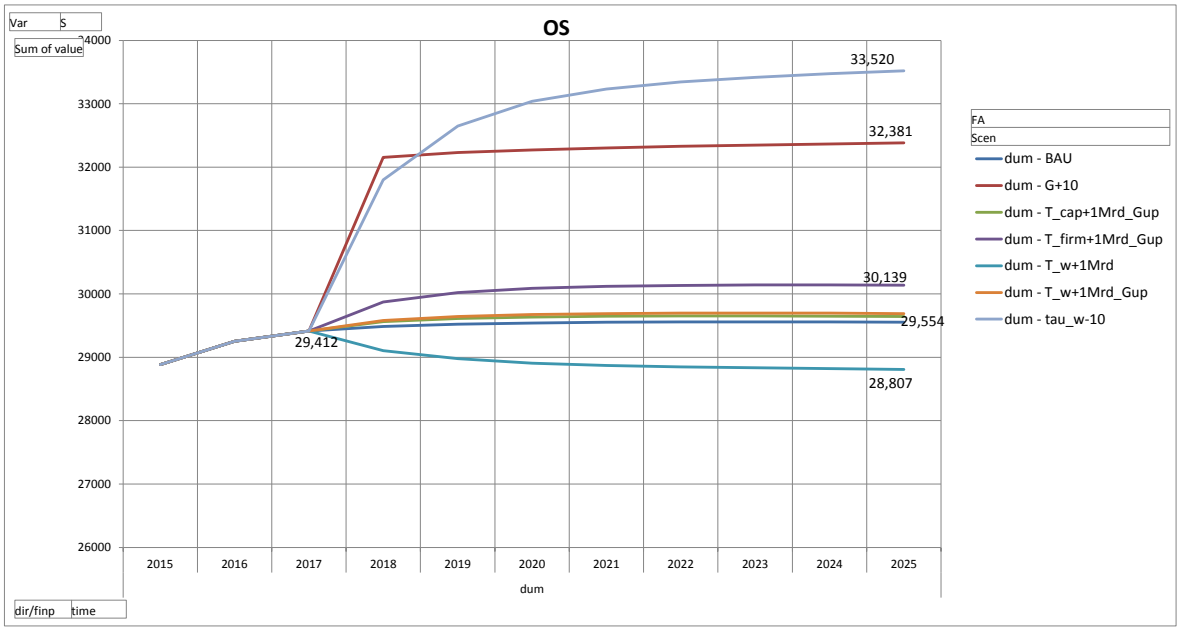


Figure 38: The Effects of Tax Scenarios on Operating Surplus of all Sectors (in mln. Euro)

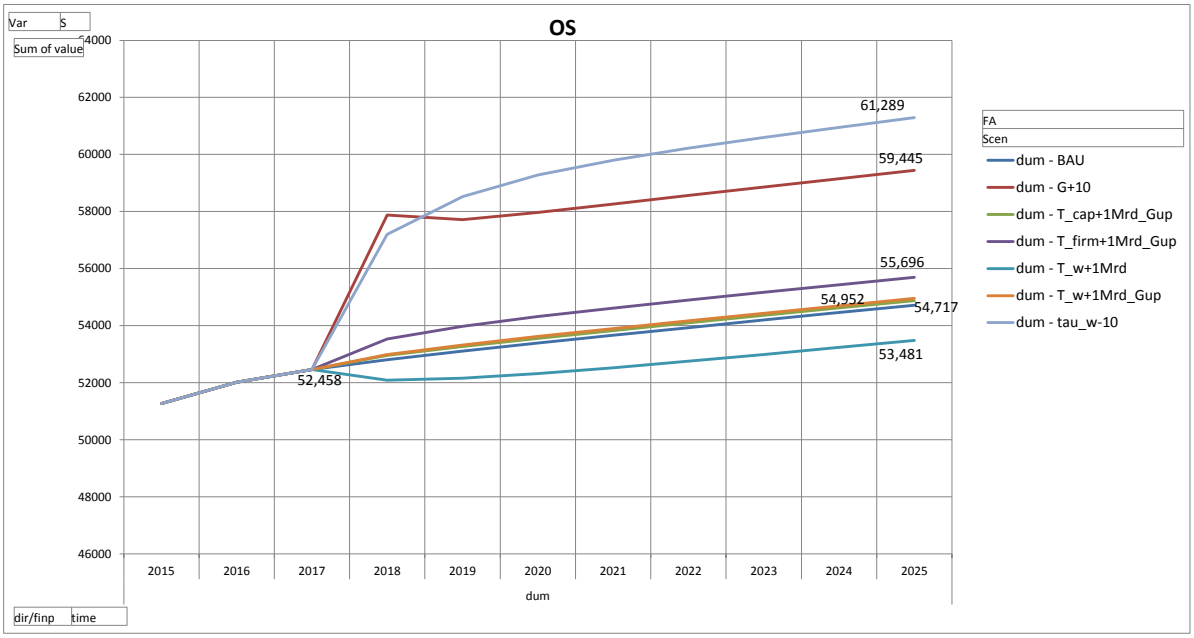
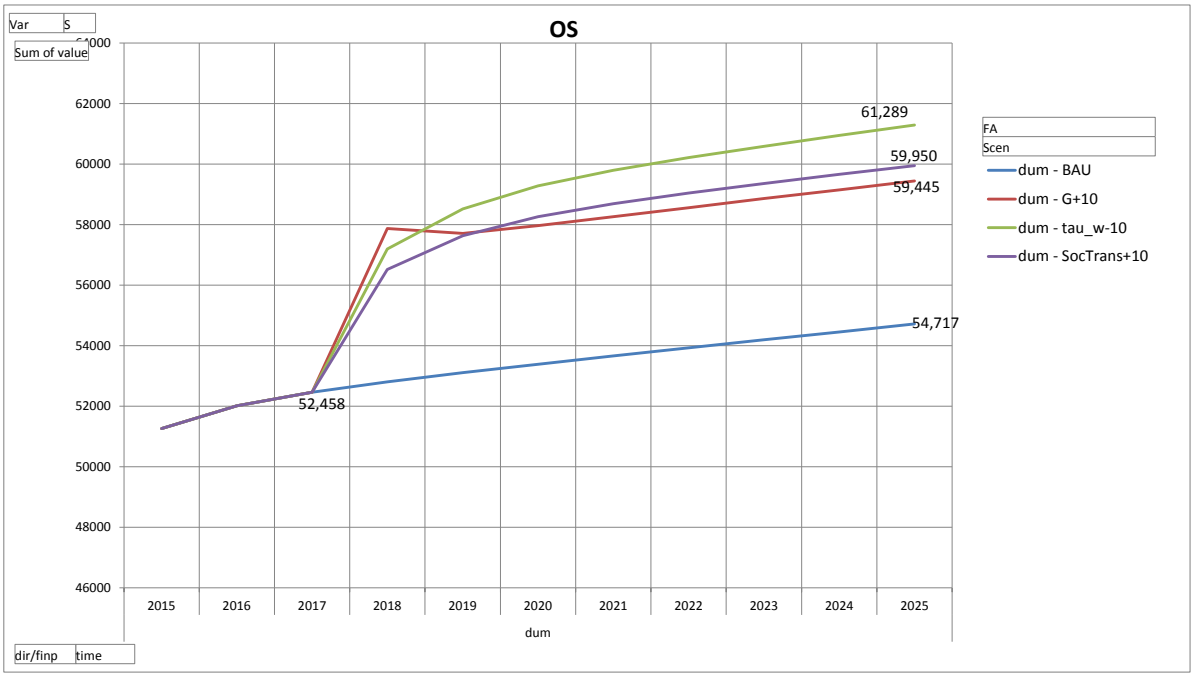


Figure 39: Operating Surplus of all Sectors incl. a Social Transfers Scenario (in mln. Euro)



6 Conclusion and Outlook

The purpose of this document was to give a first overview and exploratory simulations of a newly developed empirical SFC model of the Austrian economy, which is still work in progress. While the projections and mechanics of the model are quite simple and preliminary, it was our goal to show the richness of the underlying data structure (NASA data), and the holistic view of the Austrian economy that can be taken with this model. It was intended to introduce the reader to the principal logic as well as functioning of the model, and then to demonstrate its capabilities by the exploratory scenarios.

In comparison to the model presented in Schmelzer (2015), this model has undergone several improvements:

1. Several asset classes, including a finer depiction of the Austrian financial system
2. A more detailed tax and transfer system
3. Integration of financial accounts, including a first version of portfolio choice and balance sheet extension of agents.

The exploratory scenarios - even though preliminary in nature and not catered to the current political discussions in Austria - show basic mechanisms of how tax and other policy measures transfer to GDP growth and other crucial macroeconomic variables. It was demonstrated how different tax measures or methods of government expenditure have varying effects on decisive economic variables such das GDP, consumption, investment, household income, or operating surplus. We also showed the interaction between changes in tax rates and corresponding adaptations (or the lack of such) of government expenditures, and some of the most important channels how this policy changes transfer to the main variables of our model economy.

For further work, this preliminary model offers a broad base for extension and further improvement, since in already incorporates the full extent of the underlying NASA data structure and is scalable in the sense that this data structure can be transferred to other countries of the European Union. Among these points of improvement, extension and further work are the following:

1. Improved empirical foundations of trends and projections in model parameters, as well as exogenous variables.
2. Behavioural equations closer related to empirical evidence and economic theory.
3. Endogenous prices and returns for different asset classes, based on supply-demand interaction on financial markets.
4. Based on these prices and returns: a truly endogenous portfolio choice, with expectations formation by agents. These expectations not necessarily have to correspond the actual model outcomes in every period due to accounting constraints and behaviour of other agents not foreseen by the individual actors in the economy.
5. With endogenous prices and expectations formation, the dimension to implement endogenous financial cycles (boom-bust dynamics) in such a model is opened.
6. Improvement of the depiction of interest rates: different assets emitted nationally ("home" assets) and by the RoW ("foreign" assets) with different interest rates, and a better disaggregation of interest rate payments for the sub-sectors of financial corporations related

to additional data sources, if available. One further possibility in this field would be to calculate the spread between the return to different assets received by the agents and let their behaviour be influenced by these spreads.

7. Endogenous employment and unemployment, at best related to endogenous business cycles.
8. Include physical capital such as real capital by firms and houses - take data e.g. from firm-level data sets.
9. Add in structure from I/O tables, i.e. a sectoral, detailed production sector with an integrated structure.
10. Apply this framework, once more mature, to other countries of the Eurozone (single country models).
11. Link these single country models via non-financial and financial flows between different countries (an extension only envisaged for the medium to long-term horizon).

As can be inferred from the long list above, this framework has the potential for extensive future work and research, offering a prospect on scientific novelty in several aspects along the way. As regarding the political dimension, the broad view on the economy as an integrated system of flows and stocks presents a viable framework for policy evaluation and recommendations. Endogenous dynamics derived from empirical data help to capture likely developments of recent and long-term economic trends and their effects on overall economic developments. Basing the assumptions on agents' behaviour in these models firmly on empirical evidence and economic theory can help in addressing potential criticism regarding the choice of these assumptions.

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