A MODEL FOR A MULTI-COUNTRY, FISCAL DECISION - GAME

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Preface

This memorandum forms part of a project aimed at the development of a multi-country fiscal decision game. It mainly comprises the mathematical model of the game and is intended to invite criticism with respect to the ideas proposed.

We are indebted to Pofessor Dr. Wilhelm Weber who inspired and generously sponsored our project.

We also wish to thank Professor Dr. Roppert for kindly having read and discussed an earlier version of the manuscript.

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W.G.
C.S.
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I. Introduction

The motivation for the proposed game stems from the deficiencies and shortcomings of traditional management decision games. The latter simulate but one market, viz., the market for consumer-goods, and neglect - to name just the most important - the capital-goods market, the labour market, and the money market. Moreover, economic policy does not appear as a deliberate governmental strategy for the implementation of macro-economic goals, but is, if at all, represented only by some ta -parameters which are more or less arbitrarily fixed by the game direction. For both of these reasons, viz., the neglection of economic interdependence on the one hand and the omission of the government as an independent decision maker on the other hand, we doubt whether the traditional management games provide a realistic setting for the simulation of entrepreneurial decision making.

Apart from these objections we felt that the representation of governments by individual groups of players would offer the additional advantage of permitting the simulation of decision making not only in the field of management but also in the sphere of fiscal and macro-economic policy, which hitherto has been beyond the scope of traditional decision games.+)

+) This approach must, however, not be confused with the recently developed so-called macro-economic or econometric games which are in principle programmed econometric models showing the possible developments of the simulated economy under different sets of arbitrarily chosen parameters. (Cf. L.R.Klein und M.K. Evans, Econometric Gaming, New York 1969). In constrast to this our proposed model is entirely deterministic and forms the basis for a true decision game with various decision-making units with conflicting interests.

We therefore propose a game with the following characteristics:

(i) introduction of three groups of players representing the governments, producers of consumer goods and producers of capital goods;

(ii) introduction of three countries with the purpose (a) of creating a competetive situation of alternative economic policies between the three governments, and (b) of providing the possibility of international trade;

(iii) strict observation of the principle of economic interdependence with no economic flows other than between agents defined in the game;

(iv) introduction of four markets common to all players, viz., a market for consumer goods, a market for capital goods, a labour market and a money market.

When completely worked out the game is to comprise the following parts:

(i) a detailed players' manual (of which part II of the present paper is a draft)

(ii) presentation of the parameters, variables and the mathematical model behind the game (equivalent to part III of the present paper)

(iii) a FORTRAN IV computer program for the actual operation of the game

(iv) a flow-chart of the computer program

(v) a proposal for initial values (indispensable for actual operation)

(vi) a guideline and a program for the final evaluation of the players' performance (a sketch for this guideline

may be found in section 4.2)

The purpose of the present paper is to acquaint the reader with our ideas and to invite criticism and suggestions for further improvement.

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II. How to Play the Game

1. A general outline of the game

15 groups of players participate in the game. There are three groups representing the respective governments of three different countries. Nine groups of players represent firms producing consumer goods. They are equally distributed over three countries. It is further assumed that every country has a capital goods industry of its own, each being represented by a group of players. The game takes place under the supervision of a game direction responsible for organization and computation.

The game extends over an arbitrary number of periods (each of which can be interpreted as a fiscal year). Within a period the following stages can be discerned: at the beginning of a period all players receive certain information (mostly results from the previous period) on the basis of which they make their decisions for the present period. The outcome of this decision-making process is a number of parameters[+], the values of which are fixed, entered into a decision form and handed over to the game direction. These data are now punched into cards and fed into the computer, where they are processed. By means of the computer program several markets are simulated (money market, labour market, market of consumer goods) and on the basis of this procedure the accountancy of the firms, the budgets of the governments and additional statistical information on

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[+] Some of these parameters, are, however, obtained in the course of an auction which is described below.

the three economies are calculated and printed (balance sheet, profit and loss account, financial status, list of machinery, budget, status of public reserves and liabilities, sheet of statistical information). The data thus obtained are the results of the period and serve as information for setting the parameters of the subsequent period.

A closer look at the decision making process reveals the following sequence: at the very beginning of the game the game direction sets its parameters which normally will remain unchanged throughout all periods. The majority of these parameters are communicated to all players. At the beginning of each period the respective governments have to fix their parameters first. These governmental parameters - corresponding to fiscal and social legislation - are made known to all firms. Thus provided with the legal frame, they are now in a position to work out a strategy for the period. The capital goods required are bought at an auction.+) Now all firms (i.e. those producing consumer goods as well as those producing capital goods) fill in their decision forms and hand them over to the game direction.

+) The rules of the auction are explained in detail later.

2 Detailed instructions for the players

(2.1) Governments

Each government receives the following data at the beginning of period t:

(i) Some parameters from the game direction[+]: number and salary of the civil servants, the compulsory repayment ratio, the fraction of minimum amortisation of the uncovered public debt[++], minimum rate of interest[+++], minimum public consumption, license fees, unemployment benefit coefficient.

(ii) Its own budget and status of public reserves and liabilities for the preceding period (cf. tables 1 and 2).

(iii) General information provided by the statistical bureau of the country (cf. table 3).

(iv) The balance sheets and profit and loss accounts of the preceding period of all firms situated in the particular country (cf. tables 4, 5, 6, and 7 in sec. 2.2, 2.3 resp.).

Provided with these data, the government should be able to design a strategy for its future economic and fiscal policy. According to this strategy the government has to determine values for its parameters of action by means of which it is able to influence the economic activities.

[+]) The complete table of parameters is provided in sec. 4

[++]) The meaning of this ratio is also explained in sec. 3.1 (money market)

[+++]) See also sec. 2.2 and 2.3.

(cf. the decision form for governments, table 8).

The parameters to be fixed have the following effects:

(a) Tax rates

(i) The pay-roll-tax is levied on the total of wages and is paid by the firms. By fixing a high rate of pay-roll-tax the government increases the cost of labour and thus induces the firms to substitute capital for labour. As a consequenc of this the government must be aware of a possible increase of the rate of home unemployment (if the workers are not absorbed by other countries where there is a shortage of labour).

(ii) The turnover-tax is levied exclusively on home sales of consumer goods. Exported consumer goods are not subject to turnover-tax, for duties are considered an instrument sufficient enough to control foreign trade effectively. For the sake of simplicity all sales of capital goods are exempt from turnover-tax and duties. (The reason for this provision will be clear if the reader is acquainted with the conditions of the auction).

(iii) The property tax is levied on the firms' capital plus the accumulated amounts of profit reduced by the accumulated losses. By increasing the rate of property tax the formation of capital is impeded and the firms become more susceptible to bankruptcy.

(iv) The income-tax-function is based on a tangens hyperbolicus curve with the parameters ${}_1\varepsilon_\varsigma^t$, ${}_2\varepsilon_\varsigma^t$ and ${}_3\varepsilon_\varsigma^t$.

The arguments of this function are the respective income tax bases (profit less income tax allowance for firms; wages and salaries per employee less income tax allowance for individuals); the values of the function are the respective rates of income tax as a percentage of the tax basis. Changes of the parameters ${}_1\varepsilon_\varsigma^t$, ${}_2\varepsilon_\varsigma^t$, ${}_3\varepsilon_\varsigma^t$ have the following effects upon the income tax function:

${}_1\varepsilon_\varsigma^t$ is the maximum rate of income-tax

${}_2\varepsilon_\varsigma^t$ determines the steepness of the progression

${}_3\varepsilon_\varsigma^t$ fixes the point where progression is proportional, i.e. where the transition from accelerated to delayed progression takes place (geometrically speaking it is the point of inflection).

(b) Duties:

Duties are imposed on imports of consumer goods only. (The reader is reminded that imports of capital goods are exempt from duties.) Two different kinds of duties are available to the governments: specific duties and ad valorem duties. Specific duties are charged per unit consumption goods whereas ad valorem duties are computed as a fraction of the value of the commodities. It should be noted that both specific and ad valorem duties can be imposed simultanously and may be differentiated with respect to the different countries.

(c) Subsidies:

(i) Subsidies paid as lump sums are primarily intended to avoid bankruptcy of an individual firm and must therefore exceed or at least equal, the amount of bad debts caused by insolvency. Of course this kind of

subsidy may also be used for any other purpose.

(ii) Subsidies paid per employee are intended to reduce the cost of labour to decrease unemployment and to influence the marginal rate of substitution between labour and capital.

(iii) Subsidies paid as a fraction of non-liquid assets influence the rate of substitution between labour and capital in the opposite direction and thus (at least indirectly) favour the capital goods industry.

(iv) Subsidies on total sales contribute to the expansion of production, to the reduction of prices and to an increase in the standard of living. If, however, this subsidy is not or not entirely passed on to the consumers it has not the effects mentioned but increases profits and by this way investment.

(v) Subsidies on exports are intended to improve the export performance of domestic firms on foreign markets.

(d) Credit parameters:

(i) The amount of loans desired has to be determined on the basis of a budget forecast. Among other considerations the government has to make provision for the compulsory debt repayment, which is calculated as a fraction (determined by the game direction) of the total of liabilities. The government must also be aware of the fact that it competes with all other governments and firms for a limited amount of credit, the final allotment of which is essentially influenced by the rates of interest offered by the respective applicants for credit. A further restriction on the amount of loans desired consists in the existence of a credit restraint ratio (fixed by the game direction),

which prevents each applicant from demanding more credit than a certain multiple of his liabilities at the end of the previous period. In order to counteract uncertainty resulting from the budget forecast as well as from the credit allotment, it would be advisable for the governments to demand slightly more credit than would be necessary on the basis of the budget forecast.

(ii) The rate of interest offered must exceed (or at least equal) the minimum rate set by the g[illegible]ne direction and it is decisive for the final allotment of credits.

(iii) Voluntary redemption of the public debt: it is up to the government to repay part of its debt in addition to the compulsory repayment.

(e) Other parameters:

(i) By means of the minimum wage rate collective bargaining is introduced into the model. As there are no separate players representing trade unions we have decided to convey the fixation of the minimum wage rate to the government.

(ii) If a producer of consumer goods intends to export, he has to maintain a branch in the respective country. In order to simplify taxation, the firm running the branch has to pay a lump sum (determined by the government of the country in which the branch is situated) to the respective country. This lump sum is further referred to as "fee". Other costs are regarded as insignificant and are included in this fee.

(iii) The amount of public consumption must exceed (or at least equal) the minimum public consumption fixed by the game direction. It represents additional demand and thus helps the consumer goods industry to maintain or even increase their sales.

The rules of the game require for the financial status of any firm that the current disbursements must not exceed the sum of cash plus current receipts. If, however, this is the case, the firms are assumed to enjoy enough credit as to bridge this financial gap by means of issuing uncovered bills of exchange. Should the firms in the subsequent period again fail to meet their current obligations plus their uncovered bills of exchange, if any, they are considered bankrupt. Now the government has to decide whether it covers the bad debts or not. In the latter case the respective firms are excluded from further gaming and their bad debts are deducted from the funds available on the money market.

The same applies if in one period the accumulated losses exceed the accumulated profits plus capital. If the government does not cover the gap by means of a lump sum subsidy at the beginning of the next period, the respective firm is also excluded from further gaming.

If the budget reveals a deficit the gap is filled by issuing uncovered bills of exchange. In the following periods, however, the government is required to honour at least a certain fraction (determined by the game direction) of the amount of uncovered bills from the last period. Should it fail to do so or should it even increase its bad debts it rests with the game direction to decide whether to keep this country in the game or not.

(2.2) Firms producing consumer goods

Each firm producing consumer goods receives the following data at the beginning of period t:

(i) Some parameters from the game direction[+]: compulsory repayment ratio, credit restraint ratio, minimum rate of interest, licence fee per unit consumer goods, machine hours per unit consumtion goods (three kinds of machinery), hours of labour per unit consumption goods (three values depending on kind of machinery), rates of depreciation (different for each kind of machinery), initial capital of the firm, rate of penalty.

(ii) Balance sheet, profit and loss account, financial status and list of machinery for the preceding period (cf. tables 4, 6, 9, and 11).

(iii) General information provided by the Statistical Bureau of the country (cf. table 3).

(iv) Part of the decision forms of all governments concerning the period under consideration (cf. table 8). and representing the respective national legislations for the present period: tax rates, income tax allowance, fees for maintaining a branch in foreign markets, rates of duties, information on subsidies, minimum wage rates, amount of public consumption.
Each firm that had bad debts at the end of the preceding period is advised to observe its respective column under the heading "Subsidy paid as a lump-sum". If the subsidy is insufficient to cover the bad debts, the firm may regard itself as being excluded from the game.

+) The complete table of parameters is provided in sec. 4.

The firm is now in a position to acquaint itself with the data and to work out a general policy for the period. The capital goods required are bought at an auction which will be described in detail in sec. 3.4. The machinery ordered is delivered at the end of the period; it must, however, be prepaid at the beginning of the period (i.e. immediately after the auction). If the capital goods industry fails to deliver a machine it has to pay a penalty, which the firm will receive together with the refund of its prepayment at the beginning of the next period.

Knowing all these data and having drawn up a trial balance sheet, a trial profit and loss account and a trial financial status the firm should now be in a position to fix its parameters. (Cf. table 13)

The parameters to be fixed have the following effects:

(a) Workers:

The number of workers actually allotted depends mainly upon the wage rate offered and on the number of workers employed in the previous period (not on the number of workers desired for the period under consideration).

(b) Credit:

(i) The amount of loans desired has to be determined on the basis of the trial financial status. Among other considerations the firm has to make provision for the compulsory debt repayment which is calculated as a fraction (determined by the game direction) of the total of liabilities. The firm must also be aware of the fact that it is competing with all governments and all other firms for a limited amount of credit , the final allotment of which is essentially

influenced by the rates of interest offered by the respective applicants for credit. A further restriction on the amount of loans desired consists in the existence of a credit restraint ratio (fixed by the game direction) which prevents each applicant from demanding more credit than a certain multiple of his liabilities at the end of the previous period. In order to counteract uncertainty resulting from the trial financial status as well as from the credit allotment it wo ld be advisable for the firms to demand slightly more credit than would be necessary according to the trial financial status.

(ii) The rate of interest offered must exceed (or at least equal) the minimum rate set by the game direction and is decisive for the final allotment of credits.

(iii) Voluntary debt redemption: it is up to the firm to repay part of its debt in addition to the compulsory repayment.

(c) Prices per unit and advertising:
Each firm may fix three prices at the most (charged on the home market and on two export markets) and three amounts of advertising expenditure. The prices of the current period together with the market shares of the previous period and the advertising expenditure influence the actual sales of the firm.

(d) The quantity of consumer goods intended to be produced has to match the capacities of machinery and labour force. If the quantity is not in line with the capacities available, it is automatically adjusted in the computer stage.

If the current disbursements exceed the total of money and current receipts, the firm either issues uncovered bills of exchange or has bad debts. For the consequences in both cases see sec. 2.1.

(2.3) Firms producing capital goods

Each firm producing capital goods receives the following data at the beginning of period t:

(i) Some parameters from the game direction+): compulsory repayment ratio, credit restraint ratio, minimum rate of interest, licence fees for the production of 4 kinds of machinery, machine hours for the production of one machine of each kind, hours of labour for the production of one machine of each kind, rate of depreciation, initial capital of the firm, rate of penalty, fixed amount for the valuation of the machinery for own use.

(ii) Balance sheet, profit and loss account, financial status and list of machinery for the preceding period (cf. tables 5, 7, 10, and 12).

(iii) General information provided by the Statistical Bureau of the country (cf. table 3).

(iv) Part of the decision forms of all governments concerning the period under consideration (cf. table 8) and re-

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+) The complete table of parameters is provided in sec. 4.

presenting the respective national legislations for the present period: tax rates, income tax allowance, information on subsidies, minimum wage rates. Each firm that had bad debts at the end of the preceding period is advised to observe its respective column under the heading "Subsidy paid as a lump-sum". If the subsidy is insufficient to cover the bad debts, the firm may regard itself as being excluded from the game.

The firm is now in a position to acquaint itself with the data and to work out a general policy for he period. The capital goods to be produced are sold in advance at an auction the details of which are described in sec. 3.4. The machinery ordered is delivered at the end of the period; it must, however, be prepaid by the buyers at the beginning of the period (after the auction has taken place). If the machinery ordered cannot be delivered, a penalty must be paid which will be remitted to the buyer together with the refund of his prepayment at the beginning of the next period.

Knowing all these data and having drawn up a trial balance sheet, a trial profit and loss account and a trial financial status, the firm should now be in a position to fix its parameters (cf. table 14).

The parameters to be fixed have the following effects:

(a) Workers:

The number of workers actually allotted depends mainly upon the wage rate offered and on the number of workers employed in the previous period (not on the number of workers desired for the period under consideration).
The number of workers desired has to be geared both to the machinery available and to the amount of capital goods sold at the auction.

(b) Credit:

(i) The amount of loans desired has to be determined on the basis of the trial financial status. Among other considerations the firm has to make provision for the compulsory debt repayment which is calculated as a fraction (determined by the game direction) of the total of liabilities. The firm must also be aware of the fact that it is competing with all governments and all other firms for a limited amount of credit, the final allotment of which is essentially influenced by the rates of interest offered by the respective applicants for credit. A further restriction on the amount of loans desired consists in the existence of a credit restraint ratio (fixed by the game direction) which prevents each applicant from demanding more credit than a certain multiple of his liabilities at the end of the previous period. In order to counteract uncertainty resulting from the trial financial status as well as from the credit allotment it would be advisable for the firms to demand slightly more credit than would be necessary according to the trial financial status.

(ii) The rate of interest offered must exceed (or at least equal) the minumum rate set by the game direction and is decisive for the final allotment of credits.

(iii) Voluntary debt redemption: It is up to the firm to repay part of its debt in addition to the compulsory repayment.

(c) The quantitiy of capital goods intended to be produced has to match the capacities of machinery and labour force. If the quantity is not in line with the capacities available, it is automatically adjusted in the computer stage.

If the current disbursements exceed the total of money and current receipts the firm either issues uncovered bills of exchange or has bad debts. For the consequences in both cases see sec. 2.1.

3. The simulation of market behaviour

Since there exist no real markets within the game (with the exception of the capital goods market) they have to be replaced by computational procedures. This is done by the computer according to certain algorithms the o eration and assumptions of which will be described below. It has, of course, not been possible to allow for all determinants of real world market behaviour. Therefore the main idea of our considerations is to replace a multitude of real world behaviour patterns by some simpler device entailing almost the same effects while employing considerably less complicated methods of simulation.

(3.1.) The money market

At the beginning of the game a certain amount of cash is assumed to exist in all three economies. Moreover, additional funds may be created on a fiduciary basis. These funds are assumed to be a multiple of the sum of the respective national incomes (of the preceding period) at factor cost plus unemployment benefits. If there are bad debts, caused in former periods by bankrupt firms or governments, they are subtracted from the fiduciary issue for all periods subsequent to the respective bankruptcies.

Thus the total amount of credit available for lending in period t (i.e. the period under consideration) consists of the adjusted fiduciary issue less outstanding liabilities. This amount of credit is increased in each period by com-

pulsory and voluntary repayments and redemptions. In allocating credit two cases can be discerned: in the trivial case the funds available exceed or equal the total of credit desired and thus all economic agents are provided with the amount of credit they had applied for. In the opposite case only part of the respective amounts of credit desired can be allotted. The allocation prodecure rests on the rates of interest offered on the one hand and on the amount of credit desired on the other. In order to prevent the amount of credit desired from exerting undue influence on the allotment of credit a limit is imposed on the funds desired.

The allotment of credit is accomplished by means of refraction coefficients the detailed computation of which is shown in sec. III.3.

We are well aware of the fact that on real world capital markets a uniform rate of interest emerges as a result of supply of and demand for credit. In economic theory this uniform rate of interest is commonly referred to as the marginal efficiency of capital. As we have no permanent money market in the game we cannot reflect the individuals' changing preferences on the rate of interest. Moreover the marginal efficiency of capital directly results from the individuals' preference orderings. At the uniform rate of interest all applicants for credit that would be willing to pay a higher rate of interest enjoy a "debtor's surplus"+). As we have no other means to induce the applicants for credit to reveal their preference orders we must force them to true bids by actually charging them the rates of interest they offered. That is the reason why credits are granted at different rates of interest within the same period.

+) The term debtor's surplus is used by analogy with Marshall's consumer's surplus. Cf. Alfred Marshall, Principles of Economics, 8th edition, MacMillan & Co Ltd., London 1947, S 124.

(3.2) The Labour Market

The sum of the population of all three countries is considered constant throughout all periods. The population of each country is made up of three groups: civil servants, employed workers and unemployed. While the number of civil servants is assumed constant for each country, the number of workers (employed or unemployed) may vary. To put it in other words, the game is based on the principle of complete mobility of labour. All firms submit among their parameters the number of workers they desire for the period and o fer wage rates (which must exceed a certain minimum set by the respective governments). In the allocation of labour three possible situations may arise: if the demand for labour is equal to the supply, each firm receives the workers desired and there are no unemployed.

If the demand for labour exceeds the supply, the workers are allotted according to the wage rates offered on the one hand and to the number of workers employed by the respective firm in the preceding period on the other. The wage-rate-criterion secures that the workers seek employment in those firms where higher wages are offered whereas the second criterion reflects the workers' firm-loyalty. In allotting the workers to the firms, we must, however, observe the condition that no firm gets more workers than desired. Thus the problem has to be solved by an iterative process. (Of course there are no unemployed). If the supply of labour exceeds the demand, each firm receives the number of workers desired. Now unemployment prevails and our problem consists in apportioning the unemployed. We can discern four subcases, if we base our differentiation on a comparison of the workers allotted in period t with the sum of employed and unemployed workers of the country under consideration in period t-1 in

the following referred to as W^{t-1}:

(i) the firms of two countries employ an equal or higher number of workers than W^{t-1}; now all unemployed are apportioned to the third country, as the two other countries have employed all their workers which were unemployed in t-1 (if unemployment existed at all in these countries in t-1).

(ii) neither of the three countries employs an equal or a higher number of workers than W^{t-1}; this implies that no movement of labour force has taken place and the number of unemployed of each country is the difference between W^{t-1} and the number of workers employed in t.

(iii) the firms of one country employ an equal or higher number of workers than W^{t-1}; whereas the two other countries employ fewer than their respective W^{t-1}. For these two countries we check whether or not they have increased the number of employed workers with regard to the previous period.

(a) If one of them increased employment while the other failed to do so, the number of unemployed of the latter is determined as the difference between W^{t-1} and the number of workers employed at present, while the remainder (if there is such) is apportioned to the other country. This serves an educational purpose (goal of full employment).

(b) If both either increase or reduce employment the unemployed are allocated proportionally (see sec. III.4).

(3.3) The consumer goods market

First we have to allow for adjustments in the amounts of consumer goods actually produced and offered. The desired amount of production as stated in the decision form has to be adjusted both according to the labour force the firm has been able to acquire (see sec. 3.2) and according to the capacity of machinery available in the considered period. The amounts of consumer goods the firm intends to offer for sale have now to be corrected in order to be in line with the production facilities previously adjusted. In this context stocks may arise if the firm has decided not to offer for sale all goods available either from stock or out of current production.

For the purpose of determining the firms' total sales we have to compare the total supply of consumer goods (in money terms) with the purchasing power (i.e. overall demand for consumer goods) for each market. If the value of the total supply does not exceed the purchasing power each firm sells all goods offered in the respective market and the remaining purchasing power is carried forward to the next period (hoarding is assumed). In the opposite case not all goods offered can find buyers and we therefore have to solve the problem of evaluating for each seller the amount of unsold goods.

Each seller's market share is considered a function of its previous market share (in real terms), of the price charged by the individual firm and of the amount of advertising expenditure. All goods offered beyond this market share remain unsold and are stocked. A firm, which intends to export, has to maintain a branch in the respective country. For the branch a fee is levied by the government of the country where the branch is located (it is assumed that no additional costs arise). If the exporting firm considers the costs of a foreign

branch to high, it may decide not to offer any goods for sale, and to stock the goods which remained unsold from previous periods in a bonded warehouse.

(3.4) The capital goods market (auction)

The capital goods market is simulated by an auction; each firm producing consumer goods delegates one representative and each firm producing capital goods sends two representatives.

The auction runs as follows:

(i) First the auctioneer invites the producers of capital goods to submit an offer. If more than one seller wants to take the floor the auctioneer draws the lot between them.

(ii) Each producer(one after the other) calls his prices for one machine of each kind (he need not, however, offer all kinds of machinery).

(iii) It is now up to the offerees (firms producing consumer goods) either to make use of these offers or not. Each transaction resulting from an offer must not involve more than one machine of each kind. In other words: each time a machine has been sold the corresponding offer ceases to be valid any longer (for the respective kind of machinery).

(iv) If two or more offerees are attracted by the same offer (concerning the same kind of machinery) the auctioneer auctions off the particular machine between the competing buyers.

(v) For each transaction the auctioneer issues a contract note in triplicate (one for the buyer, one for the seller

and one for the game direction). (See table 15).

(vi) After each producer of capital goods has had the opportunity of submitting his offers, it is the buyers' turn to bid. If more than one buyer wishes to bid at the same time the auctioneer determines the order of their succession (e.g. by drawing the lot).

(vii) Each buyer bids a certain sum for the kind of machinery he wishes to acquire.

(viii) If two or more producers take up a particular bid, a Dutch auction takes place.

(ix) Another contract note is issued.

(x) After each contract one of the representatives of each capital goods producer has to calculate the remaining unemployed capacities of labour force and machinery (see table 16).

(xi) If a producer of capital goods is not able to manufacture in period t all machinery sold at the beginning of period t and is thus not in a position to deliver all machines at the end of t, he must pay a penalty of half the contract price (of the machines not delivered) to the respective buyers in addition to the reimbursement of the (pre-paid) contract price itself.

(xii) Apart from the machinery for the firms producing consumer goods, the capital goods producers have to manufacture the machinery for their own use. These machines are valuated at a fixed price.

(xiii) After the auction, each capital goods manufacturer has to file his contracts (together with the machinery to be produced for own use) according to his preferences. The preferences are revealed by a number (1 being assigned to the most important contract, 2 to the second impor-

tant, etc.) for each contract. (See table 17).

(xiv) Each producer of capital goods lists his contracts in table 17 and submits it to the game direction, where all entries are checked before they are punched into cards.

4 The game direction

4.1 Parameters of the game direction

The game direction determines the setting of the game by fixing certain parameters (cf. tables 18a and 18b) as well as the initial values of the variables.
For the sake of neutrality it is advisable to hold these parameters constant throughout the game (with minor exemptions, which will be mentioned explicitly).

The parameters to be fixed are:

(i) Parameters concerning employment
The game direction determines the size of population and the number and the salary of civil servants (equal for each country). These magnitudes must be in line with the parameters fixing technology, minimum public consumption, initial capital and the parameters concerning credit.
The unemployment benefit coefficient (expressing unemployment benefit as a fraction of the minimum wage rate) serves as a device to secure an adequate subsistence minimum for the unemployed.

(ii) Parameters concerning credit
Three of these parameters (compulsory repayment ratio, credit restraint ratio and minimum rate of interest) are to guarantee the workability of the money market:

the compulsory repayment ratio determines that part of the credit which has to be repaid per period; the credit restraint ratio is to curb the amount of individual borrowings per period (it is understood as a multiple of the amount of loan finance in the preceding period); it has been necessary to introduce a minimum rate of interest, for the amount of interest on total credits is calculated on the basis of the rate of interest offered in the respective period.
The fraction of minimum amortisation of the uncovered public debt is relevant if there is a deficit in a government's budget and was explained in sec.2.1.

(iii) License fees are paid in exchange for all sorts of raw material. This means that we treat the license fees as a substitute for expenditures on raw material. As we did not explicitly introduce firms producing raw material into our model we have decided that the license fees are to be paid to the respective governments.

(iv) The machine hours and the hours of labour describe the technology of the economy, i.e. they indicate the hours of labour and machine hours, resp., per unit consumption goods, according to the production process employed. Similar parameters have to be fixed for the different kinds of machinery to be produced.
It is assumed that the working-time of each employee and machine, respectively, amounts to 2000 hours per period.

(v) The rates of depreciation are the reciprocal values of the service lives of the respective kinds of machinery.

(vi) The initial capital is equal for each firm producing consumer goods and for each firm producing capital goods, but may differ for the two types of firms.

(vii) The minimum public consumption is to secure a reasonable supply of public goods, which cannot be guaranteed otherwise, as we did not introduce the voters as separate actors.

(viii) Penalty: The rate of penalty is equal for all countries and has to be paid in addition to the reimbursement of the pre-paid price of the machinery which the respective capital-goods producer has not been able to deliver.

(ix) The fixed amount for the valuation of machinery for own use was introduced to avoid difficulties in connection with the imputation of the costs incurred.

The above parameters (i) to (ix) are communicated to all players and represent the economic, technological and behavioural setting of the three economies. Moreover, there is a number of parameters (cf. table 18b) which are not made known to the players, for they serve technical purposes only, such as the simulation of market and advertising behaviour, etc. Their meaning may readily be grasped from the formal description of the game.

Moreover, the game direction is in a position to determine the extent of the game, i.e. it can fix the number of countries taking part (either two or three) as well as the number of firms producting consumer goods (up to three per country; for the sake of equal starting positions the game direction, however, is advised not to institute different numbers of firms in any two countries).

4.2. Other activities of the game direction

Apart from setting the parameters, the game direction has to organize and conduct the auction, to check on the proper insertion of the parameters, to supervise the computer-stage and to evaluate the results achieved at the end of the game. The criteria for the evaluation of the players' performance are:

I) Total profits are considered the decisive indicator for the success of the individual firm. It is up to the game direction to make use of other indicators (such as: total sales, average market share) in addition to profits. In the latter case the game direction should announce the additional goals at the beginning of the game.

II) The evaluation of the governments' performance comprises four separate indicators, which cannot be further condensed to a single index, unless the game direction resorts to value judgements (expressed by the weights of the single index):

(i) Employment: governmental policy should aim at both a low and possibly non-oszillating rate of unemployment. The measuring rod is made up of the sum of the squared rates of unemployment in the respective country (the rate of unemployment being the fraction of the number of unemployed with respect to the total of workers of the country for the period under consideration). Moreover, the evolution of employment is of certain interest, which suggests that its trend should be calculated.

(ii) Standard of living: we have chosen the following measuring procedure: for each period total sales of consumer goods (understood as quantity and not as

value) are divided by the number of residents (including civil servants). Then the average rate of interest per period is computed by adding up the rates of interest offered (to avoid manipulation, those offered by the government are left out of consideration) and dividing this sum by the number of firms. Using Böhm-Bawerk's theory of interest we then deflate the respective amounts of consumer goods per head and period by applying the respective average rates of interest and thus convert all amounts of consumer goods to a compound amount of consumer goods per head (as if they were available in the last period). This takes into account the underestimation of future goods with regard to goods available at present.

(iii) Price-level: the price-index is composed of prices for consumer goods and capital goods. The price of consumer goods entering into the index is understood as the weighted average of all market prices in a particular country and period (the weights being the quantities sold at the respective price).
The price for each kind of machinery is the average of the prices of machines actually delivered in a certain period into the country under consideration. If no sales of the particular kind of machinery have occured in period t, the price of the previos period applies.
Assigning the weights 2/3 to the partial index for consumer goods and 1/9 to the partial index for each kind of machinery, we get the composed price-index.

Having the time series of this composed index, we can compute the average annual price-increase, the trend of the price index and the difference between the basic and the terminal price-level.

(iv) Economic growth: we discern two time series for the evaluation of economic growth. We compute the annual rate of growth of the production of consumer goods in real terms and the rate of growth of the capital goods industry in (deflated) money terms (applying the capital goods indices as deflators). It is now possible to calculate the average rate as well as the trend of growth.

III. The Mathematical Model behind the Game

The mathematical model we are going to describe is the kernel of the computer-stage of the game. It simulates the market and thus determines the distribution of consumer goods, labour force and capital.

(1) The variables of the model

Two kinds of variables enter into our model: there are parameters of action, the values of which are fixed either by the game direction or by the players representing the governments and the firms producing consumer goods and captial goods respectively. Besides, there are magnitudes concerning the present, the next or all subsequent periodes. The values of this second kind of variables are obtained in the course of the computational procedure i.e. they are either endogenous or predetermined variables whereas the paramters of action are exogenous.

(1.1) Parameters of action

(1.1.1) Parameters fixed by the game direction

sW_ϱ	number of civil servants employed by state ϱ (equal for all states)
sw_ϱ	salary of a civil servant in state ϱ (equal for all states)
W	total of workers of all countries (constant for all periods)

k	coefficient expressing the influence of wage differentials
v	unemployment benefit coefficient
$\bar{\beta}$	compulsory repayment ratio
β	credit restraint ratio
λ	fiduciary multiplier (in some cases the game direction might find it advantageous to change this parameter during the game)
$\bar{V}$	fraction of minimum amortisation of the uncovered part of the public debt (in some cases the game direction might find it advantageous to change this parameter during the game)
$\min b$	minimum rate of interest
α_1 α_2 α_3	parameters simulating advertising behaviour
μ	smoothing constant
γ	price influence coefficient
$p_{\min}$	minimum public consumption required

$_cW_c$	hours of labour per unit capital goods required for the production of one machine of kind c
d_ς	rate of depreciation for machinery of kind ς
d_c	rate of depreciation for machinery of kind c
n	penalty
$_iC_\varrho$	initial capital of firm i in country ϱ
$_cC_\varrho$	initial capital of firm c in country ϱ
$\overset{*}{F}{}^t_\varsigma$	bad debts as a consequence of bankruptcy of government ς (why this is considered a parameter is explained in section 10.1)
p_c	fixed amount for the valuation of the machinery for the own use of the capital goods industry

μ_0	license fee paid to the government in exchange for the use of raw material for the production of consumer goods
$\mu_0\zeta$	license fee paid to the government in exchange for the use of raw material for the production of machinery of kind ζ
$\mu_0 c$	license fee paid to the government in exchange for the use of raw material for the production of machinery of kind c
$Z\zeta$	machine hours per unit consumption goods manufactured by machinery of kind ζ
$cZ\zeta$	machine hours required by the capital goods industry for the production of one machine of kind ζ
cZc	machine hours required by the capital goods industry for the production of one machine of kind c
$W\zeta$	hours of labour per unit consumption goods manufactured by machine of kind ζ
$cW\zeta$	hours of labour per unit capital goods required for the production of one machine of kind ζ

(1.1.2) Parameters fixed by the players representing the government

$\min W_\varrho^t$	minimum wage rate fixed by government ϱ for period t
B_ϱ^t	amount of loans desired by government ϱ for period t
b_ϱ^t	rate of interest offered by government ϱ in period t (in per cent)
$\overline{L}_\varrho^t$	voluntary redemption of the public debt (in addition to compulsory redemption) by government ϱ
${}_i\sigma_\varrho^t$	subsidy paid as a lump-sum to firm i by government ϱ
${}_c\sigma_\varrho^t$	subsidy paid as a lump-sum to firm c by government ϱ
${}_w\sigma_\varrho^t$	subsidy paid by government ϱ per employee
${}_a\sigma_\varrho^t$	subsidy paid by government ϱ as a fraction of the firms' total of non-liquid assets
${}_m\sigma_\varrho^t$	subsidy paid by government ϱ as a fraction of the value of total sales
${}_e\sigma_\varrho^t$	subsidy paid by government ϱ as a fraction of the value of total exports

$i f_{\varrho_r}^t$ — fee paid by firm i (residing in ϱ) to state r for maintaining a branch in market r during period t where $r \neq \varrho$

$i f_{r_\varrho}^t$ — fee received by state ϱ from firm i (residing in r) for a branch in ϱ where $\varrho \neq r$

$w f_\varrho^t$ — rate of pay-roll-tax fixed by government ϱ

$m f_\varrho^t$ — rate of turnover tax fixed by government ϱ (for domestic sales of consumer goods only)

$a f_\varrho^t$ — rate of property tax fixed by government ϱ

$\tilde{\delta}_\varrho^t$ — income tax allowance for individuals fixed by government ϱ

$\bar{\delta}_\varrho^t$ — income tax allowance for firms fixed by government ϱ

$_1\varepsilon_{\varrho_t}^t$, $_2\varepsilon_{\varrho_t}$, $_3\varepsilon_\varrho$ — parameters of the income tax function

$\sim\vartheta_{\varrho_r}^t$ — ad valorem duty imposed by government r on imports of consumer goods coming from country ϱ where $r \neq \varrho$

$\sim\vartheta_{r_\varrho}^t$ — ad valorem duty imposed by government ϱ on imports of consumer goods coming

from country r where $r \neq \varrho$

$\vartheta^t_{\varrho r}$ specific duty imposed by government r on imports of consumer goods coming from country ϱ where $r \neq \varrho$

$\vartheta^t_{r\varrho}$ specific duty imposed by government ϱ on imports of consumer goods coming from country r where $r \neq \varrho$

R^t_ϱ amount of public consumption other than salaries in period t

(1.1.3) Parameters fixed by the players representing a firm of the consumer goods industry

${}_iW^t_\varrho$ number of workers desired for period t by firm i producing consumer goods (residing in country ϱ)

${}_iw^t_\varrho$ wage offered to an individual worker by firm i (residing in country ϱ) for period t

${}_iB^t_\varrho$ amount of loans desired for period t by firm i residing in country ϱ

${}_ib^t_\varrho$ rate of interest offered by firm i in period t (in per cent)

${}_i\Pi_\varrho^t$	voluntary debt repayment (in addition to compulsory repayment) of firm i
${}_ip_\varrho^t$	per unit price charged by firm i for consumer goods intended for sale on the domestic market
${}_ip_{\varrho_r}^t$	per unit price charged by firm i (residing in country ϱ) for consumer goods intended for sale on market r (export price), $\varrho \in \{1,2,3\}, r \in \{1,2,3\} \wedge r \neq \varrho$
${}_ip_{r_\varrho}^t$	per unit price charged by firm i (residing in country r) for consumer goods intended for sale on market ϱ (import price for market), $\varrho \in \{1,2,3\}, r \in \{1,2,3\} \wedge r \neq \varrho$
${}_iq_\varrho^t$	quantity of consumer goods intended for production in period t by firm i (residing in country ϱ)
${}_ia_\varrho^t$	expenditure on advertising spent by firm i in the domestic market
${}_ia_{\varrho_r}^t$	expenditure on advertising spent by firm i (residing in ϱ) in market r where $\varrho \in \{1,2,3\}, r \in \{1,2,3\} \wedge r \neq \varrho$

${}_{i}a^{t}_{r_\varrho}$

expenditure on advertising spent by firm i (residing in r) in market ϱ, $\varrho \in \{1,2,3\}$, $r \in \{1,2,3\} \wedge r \neq \varrho$

${}^{\varsigma}N^{t}_{c_\varrho i_r}$

number of orders for capital goods of kind ς taken in by the capital goods industry in country ϱ from firm i (residing in country r) - (these data can also be collected by the game direction on the basis of the auction-contracts) $r, \varrho \in \{1,2,3\}$

${}^{\varsigma\ t}_{\nu}p_{c_\varrho i_r}$

price according to auction-contract of a machine of kind ς to be produced by the capital goods industry of country ϱ for firm i (residing in country r) bearing the preference index ν. (These data can also be collected by the game direction on the basis of the auction-contracts) $r, \varrho \in \{1,2,3\}$

${}_{i}Q^{t}_{\varrho}$

quantity of consumer goods intended for sale in period t on the domestic market by firm i (residing in country ϱ)

${}_{i}Q^{t}_{\varrho_r}$

quantity of consumer goods intended for sale in period t on market r by firm i in country ϱ (quantity intended for export) $\varrho \in \{1,2,3\}$, $r \in \{1,2,3\} \wedge r \neq \varrho$

$_{i}Q^{t}_{r\varrho}$ quantity of consumer goods intended for sale in period t on market ϱ by firm i residing in country r (quantity intended for import)
$\varrho \in \{1,2,3\}, r \in \{1,2,3\} \wedge r \neq \varrho$

$_{i}g^{t}_{\varrho r}$ share of stocks in market r intended for sale

$_{i}g^{t}_{\varrho R}$ share of stocks in market R intended for sale

(1.1.4) Parameters fixed by the players representing a firm of the capital goods industry

$_{c}W^{t}_{\varrho}$ number of workers desired for period t by the capital goods industry of country ϱ

$_{c}w^{t}_{\varrho}$ wages offered to an individual worker by the capital goods industry of country ϱ

$_{c}B^{t}_{\varrho}$ amount of loans desired for period t by the capital goods industry of country ϱ

$_{c}b^{t}_{\varrho}$ rate of interest offered by the capital goods industry of country ϱ in period t (in per cent)

$c\overline{\lfloor}^{t}_{\varrho}$ voluntary debt repayment (in addition to compulsory repayment) of the capital goods industry in country ϱ

$\nu^{\varrho\ t}_{c_\varrho i_r}$ indicator set up by the individual capital goods manufacturer for the ranking of orders according to his preference

$N^{t}_{c_\varrho}$ number of machines of kind c which are intended for production (for the own use of the capital goods industry)

$\nu^{t}_{c_\varrho}$ preference indicator set up by the individual capital goods manufacturer for machinery of kind c to be produced for own use

(1.2) Endogenous and predetermined variables

(1.2.1) Endogenous variables

$u W^{t}_{\varrho}$ number of unemployed living in country ϱ during period t

$u W^{t}_{\varrho}$ unemployment benefit paid by state ϱ in period t

$i W^{*t}_{\varrho}$, $c W^{*t}_{\varrho}$ adjusted wage rates for firms i and c respectively

$\left.\begin{matrix} {}^{\Phi}\mathcal{H}_{\varrho}^{t} \\ {}_{i}\mathcal{H}_{\varrho} \\ {}^{\bar{\Phi}}\mathcal{H}_{\varrho}^{t} \\ {}_{c}\mathcal{H}_{\varrho} \end{matrix}\right\}$ labour allotment coefficients in the Φ-th iteration

$\left.\begin{matrix} {}^{\Phi}\tilde{W}_{\varrho}^{t} \\ {}_{i}\tilde{W}_{\varrho} \\ {}^{\bar{\Phi}}\tilde{W}_{\varrho}^{t} \\ {}_{c}\tilde{W}_{\varrho} \end{matrix}\right\}$ numbers of workers provisionally allotted in iteration Φ .

${}_{u}W^{t}$ total of unemployed in period t

$\left.\begin{matrix} {}_{i}\bar{\bar{B}}_{\varrho}^{t} \\ {}_{c}\bar{\bar{B}}_{\varrho}^{t} \\ \bar{\bar{B}}_{\varrho}^{t} \end{matrix}\right\}$ adjusted amount of loans

${}_{i}\overset{*}{B}_{\varrho}^{t}$ actual borrowings of firm i

${}_{c}\overset{*}{B}_{\varrho}^{t}$ actual borrowings of firm c

$\overset{*}{B}_{\varrho}^{t}$ actual borrowings of government

B^{t} overall supply of credit

L^{t} funds created by the banking sector of the three countries on a fiduciary basis

$\left.\begin{matrix} {}_{i}\overset{*}{b}_{\varrho}^{t} \\ {}_{c}\overset{*}{b}_{\varrho}^{t} \\ \overset{*}{b}_{\varrho}^{t} \end{matrix}\right\}$ adjusted rates of interest

$\left.\begin{matrix} {}_{i}\delta_{\varrho}^{t} \\ {}_{c}\delta_{\varrho}^{t} \\ \delta_{\varrho}^{t} \end{matrix}\right\}$ refraction coefficients of credit, where: $0 < {}_{i}\delta_{\varrho}^{t}, {}_{c}\delta_{\varrho}^{t}, \delta_{\varrho}^{t} \leq 1$

$\bar{b}^t$ maximum rate of interest offered in period t

$\tilde{\beta}^t$ lack-of-funds ratio

${}_i q_\varrho^{*t}$ quantity of consumer goods actually produced by firm i (residing in country ϱ)

${}_i Q_\varrho^{*t}$ quantity of consumer goods actually offered for sale on the domestic market by firm i residing in country ϱ

${}_i Q_{\varrho r}^{*t}$ quantity of consumer goods actually offered for sale on market r by firm i residing in country ϱ (quantity actually offered for export), $\varrho \in \{1,2,3\}$, $r \in \{1,2,3\} \wedge r \neq \varrho$

${}_i Q_{r\varrho}^{*t}$ quantity of consumer goods actually offered for sale on market ϱ by firm i residing in country r (quantity offered as import), $\varrho \in \{1,2,3\}$, $r \in \{1,2,3\} \wedge r \neq \varrho$

${}_i^j \tilde{M}_\varrho^t$ provisionally computed amount of consumer goods to be sold on the domestic market (respective value of the j-th iteration)

${}_i^j \tilde{M}_{r\varrho}^t$ provisionally computed amount of imported consumer goods to be sold on market ϱ (respective value of the j-th iteration) $\varrho \in \{1,2,3\}$, $r \in \{1,2,3\} \wedge r \neq \varrho$

Q_{ϱ}^{t} — total supply of consumer goods on market ϱ in period t

P_{ϱ}^{t} — overall demand for consumer goods in country ϱ in period t

$_{i}\alpha_{\varrho}^{t}$, $_{i}\alpha_{r\varrho}^{t}$ — advertising coefficients

$_{i}A_{\varrho r}^{t}$ — zero-one variable for firm i for setting up and maintaining a branch in market r

$_{i}\mu_{\varrho}^{t}$ — market share in real terms of firm i in market ϱ

$_{i}\mu_{\varrho r}^{t}$ — market share in real terms of firm i (residing in ϱ) in market r

$_{i}\mu_{r\varrho}^{t}$ — market share in real terms of firm i (residing in r) in market ϱ

$_{i}\mu_{\varrho t}^{*t}$, $_{i}\mu_{r\varrho}^{*}$ — price refraction coefficients

$_{i}A_{\varrho t}^{t}$, $_{c}A_{\varrho}^{t}$ — zero-one variable for the application of property tax

$_{i}\tau_{\varrho t}^{t}$, $_{c}\tau_{\varrho t}^{t}$, $_{w_i}\tau_{\varrho t}^{t}$, $_{w_c}\tau_{\varrho t}^{t}$, $_{u}\tau_{\varrho t}^{t}$, $_{s}\tau_{\varrho}^{t}$ — income tax basis (profits, wages, salaries, unemployment benefits)

$i\sigma_{\varsigma}^{t}$
$c\sigma_{\varsigma_t}$
$W_i\sigma_{\varsigma_t}$
$W_c\sigma_{\varsigma_t}$
$u\sigma_{\varsigma_t}$
$s\sigma_{\varsigma}^{t}$

} rate of income tax depending on tax basis

$\overset{*}{R}{}_{\varsigma}^{t}$ adjusted amount of public consumption other than salaries

$\varsigma\overset{*}{Z}{}_{i\varsigma}^{t}$ stock of machinery of kind ς actually in operation in period t

$\overset{*}{Z}{}_{c\varsigma}^{t}$ stock of machinery of kind c actually in operation in period t

$i\vartheta_{\varsigma}^{t}$ excess capacity of machinery in consumer goods industry

$c\overline{\vartheta}_{\varsigma}^{t}$ deficient manpower in capital goods industry

$\varsigma\overline{N}_{c_\varsigma i_r}^{t}$ number of orders for the execution of which the labour force of the capital goods industry is sufficient

$\overline{N}_{c_\varsigma}^{t}$ number of machinery for own use for the production of which the labour force of the capital goods industry is sufficient

$\varsigma\widetilde{N}_{c_\varsigma i_r}^{t}$ number of orders for the execution of which the machine capacity of the capital goods industry is sufficient

$\tilde{N}^t_{c_\varsigma}$ number of machinery for own use for the production of which the machine capacity of the capital goods industry is sufficient

${}_\varsigma\bar{\bar{N}}^t_{c_\varsigma i_r}$ number of orders for the execution of which both labour force and machine capacity of the capital goods industry are sufficient

$\bar{\bar{N}}^t_{c_\varsigma}$ number of machinery for own use for the production of which both labour force and machine capacity of the capital goods industry are sufficient

${}_\varsigma D^t_{i_\varsigma}$ amount of depreciation for machinery of kind ς in possession of firm i

${}_i D^t_\varsigma$ total amount of depreciation in firm i

${}_c D^t_\varsigma$ total amount of depreciation in firm c

${}_i\pi^t_\varsigma \quad {}_c\pi^t_\varsigma$ profits of firms i, c resp. before taxation

${}_i\bar{\bar{\pi}}^t_\varsigma \quad {}_c\bar{\bar{\pi}}^t_\varsigma$ profits of firms i, c resp. after taxation

${}_i\pi^t_\varsigma \quad {}_c\pi^t_\varsigma$ loss of firms i, c resp.

${}_iE^t_\varsigma \quad {}_cE^t_\varsigma$ overall expenses of firms i, c resp.

${}_i\mathcal{E}^t_\varsigma \quad {}_c\mathcal{E}^t_\varsigma$ overall returns of firms i, c resp.

${}_{i}T_{\varsigma}^{t}$ ${}_{c}T_{\varsigma}^{t}$	amount of income tax paid by firms i, c resp.
${}_{i}U_{\varsigma}^{t}$ ${}_{c}U_{\varsigma}^{t}$	overall disbursements of firms i, c resp.
${}_{i}\mathcal{U}_{\varsigma}^{t}$ ${}_{c}\mathcal{U}_{\varsigma}^{t}$	overall receipts of firms i, c resp.
${}_{w_i}T_{\varsigma}^{t}$ ${}_{w_c}T_{\varsigma}^{t}$	amount of income tax paid by an individual worker of firms i, c resp.
${}_{u}T_{\varsigma}^{t}$	amount of income tax paid by an individual unemployed
${}_{s}T_{\varsigma}^{t}$	amount of income tax paid by an individual civil servant
$\mathcal{U}_{\varsigma}^{t}$	overall receipts of state ς
V_{ς}^{t}	total spendings of state ς
$\tilde{\mathcal{U}}_{\varsigma}^{t}$	budget surplus of state ς
$\tilde{V}_{\varsigma}^{t}$	budget deficit of state ς
${}_{i}G_{\varsigma}^{t}$	excess or deficient supply
${}_{i}m_{\varsigma}^{1\ t}$	provisional stock of consumer goods not offered (possessed by firm i in country ς located in ς)
${}_{i}m_{\varsigma r}^{1\ t}$	provisional stock of consumer goods not offered (possessed by firm i in country ς located in r)

$_i m_{\varrho}^{2\ t}$ provisional stock of consumer goods remaining unsold (possessed by firm i in country ϱ located in ϱ)

$_i m_{\varrho r}^{2\ t}$ provisional stock of consumer goods remaining unsold (possessed by firm i in country ϱ located in r)

(1.2.2) One-period lagged variables

$_i W_{\varrho}^{*t}$ $_c W_{\varrho}^{*t}$ number of workers finally alotted to firms i, c resp. residing in country ϱ for period t

W_{ϱ}^{t} total of workers irrespective whether employed or unemployed living in country ϱ during period t (it is assumed that $\sum_{\varrho} W_{\varrho}^{t}$ remains constant for all t)

$_i L_{\varrho}^{t}$ total of liabilities of firm i in period t

$_c L_{\varrho}^{t}$ total of liabilities of firm c in period t

L_{ϱ}^{t} amount of public debt of state ϱ in period t

$_i \Gamma_{\varrho}^{t}$ $_c \Gamma_{\varrho}^{t}$ amount of cash in firms i, c resp.

$_i M_{\varrho}^{*t}$ quantity of consumer goods finally sold on the domestic market in period t by firm i residing in country ϱ

$_i\overset{*}{M}{}^t_{\varsigma r}$ quantity of consumer goods finally sold in period t on market r by firm i residing in country ς (quantity finally exported)

$_i\overset{*}{M}{}^t_{r\varsigma}$ quantity of consumer goods finally sold in period t on market ς by firm i residing in country r (quantity finally imported from i in r)

$_i m^t_{\varsigma}$ stock of consumer goods located in ς possessed by firm i residing in country ς

$_i m^t_{\varsigma r}$ stock of consumer goods located in r possessed by firm i residing in country ς

$_i m^t_{r\varsigma}$ stock of consumer goods located in ς possessed by firm i residing in country r

$_i{}^{\varsigma}Z^{t-1}_{\varsigma}$ stock of machinery of kind ς in firm i (residing in country ς) at the end of period t-1 which is equal to the stock of machinery at the beginning and during period t

$_c Z^{t-1}_{\varsigma}$ stock of machinery of the capital goods industry (residing in country ς at the end of period t-1 which is equal to the stock of machinery at the beginning and during period t

${}_i\tilde{\Pi}^t_\varsigma \quad {}_c\tilde{\Pi}^t_\varsigma$	accumulated profits from former periods of firms i, c resp.
${}_{Li}\tilde{\Pi}^t_\varsigma \quad {}_{Lc}\tilde{\Pi}^t_\varsigma$	accumulated losses from former periods of firms i, c resp.
${}_{Li}\Pi^{*t}_\varsigma \quad {}_{Lc}\Pi^{*t}_\varsigma$	loss brought forward for the purpose of tax deduction in firms i, c resp.
${}_iF^t_\varsigma \quad {}_cF^t_\varsigma \quad F^t_\varsigma$	amounts of uncovered bills of exchange (of the consumer good industry, capital goods industry and the government)
${}_i\tilde{F}^t_\varsigma \quad {}_c\tilde{F}^t_\varsigma \quad \tilde{F}^t_\varsigma$	amount of bad debts caused by insolvency (of the consumer goods industry, the capital goods industry and the government)
${}_i\mathfrak{M}^t_\varsigma$	value of stock of consumer goods
$\overline{\mathfrak{M}}^t_\varsigma$	accumulated budget surplus
${}_iR^t_\varsigma \quad {}_cR^t_\varsigma$	value of the stock of machinery of firms i, c resp. at the end of period t
${}^\varsigma_iR^t_\varsigma$	value of the stock of machinery of kind ς in possession of firm i at the end of period t
${}_iH^t_\varsigma \quad {}_cH^t_\varsigma$	over-indebtedness of firms i, c resp.

(1.2.3) Multi-period lagged variables

$\xi^{t}\nu c_{\varsigma} i_{r}$

indicator set up by the individual capital goods manufacturer for the ranking of orders according to his preference

$\xi^{t}\nu p c_{\varsigma} i_{r}$

price according to auction-contract of a machine of kind ξ to be produced by the capital goods industry of country ς for firm i (residing in country r) bearing the preference index ν .

$\xi^{*t}N c_{\varsigma} i_{r}$

number of machines of kind ξ which are actually delivered by the capital goods industry of country ς at the end of period t

$\xi^{*t}\nu c_{\varsigma} i_{r}$

marginal preference indicator referring to the last order still produced by the capital goods industry of country ς

νc_{ς}^{t}

preference indicator set up by the individual capital goods manufacturer for machinery of kind c to be produced for own use

$i\overset{*}{F}{}_{\varsigma}^{t}$ $c\overset{*}{F}{}_{\varsigma}^{t}$

bad debts as a consequence of bankruptcy of firms i, c resp.

$\overset{*}{N}{}_{c_{\varsigma}}^{t}$

number of machines of kind c which are actually produced for own use by the capital goods industry of country ς at the end of period t.

(2) Adjustments

Our first task will consist in controlling the values of the players' parameters of action for which lower boundaries exist. These data have to be adjusted accordingly:

(III.2.1a) $$ {}_i w_\varsigma^{*t} \begin{cases} = {}_i w_\varsigma^t & \text{if } {}_i w_\varsigma^t \geq_{min} w_\varsigma^t \\ = {}_{min} w_\varsigma^t & \text{if } {}_i w_\varsigma^t < {}_{min} w_\varsigma^t \end{cases} $$

(III.2.1b) $$ {}_c w_\varsigma^{*t} \begin{cases} = {}_c w_\varsigma^t & \text{if } {}_c w_\varsigma^t \geq {}_{min} w_\varsigma^t \\ = {}_{min} w_\varsigma^t & \text{if } {}_c w_\varsigma^t < {}_{min} w_\varsigma^t \end{cases} $$

(III.2.2a) $$ {}_i b_\varsigma^{*t} \begin{cases} = {}_i b_\varsigma^t & \text{if } {}_i b_\varsigma^t \geq {}_{min} b \\ = {}_{min} b & \text{if } {}_i b_\varsigma^t < {}_{min} b \end{cases} $$

(III.2.2b) $$ {}_c b_\varsigma^{*t} \begin{cases} = {}_c b_\varsigma^t & \text{if } {}_c b_\varsigma^t \geq {}_{min} b \\ = {}_{min} b & \text{if } {}_c b_\varsigma^t < {}_{min} b \end{cases} $$

(III.2.2c) $$ b_\varsigma^{*t} \begin{cases} = b_\varsigma^t & \text{if } b_\varsigma^t \geq {}_{min} b \\ = {}_{min} b & \text{if } b_\varsigma^t < {}_{min} b \end{cases} $$

(III.2.3) $$ \rho_\varsigma^{*t} \begin{cases} = \rho_\varsigma^t & \text{if } \rho_\varsigma^t \geq \rho_{min} \\ = \rho_{min} & \text{if } \rho_\varsigma^t < \rho_{min} \end{cases} $$

(III.2.4a) $$ {}_i \bar{B}_\varsigma^t \begin{cases} = {}_i B_\varsigma^t & \text{if } {}_i B_\varsigma^t \leq \beta \cdot {}_i L_\varsigma^{t-1} \\ = \beta \, {}_i L_\varsigma^{t-1} & \text{if } {}_i B_\varsigma^t > \beta \cdot {}_i L_\varsigma^{t-1} \end{cases} $$

(III.2.4b) $$ {}_c \bar{B}_\varsigma^t \begin{cases} = {}_c B_\varsigma^t & \text{if } {}_c B_\varsigma^t \leq \beta \cdot {}_c L_\varsigma^{t-1} \\ = \beta \, {}_c L_\varsigma^{t-1} & \text{if } {}_c B_\varsigma^t > \beta \cdot {}_c L_\varsigma^{t-1} \end{cases} $$

(III.2.4c) $$ \bar{B}_\varsigma^t \begin{cases} = B_\varsigma^t & \text{if } B_\varsigma^t \leq \beta \cdot L_\varsigma^{t-1} \\ = \beta L_\varsigma^{t-1} & \text{if } B_\varsigma^t > \beta \cdot L_\varsigma^{t-1} \end{cases} $$

$$
\begin{aligned}
{}_{i}H_{\varsigma}^{t-1} &\geqslant {}_{i}\tilde{F}_{\varsigma}^{t-1} \\
{}_{c}H_{\varsigma}^{t-1} &\geqslant {}_{c}\tilde{F}_{\varsigma}^{t-1}
\end{aligned}
\qquad \text{(III.2.5)}
$$

For those cases for which (III.2.5) holds we compare:

$$
\begin{aligned}
{}_{i}\tilde{O}_{\varsigma}^{t} &\geqslant {}_{i}H_{\varsigma}^{t-1} \\
{}_{c}\tilde{O}_{\varsigma}^{t} &\geqslant {}_{c}H_{\varsigma}^{t-1}
\end{aligned}
\qquad \text{(III.2.6)}
$$

For all other cases [i.e. $\neg$ (III.2.5)] we compare:

$$
\begin{aligned}
{}_{i}\tilde{O}_{\varsigma}^{t} &\geqslant {}_{i}\tilde{F}_{\varsigma}^{t-1} \\
{}_{c}\tilde{O}_{\varsigma}^{t} &\geqslant {}_{c}\tilde{F}_{\varsigma}^{t-1}
\end{aligned}
\qquad \text{(III.2.7)}
$$

In those cases where either (III.2.5) $\wedge$ (III.2.6) or $\neg$ (III.2.5) $\wedge$ (III.2.7) holds we set

$$
\begin{aligned}
{}_{i}F_{\varsigma}^{t-1} &= {}_{i}\tilde{F}_{\varsigma}^{t-1} \\
{}_{c}F_{\varsigma}^{t-1} &= {}_{c}\tilde{F}_{\varsigma}^{t-1}
\end{aligned}
\qquad \text{(III.2.8)}
$$

In those cases, however, where (III.2.5) $\wedge$ $\neg$ (III.2.6), holds:

$$
\begin{aligned}
{}_i\overset{*}{F}{}_\varrho^t &= {}_iH_\varrho^{t-1} - {}_i\sigma_\varrho^t \\
{}_c\overset{*}{F}{}_\varrho^t &= {}_cH_\varrho^{t-1} - {}_c\sigma_\varrho^t
\end{aligned}
\qquad \text{(III.2.9)}
$$

If $\neg$ (III.2.5) $\wedge$ $\neg$ (III.2.7), holds:

$$
\begin{aligned}
{}_i\overset{*}{F}{}_\varrho^t &= {}_i\tilde{F}_\varrho^{t-1} - {}_i\sigma_\varrho^t \\
{}_c\overset{*}{F}{}_\varrho^t &= {}_c\tilde{F}_\varrho^{t-1} - {}_c\sigma_\varrho^t
\end{aligned}
\qquad \text{(III.2.10)}
$$

The player for whom holds either (III.2.5) $\wedge$ $\neg$ (III.2.6) or $\neg$ (III.2.5) $\wedge$ $\neg$ (III.2.7) is eliminated from further gaming. His parameters (with the exception of ${}_i\overset{*}{F}{}_\varrho^t$, ${}_c\overset{*}{F}{}_\varrho^t$, respectively, which are stored until the end of the game) are excluded from data processing.

(3) The Money Market

We assume the funds created by the common banking sector of the three countries to be a multiple of the total of wages, salaries and unemployment benefits (before taxation) of the preceding period.

$$L^t = \lambda\Big[\sum_\varrho {}_sW_\varrho \cdot {}_sw_\varrho + \sum_\varrho\sum_i {}_i\overset{*}{W}{}_\varrho^{t-1} \cdot {}_i\overset{*}{w}{}_\varrho^{t-1} + \sum_\varrho {}_c\overset{*}{W}{}_\varrho^{t-1} \cdot {}_c\overset{*}{w}{}_\varrho^{t-1} + \sum_\varrho {}_uW_\varrho^{t-1} \cdot {}_uw_\varrho^{t-1}\Big] - \sum_t\sum_\varrho\sum_i {}_i\overset{*}{F}{}_\varrho^t - \sum_t\sum_\varrho {}_c\overset{*}{F}{}_\varrho^t \qquad \text{(III.3.1)}$$

The total amount of credit available for lending in period t (overall supply of credit) therefore consists of L^t less outstanding liabilities:

$$B^t = L^t - (1-\bar{\beta})\Big(\sum_\varrho L_\varrho^{t-1} + \sum_\varrho\sum_i {}_iL_\varrho^{t-1} + \sum_\varrho {}_cL_\varrho^{t-1}\Big) + \sum_\varrho \bar{L}_\varrho^t + \sum_\varrho\sum_i {}_i\bar{L}_\varrho^t + \sum_\varrho {}_c\bar{L}_\varrho^t \qquad \text{(III.3.2)}$$

The process of credit allocation consists of several stages. First we must check whether

$$\text{(III.3.3)} \qquad \underline{B}^t \geqslant \sum_\varrho \sum_i {}_i\bar{B}_\varrho^t + \sum_\varrho {}_c\bar{B}_\varrho^t + \sum_\varrho \bar{B}_\varrho^t$$

or not.

The actual borrowings in period t are determined by the following formulae (the values of the refraction coefficients of credit will be calculated below):

$$\text{(III.3.4)} \qquad \begin{aligned} {}_i\overset{*}{B}{}_\varrho^t &= {}_i\delta_\varrho^t \, {}_i\bar{B}_\varrho^t \\ {}_c\overset{*}{B}{}_\varrho^t &= {}_c\delta_\varrho^t \, {}_c\bar{B}_\varrho^t \\ \overset{*}{B}{}_\varrho^t &= \delta_\varrho^t \, \bar{B}_\varrho^t \end{aligned}$$

Thus the total of liabilities in period t is

$$\text{(III.3.5)} \qquad \begin{aligned} {}_iL_\varrho^t &= (1-\bar{\beta}) \, {}_iL_\varrho^{t-1} - {}_i\bar{L}_\varrho^t + {}_i\overset{*}{B}{}_\varrho^t \\ {}_cL_\varrho^t &= (1-\bar{\beta}) \, {}_cL_\varrho^{t-1} - {}_c\bar{L}_\varrho^t + {}_c\overset{*}{B}{}_\varrho^t \\ L_\varrho^t &= (1-\bar{\beta}) \, L_\varrho^{t-1} - \bar{L}_\varrho^t + \overset{*}{B}{}_\varrho^t \end{aligned}$$

The values of the refraction coefficients of credit are calculated in this way:

(i) in case (III.3.3):

$$\text{(III.3.6a)} \qquad {}_i\delta_\varrho^t = {}_c\delta_\varrho^t = \delta_\varrho^t = 1$$

(ii) in case ¬ (III.3.3) a more intricate procedure is required:

the maximum rate of interest is defined as $\bar{b}^t$:

$$\bar{b}^t = \max_{i,c,\varrho} \left({}_i b^{*t}_\varrho , {}_c b^{*t}_\varrho , b^{*t}_\varrho \right)$$

In order to refract the amount of loans desired with regard to the respective rates of interest offered we choose the second power as the highest possible refraction that still makes economic sense. We must therefore check whether a quadratic refraction is sufficient:

$$\text{(III.3.7)} \qquad B^t \leqslant \sum_\varrho \sum_i \left(\frac{{}_i b^{*t}_\varrho}{\bar{b}^t} \right)^\chi {}_i \bar{B}^t_\varrho + \sum_\varrho \left(\frac{{}_c b^{*t}_\varrho}{\bar{b}^t} \right)^\chi {}_c \bar{B}^t_\varrho + \sum_\varrho \left(\frac{b^{*t}_\varrho}{\bar{b}^t} \right)^\chi \bar{B}^t_\varrho$$

where $\chi = 2$

In case (III.3.7) the refraction coefficients of credit are easily found in the following way:

$$\tilde{\beta}^t = \frac{B^t}{\sum_\varrho \sum_i \left(\frac{{}_i b^{*t}_\varrho}{\bar{b}^t} \right)^\chi {}_i \bar{B}^t_\varrho + \sum_\varrho \left(\frac{{}_c b^{*t}_\varrho}{\bar{b}^t} \right)^\chi {}_c \bar{B}^t_\varrho + \sum_\varrho \left(\frac{b^{*t}_\varrho}{\bar{b}^t} \right)^\chi \bar{B}^t_\varrho}$$

$$\text{(III.3.6b)} \qquad {}_i\delta^t_\varrho = \tilde{\beta}^t \left(\frac{{}_i b^{*t}_\varrho}{\bar{b}^t} \right)^\chi$$

$${}_c\delta^t_\varrho = \tilde{\beta}^t \left(\frac{{}_c b^{*t}_\varrho}{\bar{b}^t} \right)^\chi$$

$$\delta^t_\varrho = \tilde{\beta}^t \left(\frac{b^{*t}_\varrho}{\bar{b}^t} \right)^\chi$$

where $\chi = 2$

If ¬ (III.3.7) the refraction coefficients are determined by NEWTON's approximation so that the following equation holds:

$$B^t = \sum_\varrho \sum_i \left(\frac{{}_i b^{*t}_\varrho}{b^t}\right)^\chi {}_i\bar{B}^t_\varrho + \sum_\varrho \left(\frac{{}_c b^{*t}_\varrho}{b^t}\right)^\chi {}_c\bar{B}^t_\varrho + \sum_\varrho \left(\frac{b^{*t}_\varrho}{b^t}\right)^\chi \bar{B}^t_\varrho$$

where $0 < \chi < 2$ by virtue of ¬ (III.3.3) and ¬ (III.3.7).

(III.3.6c)
$$ {}_i\delta^t_\varrho = \left(\frac{{}_i b^{*t}_\varrho}{b^t}\right)^\chi$$
$$ {}_c\delta^t_\varrho = \left(\frac{{}_c b^{*t}_\varrho}{b^t}\right)^\chi$$
$$ \delta^t_\varrho = \left(\frac{b^{*t}_\varrho}{b^t}\right)^\chi$$

(4) The Labour Market

The allocation of labour depends on the individual wage rates offered, on the number of workers employed in the preceding period and on the number of workers desired for period t. First we compare whether:

(III.4.1) $$\sum_{\varsigma}\sum_{i} {}_{i}W_{\varsigma}^{t} + \sum_{\varsigma} {}_{c}W_{\varsigma}^{t} - \sum_{\varsigma} W_{\varsigma}^{t-1} \doteq \partial\!\!\!/$$

(III.4.1a) $$\partial\!\!\!/ = 0$$

(III.4.1b) $$\partial\!\!\!/ > 0$$

(III.4.1c) $$\partial\!\!\!/ < 0$$

In case (III.4.1a) holds:

(III.4.2a) $$\begin{aligned} {}_{i}\overset{*}{W}{}_{\varsigma}^{t} &= {}_{i}W_{\varsigma}^{t} \\ {}_{c}\overset{*}{W}{}_{\varsigma}^{t} &= {}_{c}W_{\varsigma}^{t} \\ {}_{u}W_{\varsigma}^{t} &= 0 \end{aligned}$$

In case (III.4.1b) allocation takes place by means of an iterative procedure; we describe the steps of the Φ -th iteration only.

Step 1:

$$ {}^{\Phi}_{i}\mathcal{H}^{t}_{\varsigma} = \kappa \frac{{}^{*t}_{i}W_{\varsigma}}{\sum_{\varsigma}\sum_{i} {}^{*t}_{i}W_{\varsigma} + \sum_{\varsigma} {}^{*t}_{c}W_{\varsigma}} + $$

$$ + (1-\kappa) \frac{{}^{*t}_{i}W_{\varsigma}\ {}^{*t-1}_{i}W_{\varsigma}}{\sum_{\varsigma}\sum_{i} {}^{*t}_{i}W_{\varsigma}\ {}^{*t-1}_{i}W_{\varsigma} + \sum_{\varsigma} {}^{*t}_{c}W_{\varsigma}\ {}^{*t-1}_{c}W_{\varsigma}} $$

$$ \forall i,\varsigma : \nexists\, \varphi < \Phi : {}_{i}W^{t}_{\varsigma} < {}^{\varphi}_{i}\tilde{W}^{t}_{\varsigma} \quad \text{where } \varphi = 1,2,\ldots(\Phi-1), $$

$$ {}^{\Phi}_{c}\mathcal{H}^{t}_{\varsigma} = \kappa \frac{{}^{*t}_{c}W_{\varsigma}}{\sum_{\varsigma}\sum_{i} {}^{*t}_{i}W_{\varsigma} + \sum_{\varsigma} {}^{*t}_{c}W_{\varsigma}} + $$

$$ + (1-\kappa) \frac{{}^{*t}_{c}W_{\varsigma}\ {}^{*t-1}_{c}W_{\varsigma}}{\sum_{\varsigma}\sum_{i} {}^{*}_{i}W_{\varsigma}\ {}^{*t-1}_{i}W_{\varsigma} + \sum_{\varsigma} {}^{*t}_{c}W_{\varsigma}\ {}^{*t-1}_{c}W_{\varsigma}} $$

$$ \forall c,\varsigma : \nexists\, \varphi < \Phi : {}_{c}W^{t}_{\varsigma} < {}^{\varphi}_{c}\tilde{W}^{t}_{\varsigma} \quad \text{where } \varphi = 1,2,\ldots(\Phi-1), $$

and where $0 \leq \kappa < 1$

Step 2:

$$ {}^{\Phi}_{i}\tilde{W}^{t}_{\varsigma} = {}^{\Phi}_{i}\mathcal{R}^{t}_{\varsigma}\left(\sum_{\varsigma} W^{t-1}_{\varsigma} - \sum_{\varsigma}\sum_{i} {}_{i}\overset{*}{W}{}^{t}_{\varsigma}\right) $$

$$ \forall\, {}_{i}\overset{*}{W}{}^{t}_{\varsigma} : \exists\ \varphi < \Phi : {}_{i}W^{t}_{\varsigma} = {}_{i}\overset{*}{W}{}^{t}_{\varsigma} \leqslant {}^{\varphi}_{i}\tilde{W}^{t}_{\varsigma} \quad \text{where } \varphi = 1,2,\ldots(\Phi-1),\Phi $$

$$ {}^{\Phi}_{c}\tilde{W}^{t}_{\varsigma} = {}^{\Phi}_{c}\mathcal{R}^{t}_{\varsigma}\left(\sum_{\varsigma} W^{t-1}_{\varsigma} - \sum_{\varsigma} {}_{c}\overset{*}{W}{}^{t}_{\varsigma}\right) $$

$$ \forall\, {}_{c}\overset{*}{W}{}^{t}_{\varsigma} : \exists\ \varphi < \Phi : {}_{c}W^{t}_{\varsigma} = {}_{c}\overset{*}{W}{}^{t}_{\varsigma} \leqslant {}^{\varphi}_{c}\tilde{W}^{t}_{\varsigma} \quad \text{where } \varphi = 1,2,\ldots(\Phi-1),\Phi $$

Step 3:

In this step we check whether any further iteration will be necessary (in case of (ii)).

(i) if ${}^{\Phi}_{i}\tilde{W}^{t}_{\varsigma} \leqslant {}_{i}W^{t}_{\varsigma}\ \ \forall i,\varsigma$ and if ${}^{\Phi}_{c}\tilde{W}^{t}_{\varsigma} \leqslant {}_{c}W^{t}_{\varsigma}\ \ \forall c,\varsigma$ then:

$$ {}_{i}\overset{*}{W}{}^{t}_{\varsigma} = {}^{\Phi}_{i}\tilde{W}^{t}_{\varsigma} $$

$$ {}_{c}\overset{*}{W}{}^{t}_{\varsigma} = {}^{\Phi}_{c}\tilde{W}^{t}_{\varsigma} \qquad (\text{III}.4.2\ b_2) $$

$$ {}_{\upsilon}W^{t}_{\varsigma} = 0\ ; $$

however,

(ii) if $\exists\, {}^{\Phi}_{i}\tilde{W}^{t}_{\varsigma} > {}_{i}W^{t}_{\varsigma}$ or if $\exists\, {}^{\Phi}_{c}\tilde{W}^{t}_{\varsigma} > {}_{c}W^{t}_{\varsigma}$ then:

$$ \forall i,\varsigma : {}^{\Phi}_{i}\tilde{W}^{t}_{\varsigma} \geqslant {}_{i}W^{t}_{\varsigma} \quad \text{hold } {}_{i}\overset{*}{W}{}^{t}_{\varsigma} = {}_{i}W^{t}_{\varsigma} $$

$$ \forall c,\varsigma : {}^{\Phi}_{c}\tilde{W}^{t}_{\varsigma} \geqslant {}_{c}W^{t}_{\varsigma} \quad \text{hold } {}_{c}\overset{*}{W}{}^{t}_{\varsigma} = {}_{c}W^{t}_{\varsigma} \qquad (\text{III}.4.2\ b_1) $$

All values for which ${}^{\Phi}_{i}\tilde{W}^{t}_{\varsigma} < {}_{i}W^{t}_{\varsigma}$, ${}^{\Phi}_{c}\tilde{W}^{t}_{\varsigma} < {}_{c}W^{t}_{\varsigma}$ resp., enter into step 1 of the next iteration.

In case (III.4,1c) the total of workers available exceeds the number of workers desired. Now the task consists in allotting the unemployed to the three countries.

Each firm gets the number of workers desired:

$$ {}_i\overset{*}{W}{}_\varsigma^t = {}_iW_\varsigma^t $$

(III.4.2c$_1$)

$$ {}_c\overset{*}{W}{}_\varsigma^t = {}_cW_\varsigma^t $$

The total number of unemployed to be allotted amounts to:

$$ {}_uW^t = \sum_\varsigma W_\varsigma^{t-1} - \sum_\varsigma \sum_i {}_i\overset{*}{W}{}_\varsigma^t - \sum_\varsigma {}_c\overset{*}{W}{}_\varsigma^t $$

They are allotted in the following way:

First we compare whether(+):

(i) $\sum_i {}_i\overset{*}{W}{}_\varsigma^t + {}_c\overset{*}{W}{}_\varsigma^t \geq W_\varsigma^{t-1}$, where $\varsigma \in \{1,2,3\} \wedge \varsigma \neq R,r$

+) For the sake of simplification ς, r, R denote in the present context the respective countries if not stated otherwise.

In case (i):

(ii) $$\sum_i {}_i\overset{*}{W}_r^t + {}_c\overset{*}{W}_r^t \geq W_r^{t-1}$$ where $r \in \{1,2,3\} \wedge r \neq \varrho,$

If (i) $\wedge$ (ii):

(III.4.2c$_2$)
$$
\begin{aligned}
{}_u W_\varrho^t &= 0, \text{ where } \varrho \in \{1,2,3\} \wedge \varrho \neq r, R \\
{}_u W_r^t &= 0, \text{ where } r \in \{1,2,3\} \wedge r \neq \varrho, R \\
{}_u W_R^t &= {}_u W^t, \text{ where } R \in \{1,2,3\} \wedge R \neq \varrho, r
\end{aligned}
$$

If (i) $\wedge$ $\neg$ (ii) check whether:

(iii) $$\sum_i {}_i\overset{*}{W}_R^t + {}_c\overset{*}{W}_R^t < W_R^{t-1}$$ $R \in \{1,2,3\} \wedge R \neq \varrho, r$

If (i) $\wedge$ $\neg$ (ii) $\wedge$ (iii) check whether:

(iv) $$\sum_i {}_i\overset{*}{W}_r^{t-1} + {}_c\overset{*}{W}_r^{t-1} > \sum_i {}_i\overset{*}{W}_r^t + {}_c\overset{*}{W}_r^t$$

$r \in \{1,2,3\} \wedge r \neq \varrho, R$

(v) $$\sum_i {}_i\overset{*}{W}_R^{t-1} + {}_c\overset{*}{W}_R^{t-1} > \sum_i {}_i\overset{*}{W}_R^t + {}_c\overset{*}{W}_R^t$$

$R \in \{1,2,3\} \wedge R \neq \varrho, r$

If $[(i) \wedge \neg (ii) \wedge (iii) \wedge (iv) \wedge (v)] \vee [(i) \wedge \neg (ii) \wedge (iii) \wedge \wedge \neg (iv) \wedge \neg (v)]$:

$$ {}_{u}W_{\varrho}^{t} = 0 \qquad \varrho \in \{1,2,3\} \wedge \varrho \neq r, R $$

$$ {}_{u}W_{r}^{t} = \frac{W_{r}^{t-1} - \sum_{i} {}_{i}W_{r}^{*t} - {}_{c}W_{r}^{*t}}{W_{r}^{t-1} + W_{R}^{t-1} - \sum_{i} {}_{i}W_{r}^{*t} - {}_{c}W_{r}^{*t} - \sum_{i} {}_{i}W_{R}^{*t} - {}_{c}W_{R}^{*t}} \cdot {}_{u}W $$

(III.4.2c$_3$)

$r \in \{1,2,3\} \wedge r \neq \varrho, R$

$R \in \{1,2,3\} \wedge R \neq \varrho, r$

$$ {}_{u}W_{R}^{t} = \frac{W_{R}^{t-1} - \sum_{i} {}_{i}W_{R}^{*t} - {}_{c}W_{R}^{*t}}{W_{r}^{t-1} + W_{R}^{t-1} - \sum_{i} {}_{i}W_{r}^{*t} - {}_{c}W_{r}^{*t} - \sum_{i} {}_{i}W_{R}^{*t} - {}_{c}W_{R}^{*t}} \cdot {}_{u}W $$

$R \in \{1,2,3\} \wedge R \neq \varrho, r$

$r \in \{1,2,3\} \wedge r \neq \varrho, R$

If $[(i) \wedge \neg (ii) \wedge (iii) \wedge (iv) \wedge \neg (v)] \vee [(i) \wedge \neg (ii) \wedge (iii) \wedge \wedge \neg (iv) \wedge (v)]$:

$$ {}_{u}W_{\varrho}^{t} = 0 \qquad \varrho \in \{1,2,3\} \wedge \varrho \neq r,R $$

$$ {}_{u}W_{r}^{t} = W_{r}^{t-1} - \sum_{i} {}_{i}\overset{*}{W}_{r}^{t} - {}_{c}\overset{*}{W}_{r}^{t}, \text{ if} $$

(III.4.2c$_4$) (vi) $W_{r}^{t-1} - \sum_{i} {}_{i}\overset{*}{W}_{r}^{t} - {}_{c}\overset{*}{W}_{r}^{t} \leq {}_{u}W^{t}$

$= {}_{u}W^{t}$, if $\neg$ (vi) $\quad r \in \{1,2,3\} \wedge r \neq \varrho,R$

$$ {}_{u}W_{R} = {}_{u}W^{t} - \left(W_{r}^{t-1} - \sum_{i} {}_{i}\overset{*}{W}_{r}^{t} - {}_{c}\overset{*}{W}_{r}^{t}\right), \text{ if (vi)} $$

$= 0$, if $\neg$ (vi)

If $\neg$ (i) $\wedge$ $\neg$ (ii) $\wedge$ (iii) :

$$(III.4.2c_5) \qquad {}_{u}W_{\varsigma}^{t} = W_{\varsigma}^{t-1} - \sum_{i} {}_{i}\overset{*}{W}_{\varsigma}^{t} - {}_{c}\overset{*}{W}_{\varsigma}^{t} \qquad \text{where } \varsigma \in \{1,2,3\}$$

Thus we have all necessary information to compute the total of workers living in country $\varsigma \in \{1,2,3\}$ during period t:

$$(III.4.3) \qquad W_{\varsigma}^{t} = \sum_{i} {}_{i}\overset{*}{W}_{\varsigma}^{t} + {}_{c}\overset{*}{W}_{\varsigma}^{t} + {}_{u}W_{\varsigma}^{t}$$

(5) Adjustment of the quantities of consumer goods to be produced

Should it turn out that the number of workers finally allotted (see Labour Market) is inadequate to perform the production program planned by the respective firms, the following adjustments take place:

First we compare whether:

$$\text{(i)} \qquad {}_i\overset{*}{W}{}^t_\varsigma \geqslant \sum_\varsigma \frac{{}^\varsigma_i Z^{t-1}_\varsigma \cdot w_\varsigma}{Z_\varsigma}$$

In case (i):

$$\text{(III.5.1a)} \qquad {}^\varsigma_i\overset{*}{Z}{}^t_\varsigma = {}^\varsigma_i\overset{*}{Z}{}^{t-1}_\varsigma$$

If ¬ (i) we calculate:

$${}_i\partial^t_\varsigma = \sum_\varsigma \frac{{}^\varsigma_i Z^{t-1}_\varsigma \cdot w_\varsigma}{Z_\varsigma} - {}_i\overset{*}{W}{}^t_\varsigma$$

and compare*):

$$\text{(ii)} \qquad {}_i\partial^t_\varsigma \leqslant \frac{{}^1_i Z^{t-1}_\varsigma \; w_1}{Z_1}$$

*) This is based on the experience that in the case of labour shortage the entrepreneurs usually put out of operation first the machinery requiring most labour per unit final product.

If $\neg$ (i) $\wedge$ (ii):

$$
\begin{aligned}
{}^{1}_{i}\overset{*}{Z}^{t}_{\varrho} &= {}^{1}_{i}Z^{t-1}_{\varrho} - {}_{i}\vartheta^{t}_{\varrho}\,\frac{Z_1}{W_1} \\
{}^{\varsigma}_{i}\overset{*}{Z}^{t}_{\varrho} &= {}^{\varsigma}_{i}Z^{t-1}_{\varrho} \qquad \varsigma \neq 1
\end{aligned}
\tag{III.5.1b}
$$

If $\neg$ (i) $\wedge$ $\neg$ (ii) we compare whether:

$$
{}_{i}\vartheta^{t}_{\varrho} \leqslant \frac{{}^{1}_{i}Z^{t-1}_{\varrho}\; W_1}{Z_1} + \frac{{}^{2}_{i}Z^{t-1}_{\varrho}\; W_2}{Z_2} \tag{iii}
$$

If $\neg$ (i) $\wedge$ $\neg$ (ii) $\wedge$ (iii):

$$
\begin{aligned}
{}^{1}_{i}\overset{*}{Z}^{t}_{\varrho} &= 0 \\
{}^{2}_{i}\overset{*}{Z}^{t}_{\varrho} &= {}^{2}_{i}Z^{t-1}_{\varrho} - \left({}_{i}\vartheta^{t}_{\varrho} - \frac{{}^{1}_{i}Z^{t-1}_{\varrho}\; W_1}{Z_1}\right)\frac{Z_2}{W_2} \\
{}^{3}_{i}\overset{*}{Z}^{t}_{\varrho} &= {}^{3}_{i}Z^{t-1}_{\varrho}
\end{aligned}
\tag{III.5.1c}
$$

If $\neg$ (i) $\wedge$ $\neg$ (ii) $\wedge$ $\neg$ (iii):

$$
\begin{aligned}
{}^{1}_{i}\overset{*}{Z}^{t}_{\varrho} &= 0 \\
{}^{2}_{i}\overset{*}{Z}^{t}_{\varrho} &= 0 \\
{}^{3}_{i}\overset{*}{Z}^{t}_{\varrho} &= {}^{3}_{i}Z^{t-1}_{\varrho} - \left({}_{i}\vartheta^{t}_{\varrho} - \frac{{}^{1}_{i}Z^{t-1}_{\varrho}\; W_1}{Z_1} - \frac{{}^{2}_{i}Z^{t-1}_{\varrho}\; W_2}{Z_2}\right)\frac{Z_3}{W_3}
\end{aligned}
\tag{III.5.1d}
$$

Thus knowing the stock of machinery in operation, we can determine the quantitiy of consumer goods actually produced.

We compare whether*):

$$\text{(iv)} \qquad {}_i q_\varsigma^t \leqslant 2000 \sum_\varsigma \frac{{}_{i\varsigma}^{\ast t} Z_\varsigma}{z_\varsigma}$$

In case (iv):

$$\text{(III.5.2a)} \qquad {}_i \overset{\ast t}{q}_\varsigma = {}_i q_\varsigma^t$$

If $\neg$ (iv):

$$\text{(III.5.2b)} \qquad {}_i \overset{\ast t}{q}_\varsigma = 2000 \sum_\varsigma \frac{{}_{i\varsigma}^{\ast t} Z_\varsigma}{z_\varsigma}$$

In correspondence with the adjusted amount of consumer goods produced we now have to revise the amount of consumer goods actually offered.

We define:

$${}_i Q_\varsigma^t - {}_i \overset{\ast t}{q}_\varsigma - {}_i m_\varsigma^{t-1} + \sum_{\substack{r \\ r \neq \varsigma}} {}_i Q_{\varsigma r}^t - \sum_{\substack{r \\ r \neq \varsigma}} {}_i g_{\varsigma r}^t \, {}_i m_{\varsigma r}^{t-1} \doteqdot {}_i G_\varsigma^t$$

$$\forall i, \varsigma_r : \quad \text{(v)} \quad {}_i Q_{\varsigma r}^t - {}_i g_{\varsigma r}^t \, {}_i m_{\varsigma r}^{t-1} > 0$$

*) It is assumed that both machinery and workers operate 2000 hours per period.

We now compare whether:

(vi) $$ {}_iG_\varrho^t > 0 $$

If (vi) holds:

(III.5.3a)*) $$ {}_i\overset{*}{Q}_\varrho^t = {}_iQ_\varrho^t - \frac{{}_iG_\varrho^t}{{}_iG_\varrho^t + {}_i\overset{*}{q}_\varrho^t + {}_im_\varrho^{t-1}} \, {}_iQ_\varrho^t $$

$$ {}_i\overset{*}{Q}_{\varrho r}^t = \begin{cases} {}_iQ_{\varrho r}^t, & \text{if } \neg (v) \\ {}_iQ_{\varrho r}^t - \frac{{}_iG_\varrho^t}{{}_iG_\varrho^t + {}_i\overset{*}{q}_\varrho^t + {}_im_\varrho^{t-1}} \left({}_iQ_{\varrho r}^t - {}_im_{\varrho r}^{t-1} \, {}_ig_{\varrho r}^t \right) & \text{if } (v) \; **) \end{cases} $$

If $\neg$ (vi):

$$ {}_i\overset{*}{Q}_\varrho^t = {}_iQ_\varrho^t $$

(III.5.3b) $$ {}_i\overset{*}{Q}_{\varrho r}^t = {}_iQ_{\varrho r}^t $$

If (vi) the respective provisional stocks are:

(III.5.4a) $$ {}_i\overset{1}{m}_\varrho^t = 0 $$

---

*) The denominator $({}_iG_\varrho^t + {}_i\overset{*}{q}_\varrho^t + {}_im_\varrho^{t-1})$ follows from

$$ \left[{}_iQ_\varrho^t + \sum_{r \neq \varrho} \left({}_iQ_{\varrho r}^t - {}_ig_{\varrho r}^t \, {}_im_{\varrho r}^{t-1} \right) \right] $$

**) It is assumes that stocks of consumer goods abroad cannot be repatriated.

$$(III.5.4b)\quad {}^{1}_{i}m^{t}_{gr} = \begin{cases} {}_{i}m^{t-1}_{gr} - {}_{i}\overset{*}{Q}^{t}_{gr}, & \text{if } \neg(v) \\ {}_{i}m^{t-1}_{gr} - {}_{i}g^{t}_{gr}\,{}_{i}m^{t-1}_{gr}, & \text{if } (v) \end{cases}$$

If $\neg$ (vi) the respective provisional stocks are:

$$(III.5.5a)\quad {}^{1}_{i}m^{t}_{g} = |G|$$

$$(III.5.5b)\quad {}^{1}_{i}m^{t}_{gr} = \begin{cases} {}_{i}m^{t-1}_{gr} - {}_{i}\overset{*}{Q}^{t}_{gr}, & \text{if } \neg(v) \\ {}_{i}m^{t-1}_{gr} - {}_{i}g^{t}_{gr}\,{}_{i}m^{t-1}_{gr}, & \text{if } (v) \end{cases}$$

(6) Adjustment of the quantity of machinery to be produced

Similar to point (5) it could turn out that the number of workers finally allotted and/or the capacity of the machinery available do not suffice to produce all orders taken in.

For this purpose we compare whether:

$$\text{(i)} \quad {}_c\overset{*}{W}{}^t_\varsigma \cdot 2000 \geqslant \sum_i \sum_r \sum_\varsigma {}^\varsigma N^t_{c_\varsigma i_r} \cdot {}_cW_\varsigma + N^t_{c_\varsigma} \cdot {}_cW_c \qquad r \in \{1,2,3\}$$

If (i) we compare:

$$\text{(ii)} \quad {}_c Z^{t-1}_\varsigma \cdot 2000 \geqslant \sum_i \sum_r \sum_\varsigma {}^\varsigma N^t_{c_\varsigma i_r} \cdot {}_cZ_\varsigma + N^t_{c_\varsigma} {}_cZ_c$$

If (i) $\wedge$ (ii):

$$\text{(III.6.1a)} \qquad {}^\varsigma\overset{*}{N}{}^t_{c_\varsigma i_r} = {}^\varsigma N^t_{c_\varsigma i_r}$$
$$\overset{*}{N}{}^t_{c_\varsigma} = N^t_{c_\varsigma}$$

If $\neg$ (i) we compute:

$${}_c\bar{\vartheta}^t_\varsigma = \sum_i \sum_r \sum_\varsigma {}^\varsigma N^t_{c_\varsigma i_r} \cdot {}_cW_\varsigma + N^t_{c_\varsigma} {}_cW_c - {}_c\overset{*}{W}{}^t_\varsigma \cdot 2000$$

We must now determine those orders which cannot be executed for lack of labour force, by means of an iterative process. We begin with the highest ν and substract 1 from the respective N. [+)]

$$\max \left({}^{\xi}\nu^{t}_{c_\varrho i_r}, \nu^{t}_{c_\varrho} \right) = {}^{\bar\xi}\nu^{t}_{\bar c_\varrho \bar i_r} \oplus \nu^{t}_{\bar c_\varrho} \Longrightarrow$$

$$(a) \quad {}_cZ_{\bar\xi} \oplus {}_cZ_c \geqslant c\bar\vartheta^{t}_{\varrho}$$

$$(b) \quad {}_cZ_{\bar\xi} \oplus {}_cZ_c < c\bar\vartheta^{t}_{\varrho}$$

In case (a) the shortage of labour force is outweighted by eliminating the machine with the highest preference index from production.
In case (b) more machines have to be eliminated according to the preference order of the individual capital goods manufacturerand we continue the iterative process in the same way.
After a finite number of iterations the following inequality holds:

$$c\bar\vartheta^{t}_{\varrho} \leqslant \sum_i \sum_r \sum_\xi \left({}^{\xi}N^{t}_{c_\varrho i_r} - {}^{\xi}\bar N^{t}_{c_\varrho i_r} \right) {}_cW_\xi + \left(N^{t}_{c_\varrho} - \bar N^{t}_{c_\varrho} \right) {}_cW_c$$

We must now check whether this preliminary production program is in line with the machine capacity available.

$$(iii) \quad {}_cZ^{t-1}_{\varrho}\, 2000 \geqslant \sum_i \sum_r \sum_\xi {}^{\xi}\bar N^{t}_{c_\varrho i_r}\, {}_cZ_\xi + \bar N^{t}_{c_\varrho}\, {}_cZ_c$$

[+)] $p \oplus q$ means $(p \vee q) \wedge \neg(p \wedge q)$

Thus, if $\neg$ (i) $\wedge$ (iii):

$$
\begin{aligned}
{}^{\varsigma}\overset{*}{N}{}^{t}_{c_\varsigma i_r} &= {}^{\varsigma}\overline{N}{}^{t}_{c_\varsigma i_r} \\
\overset{*}{N}{}^{t}_{c_\varsigma} &= \overline{N}{}^{t}_{c_\varsigma}
\end{aligned}
\qquad \text{(III.6.1b)}
$$

If, however, (i) $\wedge$ $\neg$ (ii):

$$
{}_c\overline{\partial}^{t}_{\varsigma} = \sum_i \sum_r \sum_{\varsigma} {}^{\varsigma}N^{t}_{c_\varsigma i_r}\, {}_cZ_{\varsigma} + N^{t}_{c_\varsigma}\, {}_cZ_c - {}_cZ^{t-1}_{\varsigma} \cdot 2000
$$

We now determine by the same iterative process as above those orders which cannot be executed for lack of machine capacity and get:

$$
\begin{aligned}
{}^{\varsigma}\overset{*}{N}{}^{t}_{c_\varsigma i_r} &= {}^{\varsigma}\tilde{N}^{t}_{c_\varsigma i_r} \\
\overset{*}{N}{}^{t}_{c_\varsigma} &= \tilde{N}^{t}_{c_\varsigma}
\end{aligned}
\qquad \text{(III.6.1c)}
$$

If $\neg$ (i) $\wedge$ $\neg$ (iii) we compute:

$$
{}_c\overline{\partial}^{t}_{\varsigma} = \sum_i \sum_r \sum_{\varsigma} {}^{\varsigma}\overline{N}{}^{t}_{c_\varsigma i_r} \cdot {}_cZ_{\varsigma} + \overline{N}{}^{t}_{c_\varsigma}\, {}_cZ_c - {}_cZ^{t-1}_{\varsigma} \cdot 2000
$$

By means of the same iterative process as above we eliminate those orders which cannot be executed for lack of both labour force and machine capacity and finally get:

(7) The consumer goods market

Before we can approach the problem of determining the amount of sales we have to compute both the overall demand for consumer goods as well as their total monetary supply in each market.*)

$$(III.7.1)\quad P_\varrho^t = \sum_i {}^*W_\varrho^t \; {}_i\overline{w}_\varrho^t - \sum_i {}^*W_\varrho^t \; {}_{w_i}T_\varrho^t + {}_c{}^*W_\varrho^t \; {}_c\overline{w}_\varrho^t -$$
$$- {}_c{}^*W_\varrho^t \; {}_{w_c}T_\varrho^t + {}_sW_\varrho \; {}_s\overline{w}_\varrho - {}_sW_\varrho \; {}_sT_\varrho^t + {}_uW_\varrho^t \; {}_u\overline{w}_\varrho^t -$$
$$- {}_uW_\varrho^t \; {}_uT_\varrho^t + \sum_i {}_ib_\varrho^t \; {}_iL_\varrho^t + {}_cb_\varrho^t \; {}_cL_\varrho^t +$$
$$+ b_\varrho^t L_\varrho^t + \overline{R}_\varrho^t + \overline{P}_\varrho^{t-1}$$

$$(III.7.2)^{**})\quad Q_\varrho^t = \sum_i {}^*Q_\varrho^t \; {}_ip_\varrho^t + \sum_\varrho \sum_i {}^*Q_{r_\varrho} \left[{}_ip_{r_\varrho}^t \left(1 + \vartheta_{r_\varrho}^t\right) + \vartheta_{r_\varrho}^t \right]$$

We now compare whether:

$$(i)\qquad Q_\varrho^t \leqslant P_\varrho^t$$

---

*) Income tax-rate and unemployment benefit will be determined later.

**) It is assumed that imported goods are stored in bonded warehouses so that no duty has to be paid until they are actually supplied.

In case (i):

$$ {}_i\overset{*}{M}{}_{\varrho}^{t} = {}_i\overset{*}{Q}{}_{\varrho}^{t} $$

$$ {}_i\overset{*}{M}{}_{r\varrho}^{t} = {}_i\overset{*}{Q}{}_{r\varrho}^{t} \qquad \text{(III.7.3a)} $$

$$ \overline{P}_{\varrho}^{t} = P_{\varrho}^{t} - Q_{\varrho}^{t} $$

In case ¬ (i) a more tedious calculation is necessary:
We determine the market shares for period (t-1) in real terms:

$$ {}_i\mu_{\varrho}^{t-1} = \frac{{}_i\overset{*}{M}{}_{\varrho}^{t-1}}{\sum_i {}_i\overset{*}{M}{}_{\varrho}^{t-1} + \sum_{r \neq \varrho} \sum_i {}_i\overset{*}{M}{}_{r\varrho}^{t-1}} $$

(III.7.4)

$$ {}_i\mu_{r\varrho}^{t-1} = \frac{{}_i\overset{*}{M}{}_{r\varrho}^{t-1}}{\sum_i {}_i\overset{*}{M}{}_{\varrho}^{t-1} + \sum_{r \neq \varrho} \sum_i {}_i\overset{*}{M}{}_{r\varrho}^{t-1}} $$

We eliminate firms without offers in period t and smooth the coefficients*):

*) The purpose of smoothing consists in allowing firms which had no market share in the preceding period to re-enter the market.

$$ {}_i\bar{\mu}_s^t = {}_i\mu_s^{t-1} + \mu \qquad \forall i,s : {}_i\overset{*}{Q}_s^t > 0, \text{ i.e.,} $$
$$ {}_i\mu_s^{t-1} = 0 \text{ if } ({}_i\overset{*}{M}_s^{t-1} = 0) \wedge ({}_i\overset{*}{Q}_s^t > 0) $$

(III.7.5)

$$ {}_i\bar{\mu}_{rs}^t = {}_i\mu_{rs}^{t-1} + \mu \qquad \forall i,r : {}_i\overset{*}{Q}_{rs}^t > 0,\ r \neq s, \text{ i.e.,} $$
$$ {}_i\mu_{rs}^{t-1} = 0 \text{ if } ({}_i\overset{*}{M}_{rs}^{t-1} = 0) \wedge ({}_i\overset{*}{Q}_{rs}^t > 0) $$

We now introduce the influence exerted by advertising:

$$ {}_i\tilde{\mu}_s^t = {}_i\bar{\mu}_s^t \left(1 + {}_i\alpha_s^t\right) $$

(III.7.6)

$$ {}_i\tilde{\mu}_{rs}^t = {}_i\bar{\mu}_{rs}^t \left(1 + {}_i\alpha_{rs}^t\right) $$

where:+) $$ {}_i\alpha_s^t = \frac{\alpha_1}{1 + \alpha_2 e^{-\alpha_3 \, {}_i a_s^t}} - \frac{\alpha_1}{1 + \alpha_2} $$

$$ {}_i\alpha_{rs}^t = \frac{\alpha_1}{1 + \alpha_2 e^{-\alpha_3 \, {}_i a_{rs}^t}} - \frac{\alpha_1}{1 + \alpha_2} $$

When the prices charged are taken into consideration we first select:

$$ \tilde{p} = \max_{\substack{i,r \\ r \neq s}} \left\{ {}_ip_s^t, \left[{}_ip_{rs}^t \left(1 + \vartheta_{rs}^t\right) + \nu_{rs}^t \right] \right\} $$

$$ \bar{p} = \min_{\substack{i,r \\ r \neq s}} \left\{ {}_ip_s^t, \left[{}_ip_{rs}^t \left(1 + \vartheta_{rs}^t\right) + \nu_{rs}^t \right] \right\} $$

+) e being Euler's number.

and compute refraction coefficients:

$$i\overset{*}{\mu}{}_{s}^{t} = 1 + \frac{(\tilde{p} - {}_{i}p_{s}^{t})^2}{\gamma\,(\tilde{p} - \bar{p})^2}$$

$$i\overset{*}{\mu}{}_{r_s}^{t} = 1 + \frac{[\tilde{p} - ({}_{i}p_{r_s}^{t}\,(1+\vartheta_{r_s}^{t}) + \vartheta_{r_s}^{t})]^2}{\gamma\,(\tilde{p} - \bar{p})^2}$$

(III.7.7)

In order to determine the amount of sales, an iterative process is initiated.

Step 1:

For the first iteration holds:

$$i\overset{1}{\gamma}{}_{s}^{t} = \frac{i\tilde{\mu}_{s}^{t}\; i\overset{*}{\mu}{}_{s}^{t}}{\sum_i i\tilde{\mu}_{s}^{t}\; i\overset{*}{\mu}{}_{s}^{t} + \sum_i \sum_r i\tilde{\mu}_{r_s}^{t}\; i\overset{*}{\mu}{}_{r_s}^{t}}$$

$$i\overset{1}{\gamma}{}_{r_s}^{t} = \frac{i\tilde{\mu}_{r_s}^{t}\; i\overset{*}{\mu}{}_{r_s}^{t}}{\sum_i i\tilde{\mu}_{s}^{t}\; i\overset{*}{\mu}{}_{s}^{t} + \sum_i \sum_r i\tilde{\mu}_{r_s}^{t}\; i\overset{*}{\mu}{}_{r_s}^{t}}$$

(III.7.8a)

For all subsequent iterations, however, holds (where J denotes the itaration under consideration):

$$ {}_i^J f_s^t = \frac{{}_i^{J-1} f_s^t}{\sum_i {}_i^{J-1} f_s^t + \sum_i \sum_r {}_i^{J-1} f_{rs}^t} \qquad \text{(III.7.8b)} $$

$$ \forall i : \nexists\, j < J : {}_i^j \tilde{M}_s^t > {}_i \overset{*}{Q}_s^t $$

$$ {}_i^J f_{rs}^t = \frac{{}_i^{J-1} f_{rs}^t}{\sum_i {}_i^{J-1} f_s^t + \sum_i \sum_r {}_i^{J-1} f_{rs}^t} $$

$$ \forall i : \nexists\, j < J : {}_i^j \tilde{M}_{rs}^t > {}_i \overset{*}{Q}_{rs}^t \text{, where } r \neq s $$

Step 2:

We compute the provisional amount of consumer goods to be sold (in real terms):

$$ {}_i^J \tilde{M}_s^t = \frac{{}_i^J f_s^t \left[P_s^t - \sum_i \overset{*}{M}_s^t \, {}_i p_s^t - \sum_i \sum_r {}_i \overset{*}{M}_{rs}^t \, {}_i p_{rs}^t \right]}{{}_i p_s^t} $$

$$ \forall {}_i \overset{*}{M}_s^t, {}_i \overset{*}{M}_{rs}^t : \exists\, j < J : {}_i^j \tilde{M}_s^t \geq {}_i \overset{*}{Q}_s^t $$

$$ {}_i^J \tilde{M}_{rs}^t = \frac{{}_i^J f_{rs}^t \left[P_s^t - \sum_i \overset{*}{M}_s^t \, {}_i p_s^t - \sum_i \sum_r {}_i \overset{*}{M}_{rs}^t \, {}_i p_{rs}^t \right]}{{}_i p_{rs}^t} \qquad \text{(III.7.8c)} $$

$$ \forall {}_i \overset{*}{M}_s^t, {}_i \overset{*}{M}_{rs}^t : \exists\, j < J : {}_i^j \tilde{M}_{rs}^t \geq {}_i \overset{*}{Q}_{rs}^t $$

Step 3:

We define:

$$ {}_i\overset{*}{Q}{}^t_{\varrho} - {}^J_i\tilde{M}^t_{\varrho} \doteq {}^J_i\varphi^t_{\varrho} $$

$$ {}_i\overset{*}{Q}{}^t_{r_\varrho} - {}^J_i\tilde{M}^t_{r_\varrho} \doteq {}^J_i\varphi^t_{\varrho} \qquad \forall i, r_\varrho $$

and discern the following cases:

(ii) $$ ({}^J_i\varphi^t_{\varrho} \geqslant 0) \wedge ({}^J_i\varphi^t_{r_\varrho} \geqslant 0) \qquad \forall i, r_\varrho $$

(iii)
(A) $$ \exists\, i, r_\varrho : ({}^J_i\varphi^t_{\varrho} > 0) \vee ({}^J_i\varphi^t_{r_\varrho} > 0) $$

and $$ \exists\, i, r_\varrho $$ for which hold:

(B) $$ ({}^J_i\varphi^t_{\varrho} < 0) \vee ({}^J_i\varphi^t_{r_\varrho} < 0) $$

In case (ii) we are at the end of the iteration and have the following distribution of the remaining supplies:

$$ {}_i\overset{*}{M}{}^t_{\varrho} = {}^J_i\tilde{M}^t_{\varrho} $$

(III.7.3b)
$$ {}_i\overset{*}{M}{}^t_{r_\varrho} = {}^J_i\tilde{M}^t_{r_\varrho} $$

In case (iii) for those supplies that comply with condition (B), holds:

$$ {}_i\overset{*}{M}{}_{s}^{t} = {}_i\overset{*}{Q}{}_{s}^{t} $$

(III.7.3c)

$$ {}_i\overset{*}{M}{}_{r_s}^{t} = {}_i\overset{*}{Q}{}_{r_s}^{t} $$

Those firms for which subcase (A) holds (i.e. whose supplies exceed provisional allotment) enter into the next iteration.

After the final iteration we can determine the amount of unsold consumer goods for period t:

$$ {}_i{}^{2}m_{s}^{t} = {}_i\overset{*}{Q}{}_{s}^{t} - {}_i\overset{*}{M}{}_{s}^{t} $$

(III.7.9)

$$ {}_i{}^{2}m_{r_s}^{t} = {}_i\overset{*}{Q}{}_{r_s}^{t} - {}_i\overset{*}{M}{}_{r_s}^{t} $$

Consequently the total stocks are:

$$ {}_im_{s}^{t} = {}_i{}^{1}m_{s}^{t} + {}_i{}^{2}m_{s}^{t} $$

(III.7.10)

$$ {}_im_{sr} = {}_i{}^{1}m_{sr}^{t} + {}_i{}^{2}m_{sr}^{t} $$

(8) Accountancy of the consumer goods industry

(8.1) The profit and loss account of firm i

For the profit and loss account we need the following entries:

(8.1.1) Total home sales $\quad {}_i\overset{*}{M}{}^t_{\varsigma}\ {}_ip^t_{\varsigma}$

(8.1.2) Exports (at prices actually paid by the foreign consumer, i.e. including tariffs)

$$\sum_{\substack{r \\ r\neq\varsigma}} {}_i\overset{*}{M}{}^t_{\varsigma r}\left[{}_ip^t_{\varsigma r}\left(1+\vartheta^t_{\varsigma r}\right)+\nu^t_{\varsigma r}\right]$$

(8.1.3) Subsidies:

a) per man employed $\quad {}_i\overset{*}{W}{}^t_{\varsigma}\ {}_w\sigma^t_{\varsigma}$

b) per money unit of non liquid assets

$${}_a\sigma^t_{\varsigma}\left({}_iR^t_{\varsigma}+{}_i\mathfrak{M}^t_{\varsigma}+\sum_{\varsigma}\sum_{\varsigma}{}_y{}^{\varsigma}p^t_{c_{\varsigma}i_r}\right)$$

c) per money unit of turnover

$${}_m\sigma^t_{\varsigma}\left({}_i\overset{*}{M}{}^t_{\varsigma}\ {}_ip^t_{\varsigma}+\sum_r {}_i\overset{*}{M}{}_{\varsigma r}\ {}_ip^t_{\varsigma r}\right)$$

d) per money unit of exports

$${}_e\sigma^t_{\varsigma}\sum_r {}_i\overset{*}{M}{}^t_{\varsigma r}\ {}_ip^t_{\varsigma r}$$

e) paid as a lump-sum

$${}_i\sigma^t_{\varsigma}$$

(8.1.4) Penalty:

$$n \sum_{\varsigma} \sum_{\xi} {}_{\nu}p\, c_{\varsigma}\, i_{r}^{\xi\, t-1} \qquad \forall \nu : {}^{\xi}\nu c_{\varsigma}\, i_{r}^{t-1} > {}^{\xi}{}^{*}\nu c_{\varsigma}\, i_{r}^{t-1}$$

(8.1.5) Change of stocks:

If the amount $\left({}_{i}\mathcal{BOL}_{\varsigma}^{t} - {}_{i}\mathcal{BOL}_{\varsigma}^{t-1}\right)$ has a positive sign, it is credited to the profit and loss account. If the sign is negative, it is debited to the profit and loss account and if $\left({}_{i}\mathcal{BOL}_{\varsigma}^{t} - {}_{i}\mathcal{BOL}_{\varsigma}^{t-1}\right)$ equals zero there are no entries at all.

(8.1.6) Loss brought forward for the purpose of tax deductions

$${}_{i}L_{\varsigma}^{*\,t-1}$$

(8.1.7) Wages

$${}_{i}W_{\varsigma}^{*\,t} \cdot {}_{i}W_{\varsigma}^{*\,t}$$

(8.1.8) Depreciation

$${}_{i}D_{\varsigma}^{t}$$

(8.1.9) License fees for raw material

$${}_{i}q_{\varsigma}^{*\,t}\, \mathcal{LIZ}$$

(8.1.10) Interest

$${}_{i}L_{\varsigma}^{t}\; {}_{i}b_{\varsigma}^{*t} \cdot \frac{1}{100}$$

(8.1.11) Payroll-tax:

$$ {}_i\overset{*}{W}{}_{\varrho}^{t} \; {}_i\overset{*}{W}{}_{\varrho}^{t} \; w\tau_{\varrho}^{t} $$

(8.1.12) Fee for branch in foreign market

$$ \sum_{\substack{r \\ r \neq \varrho}} {}_iA_{\varrho r}^{t} \; {}_i\tau_{\varrho r}^{t} $$

where:

$$ {}_iA_{\varrho r}^{t} = 0 \quad \text{if} \quad {}_i\overset{*}{Q}_{\varrho r} = 0 \quad \text{where } \varrho \neq r $$

$$ {}_iA_{\varrho r}^{t} = 1 \quad \text{if} \quad {}_i\overset{*}{Q}_{\varrho r} > 0 \quad \text{where } \varrho \neq r $$

(8.1.13) Advertising

on the home market: ${}_ia_{\varrho}^{t}$

on the foreign market: $\sum_{\substack{r \\ r \neq \varrho}} {}_ia_{\varrho r}^{t}$

(8.1.14) Turnover tax (for home sales only)

$$ {}_i\overset{*}{M}{}_{\varrho}^{t} \; {}_ip_{\varrho}^{t} \; m\tau_{\varrho}^{t} $$

(8.1.15) Duties:

ad valorem duty:

$$ \sum_{\substack{r \\ r \neq \varrho}} {}_i\overset{*}{M}{}_{\varrho r}^{t} \; {}_ip_{\varrho r}^{t} \; \nu_{\varrho r}^{t} $$

specific duty:

$$\sum_{\substack{r \\ r \neq s}} {}_i\overset{*}{M}{}^t_{sr}\, \vartheta^t_{sr}$$

(8.1.16) Property tax:

$${}_i\mathcal{A}^t_s\, a_s^t \left({}_iC^t_s + {}_i\tilde{\pi}^{t-1}_s - {}^L_i\tilde{\pi}^{t-1}_s\right)$$

where

$${}_i\mathcal{A}^t_s = 1 \quad \text{if } \left({}_iC^t_s + {}_i\tilde{\pi}^{t-1}_s\right) > {}^L_i\tilde{\pi}^{t-1}_s$$

$${}_i\mathcal{A}^t_s = 0 \quad \text{if } \left({}_iC^t_s + {}_i\tilde{\pi}^{t-1}_s\right) \leq {}^L_i\tilde{\pi}^{t-1}_s$$

For the determination of profit, loss and income-tax we compute the overall expenses and returns that are subject to income-tax:

(III.8.1)
$$\begin{aligned} {}_iE^t_s = {}^L_i\overset{*}{\pi}{}^{t-1}_s + {}_i\overset{*}{W}{}^t_s\, {}_iw^t_s + {}_iD^t_s + {}_i\overset{*}{q}{}^t_s\, m_0 + \\ + {}_iL^t_s\, {}_ib^t_s\, \tfrac{1}{100} + \left({}_i\mathcal{DT}^{t-1}_s - {}_i\mathcal{DT}^t_s\right)^{(1)} + \\ + \sum_{\substack{r \\ r \neq s}} {}_iA^t_{sr}\, {}_if^t_{sr} + {}_ia^t_s + \sum_{\substack{r \\ r \neq s}} {}_ia^t_{rs} + \\ + {}_i\overset{*}{M}{}^t_s\, {}_ip^t_s\, m_t^t + \sum_{\substack{r \\ r \neq s}} {}_i\overset{*}{M}{}^t_{sr}\, {}_ip^t_{sr}\, \vartheta^t_{sr} + \\ + \sum_{\substack{r \\ r \neq s}} {}_i\overset{*}{M}{}^t_{sr}\, \vartheta^t_{sr} + {}_i\overset{*}{W}{}^t_s\, {}_i\overset{*}{w}{}^t_s\, w_s^t \end{aligned}$$

(III.8.2) $$ {}_i\mathcal{L}_s^t = {}_i\overset{*}{M}_s^t \, {}_ip_s^t + \sum_{r \neq s} {}_i\overset{*}{M}_{sr}^t \left[{}_ip_{sr}^t \left(1 + \vartheta_{sr}^t\right) + \vartheta_{sr}^t \right] + $$
$$ + {}_i\overset{*}{W}_{sw}^t \, \mathcal{O}_s^t + \left({}_iR_s^t + {}_i\mathcal{DT}_s^t + \sum_s \sum_{\xi} {}_{\nu}p^{\xi}_{c_s i_r} \right)_a \mathcal{O}_s^t + $$
$$ + {}_m\mathcal{O}_s^t \left({}_i\overset{*}{M}_s^t \, {}_ip_s^t + \sum_r {}_i\overset{*}{M}_{sr}^t \, {}_ip_{sr}^t \right) + $$
$$ + {}_e\mathcal{O}_s^t \sum_{r \neq s} {}_i\overset{*}{M}_{sr}^t \, {}_ip_{sr}^t + {}_i\mathcal{O}_s^t + n \sum_s \sum_{\xi} {}_{\nu}p^{\xi}_{c_s i_r}{}^{t-1} + $$
$$ + \left({}_i\mathcal{DT}_s^t - {}_i\mathcal{DT}_s^{t-1} \right) \text{(2)} $$

---

(1) Only if $\left({}_i\mathcal{DT}_s^{t-1} - {}_i\mathcal{DT}_s^t \right) > 0$

(2) Only if $\left({}_i\mathcal{DT}_s^t - {}_i\mathcal{DT}_s^{t-1} \right) > 0$

We check whether:

(i) $$ {}_i\mathcal{L}_s^t \leqslant {}_iE_s^t $$

In case (i) we calculate:

$$ {}^{L}_{i}\overset{*}{\Pi}^{t}_{s} = {}_{i}E^{t}_{s} - {}_{i}\overset{\varphi}{\mathcal{L}}^{t}_{s} $$

and compare:

$$ \text{(ii)} \quad {}^{L}_{i}\overset{*}{\Pi}^{t}_{s} - {}^{L}_{i}\overset{*}{\Pi}^{t-1}_{s} + {}_{i}A^{t}_{s}\,a^{t}_{s}\left({}_{i}C^{t}_{s} + {}_{i}\tilde{\Pi}^{t-1}_{s} - {}^{L}_{i}\tilde{\Pi}^{t-1}_{s}\right) < 0 $$

If (i) $\wedge$ (ii):

$$ {}^{L}_{i}\Pi^{t}_{s} = 0 $$

$$ \text{(III.8.3a)} \quad {}_{i}\bar{\Pi}^{t}_{s} = {}^{L}_{i}\overset{*}{\Pi}^{t-1}_{s} - {}_{i}\overset{*}{\Pi}^{t}_{s} - {}_{i}A^{t}_{s}\,a^{t}_{s}\left({}_{i}C^{t}_{s} + {}_{i}\tilde{\Pi}^{t-1}_{s} - {}^{L}_{i}\tilde{\Pi}^{t-1}_{s}\right) $$

$$ {}_{i}\tau^{t}_{s} = 0 $$

If (i) $\wedge$ $\neg$(ii):

$$ {}_{i}{}^{L}\pi_{\varsigma}^{t} = {}_{i}{}^{L}\overset{*}{\pi}_{\varsigma}^{t-1} - {}_{i}{}^{L}\overset{*}{\pi}_{\varsigma}^{t} + {}_{i}A_{\varsigma}^{t}\, a_{\varsigma}^{t}\, \left({}_{i}C_{\varsigma}^{t} + {}_{i}\tilde{\pi}_{\varsigma}^{t-1} - {}_{i}{}^{L}\tilde{\pi}_{\varsigma}^{t-1} \right) $$

(III.8.3b) $$ {}_{i}\bar{\pi}_{\varsigma}^{t} = 0 $$

$$ {}_{i}\tau_{\varsigma}^{t} = 0 $$

If $\neg$ (i) we calculate:

$$ {}_{i}\pi_{\varsigma}^{t} = {}_{i}\varphi_{\varsigma}^{t} - {}_{i}E_{\varsigma}^{t} $$

and compare:

(iii) $$ {}_{i}\pi_{\varsigma}^{t} - \bar{\sigma}_{\varsigma}^{t} > 0 $$

If $\neg$ (i) $\wedge$ (iii):

$$ {}_{i}\tau_{\varsigma}^{t} = {}_{i}\pi_{\varsigma}^{t} - \bar{\sigma}_{\varsigma}^{t} $$

If $\neg$ (i) $\wedge$ $\neg$ (iii):

$$ {}_{i}\tau_{\varsigma}^{t} = 0 $$

In both cases we check*):

(iv) $$ {}_{i}\pi_{\varsigma}^{t} + {}_{i}{}^{L}\overset{*}{\pi}_{\varsigma}^{t-1} - {}_{i}\tau_{\varsigma}^{t} - {}_{i}A_{\varsigma}^{t}\, a_{\varsigma}^{t}\, \left({}_{i}C_{\varsigma}^{t} + {}_{i}\tilde{\pi}_{\varsigma}^{t-1} - {}_{i}{}^{L}\tilde{\pi}_{\varsigma}^{t-1} \right) > 0 $$

*) The amount of income tax is computed in connection with the budget.

If (iv):

$$i\overline{\pi}_s^t = i\pi_s^t + {}^L i\pi_s^{*t-1} - \overline{\tau}_s^t - iA_{sa}^t \rceil_s^t \left(iC_s^t + i\tilde{\pi}_s^{t-1} - {}^L i\tilde{\pi}_s^{t-1} \right)$$

(III.8.3c)

$${}^L i\pi_s^t = 0$$

If $\neg$ (iv):

$$i\overline{\pi}_s^t = 0$$

(III.8.3d)

$${}^L i\pi_s^t = iA_{sa}^t \rceil_s^t \left(iC_s^t + i\tilde{\pi}_s^{t-1} - {}^L i\tilde{\pi}_s^{t-1} \right) + i\tau_s^t - i\pi_s^t - {}^L i\pi_s^{*t}$$

(8.2) The financial status

For the financial status we need the following items:

(8.2.1) Cash brought forward from (t-1) $\quad {}_i\Gamma_\varrho^{t-1}$

(8.2.2) Reimbursement of the prices of machinery which could not be delivered.

$$\sum_\varrho \sum_\varrho {}_\nu^\varrho p c_\varrho i_r \qquad \forall \nu : {}_\nu^\varrho c_{\varrho i_r}^{t-1} > {}_\nu^{\varrho *} c_{\varrho i_r}^{t-1}$$

(8.2.3) Prepayment of the machinery ordered in period t

$$\sum_\varrho \sum_\varrho {}_\nu^\varrho p c_\varrho i_r$$

For the determination of cash surplus and deficit we calculate the overall disbursements and receipts:

$$\begin{aligned}(\text{III.8.4}) \quad {}_iU_\varrho^t = {} & \sum_\varrho \sum_\varrho {}_\nu^\varrho p c_\varrho i_r + {}_iW_\varrho^{*t}\, {}_iw_\varrho^{*t} + {}_iq_\varrho^{*t}\, m + \\ & + {}_iL_\varrho^t\, {}_ib_\varrho^{*t}\, \tfrac{1}{100} + \sum_r {}_iA_{\varrho r}^t\, {}_if_{\varrho r}^t + \\ & + {}_iW_\varrho^{*t}\, {}_iw_\varrho^{*t}\, w\gamma_\varrho^t + \sum_{r\neq\varrho} {}_iA_\varrho^t\, a\gamma_\varrho^t \left({}_iC_\varrho^t + {}_i\tilde{\Pi}_\varrho^{t-1} - {}_i^L\tilde{\Pi}_\varrho^{t-1}\right) \\ & + {}_iM_\varrho^{*t}\, {}_ip_\varrho^t\, m\gamma_\varrho^t + {}_i\Gamma_\varrho^t + \sum_r {}_iM_{\varrho r}^{*t}\, {}_ip_{\varrho r}^t\, \vartheta_{\varrho r}^t + \\ & + \sum_{r\neq\varrho} {}_iM_{\varrho r}^{*t}\, \vartheta_{\varrho r}^t + {}_ia_\varrho^t + \sum_{r\neq\varrho} {}_ia_{\varrho r}^t + {}_i\bar{L}_\varrho^t + \bar{\beta}\, {}_iL^{t-1}_\varrho\end{aligned}$$

$$(III.8.5)\quad {}_i\mathcal{U}_s^t = {}_i\Gamma_s^{t-1} + {}_i\overset{*}{M}_s^t\, {}_ip_s^t + \sum_{r\neq s} {}_i\overset{*}{M}_{sr}^t \left[{}_ip_{sr}^t (1+\vartheta_{sr}^t) + \vartheta_{sr}^t \right] +$$
$$+ {}_i\overset{*}{W}_s^t\, {}_w\mathcal{O}_s^t + \left({}_iR_s^t + {}_i\mathcal{M}_s^t + \sum_{s}\sum_{\varsigma} {}_\nu p_{c_s i_r}^{\varsigma\, t} \right) {}_a\mathcal{O}_s^t +$$
$$+ {}_m\mathcal{O}_s^t \left({}_i\overset{*}{M}_s^t\, {}_ip_s^t + \sum_{r\neq s} {}_i\overset{*}{M}_{sr}^t\, {}_ip_{sr}^t \right) +$$
$$+ {}_e\mathcal{O}_s^t \sum_{r\neq s} {}_i\overset{*}{M}_{sr}^t\, {}_ip_{sr}^t + {}_i\mathcal{O}_s^t + {}_i\overset{*}{B}_s^t +$$
$$+ n \sum_{s}\sum_{\varsigma}^{r\neq s} {}_\nu p_{c_s i_r}^{\varsigma\, t-1} + \sum_{s}\sum_{\varsigma} {}_\nu p_{c_s i_r}^{\varsigma\, t-1}$$

We check whether:

$$(i)\qquad {}_i\mathcal{U}_s^t - {}_iU_s^t - {}_iF_s^{t-1} \geq 0$$

In case (i):

$$ {}_i\Gamma_s^t = {}_i\mathcal{U}_s^t - {}_iU_s^t - {}_iF_s^{t-1}$$

$$(III.8.6a)\qquad {}_iF_s^t = 0$$

$$ {}_i\tilde{F}_s^t = 0$$

If $\neg$ (i) we compare:

(ii) $${}_i\overline{F}_s^{t-1} > 0$$ where:

$$\neg \text{ (ii) } {}_i\overline{F}_s^{t-1} = 0$$

If $\neg$ (i) $\wedge$ (ii) we check whether:

(iii) $${}_i\overline{O}_s^{t} \geqslant {}_i\overline{F}_s^{t-1}$$

If $[\neg$ (i) $\wedge$ $\neg$ (ii)$] \vee [\neg$(i) $\wedge$ (ii) $\wedge$ (iii)$]$:

$${}_i\overline{\Gamma}_s^{t} = 0$$

(III.8.6b) $${}_i\overline{F}_s^{t} = {}_i\overline{U}_s^{t} - {}_i\overline{U}_s^{t}$$

$${}_i\tilde{\overline{F}}_s^{t} = 0$$

If, however, $\neg$ (i) $\wedge$ (ii) $\wedge$ $\neg$ (iii):

$${}_i\overline{\Gamma}_s^{t} = 0$$

(III.8.6c) $${}_i\tilde{\overline{F}}_s^{t} = {}_i\overline{U}_s^{t} - {}_i\overline{U}_s^{t} - {}_i\overline{F}_s^{t-1}$$

${}_i\overline{F}_s^{t}$ is determined at the beginning of period (t+1) - see (III.2.6a).

In case (III.8.6c) the government of country ς must be informed of the recurring existence and amount of uncovered bills of exchange. If the government does not subsidize the full amount of the uncovered bills of exchange the respective firm is considered bankupt and excluded from further gaming and ${}_i\tilde{F}_\varsigma^t$ is deducted from L^t in all subsequent periods.

(8.3) Balance sheet

For the balance sheet we need the following data:

(8.3.1) Quantity of machines purchased in previous periods still in operation:

$$ {}^{\varsigma}_{i}Z_{\varsigma}^{t} = \sum_{\varsigma} {}^{\varsigma}\overset{*}{N}{}^{t}_{c_\varsigma i_r} + \sum_{\varsigma} {}^{\varsigma}\overset{*}{N}{}^{t-1}_{c_\varsigma i_r} + \ldots + \sum_{\varsigma} {}^{\varsigma}\overset{*}{N}{}^{t-\frac{1}{d_\varsigma}+1}_{c_\varsigma i_r} $$

(8.3.2) The depreciation is:

$$ {}^{\varsigma}_{i}D_{\varsigma}^{t} = d_\varsigma \sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t-1}_{c_\varsigma i_r} + d_\varsigma \sum {}^{\varsigma}_{\nu}p^{t-2}_{c_\varsigma i_r} + \ldots $$

$$ \ldots + d_\varsigma \sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t-\frac{1}{d_\varsigma}}_{c_\varsigma i_r} $$

$$ \forall \nu : {}^{\varsigma}\nu^{t}_{c_\varsigma i_r} \leqslant {}^{\varsigma}\overset{*}{\nu}{}^{t}_{c_\varsigma i_r} $$

$$ {}_iD_{\varsigma}^{t} = \sum_{\varsigma} {}^{\varsigma}_{i}D_{\varsigma}^{t} $$

$$ \forall t : t-1, t-2, \ldots . t-\frac{1}{d_\varsigma} $$

(8.3.3) The value of the stock of machinery is*):

$$
\begin{aligned}
{}^{\varsigma}_{i}R^{t}_{\varsigma} = {} & \sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t}_{\varsigma}c_{\varsigma}i_{r} + (1-d_{\varsigma})\sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t-1}_{\varsigma}c_{\varsigma}i_{r} + \\
& + (1-2d_{\varsigma})\sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t-2}_{\varsigma}c_{\varsigma}i_{r} + \ldots + \\
& + d_{\varsigma}\sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t-\frac{1}{d_{\varsigma}}+1}_{\varsigma}c_{\varsigma}i_{r}
\end{aligned}
$$

$$
{}_{i}R^{t}_{\varsigma} = \sum_{\varsigma} {}^{\varsigma}_{i}R^{t}_{\varsigma}
$$

(8.3.4) Pre-payment for the machinery which the capital goods industry failed to deliver, is:

$$
\sum_{\varsigma}\sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t}_{\varsigma}c_{\varsigma}i_{r} \qquad \forall\,\nu : {}^{\varsigma}_{\nu}v^{t}_{\varsigma}c_{\varsigma}i_{r} > {}^{\varsigma*t}_{\nu}v_{\varsigma}c_{\varsigma}i_{r}
$$

(8.3.5) The value of the unsold stocks is:

$$
{}_{i}\mathfrak{M}^{t}_{\varsigma} = {}_{i}m^{t}_{\varsigma}\,{}_{i}p^{t}_{\varsigma} + \sum_{\substack{r \\ r\neq\varsigma}} {}_{i}m^{t}_{\varsigma r}\,{}_{i}p^{t}_{\varsigma r}
$$

The accumulated loss is:

$$
{}^{L}_{i}\tilde{\Pi}^{t}_{\varsigma} = {}^{L}_{i}\tilde{\Pi}^{t-1}_{\varsigma} + {}^{L}_{i}\Pi^{t}_{\varsigma} \qquad \text{(III.8.7a)}
$$

*) The last term is derived from $\left[1-\left(\frac{1}{d_{\varsigma}}-1\right)d_{\varsigma}\right] = d_{\varsigma}$

The accumulated profit is:

$$(III.8.7b) \quad {}_i\tilde{\Pi}_s^t = {}_i\tilde{\Pi}_s^{t-1} + {}_i\bar{\Pi}_s^t$$

For the purpose of evaluating the amount of over-indebtedness we compare whether:

$$(i) \quad {}_iC_s + {}_i\tilde{\Pi}_s^t < {}^L{}_i\tilde{\Pi}_s^t$$

If (i) holds, the amount of over-indebtedness amounts to:

$${}_iH_s^t = {}^L{}_i\tilde{\Pi}_s^t - {}_iC_s - {}_i\tilde{\Pi}_s^t$$

and will explicitly be referred to in the balance sheet.

If however, $\neg$ (i) : $\quad {}_iH_s^t = 0$

(8.4) List of machinery

The list of machinery contains the following values:

(8.4.1) Quantity of machinery of kind ς in use during period t (equal to the stock of machinery at the end of period t-1)

$$ {}_{i}^{\varsigma}Z_{\varsigma}^{t-1} $$

(8.4.2) Initial outlay for the machinery of kind ς in use during period t

$$ \sum_{r} {}_{\nu}^{\varsigma}pc_{r}i_{\varsigma}^{t-1} + \sum_{r} {}_{\nu}^{\varsigma}pc_{r}i_{\varsigma}^{t-2} + \ldots\ldots + \sum_{r} {}_{\nu}^{\varsigma}pc_{r}i_{\varsigma}^{t-\frac{1}{d_{\varsigma}}} $$

(8.4.3) Value of the operating machinery of kind ς after allowance for depreciation

$$ {}_{i}^{\varsigma}R_{\varsigma}^{t-1} $$

(8.4.4) Depreciation of machinery of kind ς in period t

$$ {}_{i}^{\varsigma}D_{\varsigma}^{t} $$

(8.4.5) Value of the machinery of kind ς used during period t at the end of period t

$$ {}_{i}^{\varsigma}R_{\varsigma}^{t-1} - {}_{i}^{\varsigma}D_{\varsigma}^{t} $$

(8.4.6) Age structure of machinery of kind ς bought in period t - Θ_ς (where $\Theta_\varsigma = 1, \ldots, 1/d_\varsigma$)

(i) quantity $\sum_r {}^{\varsigma}\overset{*}{N}{}^{t-\Theta_\varsigma} c_r i_\varsigma$

(ii) initial outlay $\sum_r {}^{\varsigma}_{\nu}p^{t-\Theta_\varsigma} c_r i_\varsigma$

(iii) value after allowance for depreciation

$$(1 - \Theta_\varsigma d_\varsigma) \sum_r {}^{\varsigma}_{\nu}p^{t-\Theta_\varsigma} c_r i_\varsigma$$

(8.4.7) Machinery of kind ς scrapped at the end of period t

(i) quantity $\sum_r {}^{\varsigma}\overset{*}{N}{}^{t-\Theta_\varsigma} c_r i_\varsigma$

(ii) initial outlay $\sum_r {}^{\varsigma}_{\nu}p^{t-\Theta_\varsigma} c_r i_\varsigma$

(8.4.8) Machinery of kind ς actually received at the end of period t

(i) quantity $\sum_r {}^{\varsigma}\overset{*}{N}{}^{t} c_r i_\varsigma$

(ii) total outlay $\sum_r {}^{\varsigma}_{\nu}p^{t} c_r i_\varsigma$

(8.4.9) Stock of machinery of kind ς at the end of period t (equal to the stock actually in operation during period t+1)

(i) quantity

$$ {}_{i}Z_{\varsigma}^{t} $$

(ii) initial outlay

$$ \sum_{r} {}_{\nu}p^{\varsigma}\, c_{r}\, i_{\varsigma}^{\,t} + \sum_{r} {}_{\nu}p^{\varsigma}\, c_{r}\, i_{\varsigma}^{\,t-1} + \ldots\ldots \sum_{r} {}_{\nu}p^{\varsigma}\, c_{r}\, i_{\varsigma}^{\,t-\frac{1}{d_{\varsigma}}+1} $$

(iii) value after allowance for depreciation

$$ {}_{i}R_{\varsigma}^{t} $$

(9) Accounting of the capital goods industry

(9.1) The profit and loss account of firm c

(9.1.1) Total home sales

$$\sum_{\varsigma}\sum_{i} {}_{\nu}^{\varsigma}p\, {}_{c\varsigma i_r}^{\ t} \qquad \forall \nu : {}^{\varsigma}\nu_{c\varsigma i_r}^{t} \leqslant {}^{\varsigma}\overset{*}{\nu}_{c\varsigma i_r}^{t}$$

(9.1.2) Exports

$$\sum_{\varsigma}\sum_{i}\sum_{\substack{r \\ r\neq\varsigma}} {}_{\nu}^{\varsigma}p\, {}_{c\varsigma i_r}^{\ t} \qquad \forall \nu : {}^{\varsigma}\nu_{c\varsigma i_r}^{t} \leqslant {}^{\varsigma}\overset{*}{\nu}_{c\varsigma i_r}^{t}$$

(9.1.3) Subsidies

a) per man employed $\quad {}_{c}\overset{*}{W}_{\varsigma}^{t}\, {}_{w}\tilde{O}_{\varsigma}^{t}$

b) per money unit of non-liquid assets $\quad {}_{a}\tilde{O}_{\varsigma}^{t}\, {}_{c}R_{\varsigma}^{t}$

c) per money unit of turnover

$${}_{m}\tilde{O}_{\varsigma}^{t}\left(\sum_{\varsigma}\sum_{i} {}_{\nu}^{\varsigma}p\, {}_{c\varsigma i_r}^{\ t} + \sum_{\varsigma}\sum_{i}\sum_{\substack{r \\ r\neq\varsigma}} {}_{\nu}^{\varsigma}p\, {}_{c\varsigma i_r}^{\ t}\right)$$

d) per money unit of exports

$${}_{e}\tilde{O}_{\varsigma}^{t}\sum_{\varsigma}\sum_{i}\sum_{r,\, r\neq\varsigma} {}_{\nu}^{\varsigma}p\, {}_{c\varsigma i_r}^{\ t}$$

e) paid as a lump sum

$${}_{c}\tilde{O}_{\varsigma}^{t}$$

(9.1.4) Value of the machines produced (in period t) for own use:

$$\overset{*}{N}{}^{t}_{c_\varsigma}\, p_c$$

(9.1.5) Loss brought forward for the purpose of tax deduction:

$$L\overset{*}{\Pi}{}^{t-1}_{c_\varsigma}$$

(9.1.6) Wages

$$\overset{*}{W}{}^{t}_{c_\varsigma}\ \overset{*}{W}{}^{t}_{c_\varsigma}$$

(9.1.7) Depreciation

$$D^{t}_{c_\varsigma}$$

(9.1.8) License fee for raw material:

$$\sum_{\varsigma} m_{\varsigma} \left(\sum_{i}^{\varsigma} \overset{*}{N}{}^{t}_{c_\varsigma i_r} + \sum_{r \neq \varsigma} \sum_{i}^{\varsigma} \overset{*}{N}{}^{t}_{c_\varsigma i_r} \right) + m_c \overset{*}{N}{}^{t}_{c_\varsigma}$$

(9.1.9) Interest

$$ {}_{c}L_{\varsigma}^{t} \; {}_{c}b_{\varsigma}^{*t} \; \frac{1}{100} $$

(9.1.10) Pay-roll tax

$$ {}_{c}W_{\varsigma}^{*t} \; {}_{c}W_{\varsigma}^{*t} \; w\!\uparrow_{\varsigma}^{t} $$

(9.1.11) Allowance for penalty

$$ n \sum_{\varsigma} \sum_{i} \sum_{r} {}_{\nu}p_{c_{\varsigma} i_r}^{\varsigma\, t} \qquad \forall \nu : {}^{\varsigma}\nu_{c_{\varsigma} i_r}^{t} > {}^{\varsigma}\nu_{c_{\varsigma} i_r}^{*t} $$

$$ r \in \{1,2,3\} $$

(9.1.12) Property tax

$$ {}_{c}A_{\varsigma a}^{t} \uparrow_{\varsigma}^{t} \left({}_{c}C_{\varsigma}^{t} + {}_{c}\tilde{\Pi}_{\varsigma}^{t-1} - {}^{L}{}_{c}\tilde{\Pi}_{\varsigma}^{t-1} \right) $$

where: ${}_{c}A_{\varsigma}^{t} = 1$ if $\left({}_{c}C_{\varsigma}^{t} + {}_{c}\tilde{\Pi}_{\varsigma}^{t-1} \right) > {}^{L}{}_{c}\tilde{\Pi}_{\varsigma}^{t-1}$

${}_{c}A_{\varsigma}^{t} = 0$ if $\left({}_{c}C_{\varsigma}^{t} + {}_{c}\tilde{\Pi}_{\varsigma}^{t-1} \right) \leq {}^{L}{}_{c}\tilde{\Pi}_{\varsigma}^{t-1}$

For the determination of profit, loss and income-tax we compute the overall expenses and returns that are subject to income-tax:

$$(III.9.1)\quad {}_cE_\varsigma^t = {}_c\overset{L}{\Pi}{}_\varsigma^{*t-1} + {}_cW_\varsigma^{*t}\,{}_cw_\varsigma^{*t} + {}_cD_\varsigma^t +$$
$$+ \sum_\varsigma m_\varsigma \left(\sum_i {}^\varsigma N_{c_\varsigma i_r}^{*t} + \sum_r \sum_i {}^\varsigma N_{c_\varsigma i_r}^{*t}\right) +$$
$$+ m_c N_{c_\varsigma}^{*t} + {}_cL_{\varsigma c}^t b_\varsigma^{*t} \frac{1}{100} + {}_cW_\varsigma^{*t}\,{}_cw_\varsigma\, w_\varsigma^t$$

$$(III.9.2)\quad {}_c\overset{\varphi}{E}{}_\varsigma^t = \sum_\varsigma \sum_i {}_\nu^\varsigma p_{c_\varsigma i_r}^t + \sum_\varsigma \sum_i \sum_{\substack{r \\ r\neq\varsigma}} {}_\nu^\varsigma p_{c_\varsigma i_r}^t + {}_cW_\varsigma^{*t} w_\varsigma^t +$$
$$+ {}_a\overset{\sim}{\sigma}_\varsigma^t\, {}_cR_\varsigma^t + {}_m\overset{\sim}{\sigma}_\varsigma^t \left(\sum_\varsigma \sum_i {}_\nu^\varsigma p_{c_\varsigma i_r}^t + \sum_\varsigma \sum_i \sum_{\substack{r \\ r\neq\varsigma}} {}_\nu^\varsigma p_{c_\varsigma i_r}^t\right) +$$
$$+ {}_e\overset{\sim}{\sigma}_\varsigma^t \sum_\varsigma \sum_i \sum_{\substack{r \\ r\neq\varsigma}} {}_\nu^\varsigma p_{c_\varsigma i_r}^t + {}_c\overset{\sim}{\sigma}_\varsigma^t + N_{c_\varsigma}^{*}\, {}_cp$$

We check whether:

$$\text{(i)} \quad {}_c\overset{\varphi}{\xi}{}^t_s \leqslant {}_cE^t_s$$

In case (i) we calculate:

$${}_c\overset{L*}{\Pi}{}^t_s = {}_cE^t_s - {}_c\overset{\varphi}{\xi}{}^t_s$$

and compare:

$$\text{(ii)} \quad {}_c\overset{L*}{\Pi}{}^t_s - {}_c\overset{L*}{\Pi}{}^{t-1}_s + {}_cA^t_s \, {}_a\eta^t_s \left({}_cC^t_s + {}_c\overset{\sim}{\Pi}{}^{t-1}_s - {}_c\overset{L\sim}{\Pi}{}^{t-1}_s \right) < 0$$

If (i) $\wedge$ (ii):

$$\text{(III.9.3a)} \quad \begin{aligned} {}_c\overset{L}{\Pi}{}^t_s &= 0 \\ {}_c\overset{\sim}{\Pi}{}^t_s &= {}_c\overset{L*}{\Pi}{}^{t-1}_s - {}_c\overset{L*}{\Pi}{}^t_s - {}_cA^t_s \, {}_a\eta^t_s \left({}_cC^t_s + {}_c\overset{\sim}{\Pi}{}^{t-1}_s - {}_c\overset{L\sim}{\Pi}{}^{t-1}_s \right) \\ {}_c\tau^t_s &= 0 \end{aligned}$$

If (i) $\wedge$ $\neg$ (ii):

$$ {}^{L}_{c}\Pi^{t}_{s} = {}^{L}_{c}\overset{*}{\Pi}^{t-1}_{s} - {}^{L}_{c}\overset{*}{\Pi}^{t}_{s} + {}_{c}A^{t}_{s}\, {}_{a}q^{t}_{s}\,\eta^{t}_{s}\,({}_{c}C^{t}_{s} + {}_{c}\tilde{\Pi}^{t-1}_{s} - {}^{L}_{c}\tilde{\Pi}^{t-1}_{s}) $$

(III.9.3b) $$ {}_{c}\bar{\Pi}^{t}_{s} = 0 $$

$$ {}_{c}\bar{L}^{t}_{s} = 0 $$

If $\neg$ (i) we calculate:

$$ {}_{c}\bar{\Pi}^{t}_{s} = {}_{c}\mathcal{L}^{t}_{s} - {}_{c}E^{t}_{s} $$

and compare:

(iii) $$ {}_{c}\bar{\Pi}^{t}_{s} - \bar{\sigma}^{t}_{s} > 0 $$

If $\neg$ (i) $\wedge$ (iii):

$$ {}_{c}\bar{L}^{t}_{s} = {}_{c}\bar{\Pi}^{t}_{s} - \bar{\sigma}^{t}_{s} $$

If $\neg$ (i) $\wedge$ $\neg$ (iii)

$$ {}_c\tau_g^t = 0 $$

In both cases we check*):

$$ \text{(iv)}\quad {}_c\pi_g^t + {}_c\overset{L*}{\pi}{}_g^{t-1} - {}_c\tau_g^t - {}_c\alpha_g^t\,{}_a\eta_g \left({}_cC_g^t + {}_c\tilde{\pi}_g^{t-1} - {}_c\tilde{\pi}_g^{L\,t-1} \right) > 0 $$

If (iv):

$$ {}_c\pi_g^t = {}_c\pi_g^t + {}_c\overset{L*}{\pi}{}_g^{t-1} - {}_c\tau_g^t - {}_c\alpha_g^t\,{}_a\eta_g^t \left({}_cC_g^t + {}_c\tilde{\pi}_g^{t-1} - {}_c\tilde{\pi}_g^{L\,t-1} \right) $$

(III.9.3c)

$$ {}_c\pi_g^{Lt} = 0 $$

---

*) The amount of income-tax is computed in connection with the budget.

If $\neg$ (iv):

$$c\overline{\Pi}_{\varsigma}^{t} = 0$$

(III.9.3d)

$$^{L}_{c}\Pi_{\varsigma}^{t} = c\Delta_{\varsigma}^{t}\alpha_{\varsigma}^{t}\left(_{c}C_{\varsigma}^{t} + c\tilde{\Pi}_{\varsigma}^{t-1} - ^{L}_{c}\tilde{\Pi}_{\varsigma}^{t-1}\right) + c\Gamma_{\varsigma}^{t} - c\Pi_{\varsigma}^{t} - ^{L*}_{c}\Pi_{\varsigma}^{t-1}$$

(9.2) The financial status

For the financial status we need the following items:

(9.2.1) Cash brought forward from (t-1)

$$c\Gamma_{\varsigma}^{t-1}$$

(9.2.2) Pre-payment received for the machinery ordered

$$\sum_{r}\sum_{i}\sum_{\varsigma}{}_{\nu}^{\varsigma}p c_{\varsigma}{}_{i_r}^{t} \qquad r \in \{1,2,3\}$$

(9.2.3) Payment of penalty

$$n \sum_r \sum_i \sum_\varsigma {}^{\varsigma}_{\nu}p^{t-1}_{c_\varsigma i_r} \qquad \forall \nu : {}^{\varsigma}_{\nu}c^{t-1}_{\varsigma i_r} > {}^{\varsigma *}_{\nu}c^{t-1}_{\varsigma i_r}$$

(9.2.4) Re-payment of funds received for ordered machinery which could not be delivered

$$\sum_r \sum_i \sum_\varsigma {}^{\varsigma}_{\nu}p^{t-1}_{c_\varsigma i_r} \qquad \forall \nu : {}^{\varsigma}_{\nu}c^{t-1}_{\varsigma i_r} > {}^{\varsigma *}_{\nu}c^{t-1}_{\varsigma i_r}$$

For the determination of cash surplus and deficit we again calculate the overall disbursements and receipts:

$$\begin{aligned}
(\text{III.9.4}) \quad {}_cU^t_\varsigma = {}_cW^{*t}_\varsigma \, {}_cW^{*t}_\varsigma + \sum_\varsigma m_{D_\varsigma} \Big(\sum_i {}^{\varsigma}\overset{*}{N}{}^t_{c_\varsigma i_r} + \sum_{r \neq \varsigma} \sum_t {}^{\varsigma}\overset{*}{N}_{c_\varsigma i_r} \Big) + \\
+ m_{D_c} \overset{*}{N}{}^t_{c_\varsigma} + {}_cL^t_\varsigma \, {}_cb^{*t}_\varsigma \tfrac{1}{100} + {}_cW^{*t}_\varsigma \, {}_cW^{*t}_\varsigma \, w^t_\varsigma + \\
+ {}_cA^t_\varsigma \, a^t_\varsigma \Big({}_cC^t_\varsigma + {}_c\tilde{\Pi}^{t-1}_\varsigma - {}_c\tilde{\Pi}^{t-1}_{L\varsigma} \Big) + \overline{T}^t_\varsigma + \\
+ n \sum_r \sum_i \sum_\varsigma {}^{\varsigma}_{\nu}p^{t-1}_{c_\varsigma i_r} + \sum_r \sum_i \sum_\varsigma {}^{\varsigma}_{\nu}p^{t-1}_{c_\varsigma i_r} + \\
+ {}_c\overline{L}^t_\varsigma + \overline{\beta} \, {}_cL^{t-1}_\varsigma
\end{aligned}$$

$$(III.9.5)\quad {}_c\mathcal{U}_\varsigma^t = {}_c\Gamma_\varsigma^{t-1} + {}_c\overset{*}{W}_\varsigma^t\, {}_w\mathcal{O}_\varsigma^t + {}_a\mathcal{O}_\varsigma^t\, {}_cR_\varsigma^t +$$

$$+ {}_m\mathcal{O}_\varsigma^t \left(\sum_\varsigma \sum_i {}_\nu^\varsigma p_{c_\varsigma i_r}^t + \sum_\varsigma \sum_i \sum_{r \neq \varsigma} {}_\nu^\varsigma p_{c_\varsigma i_r}^t \right) +$$

$$+ {}_e\mathcal{O}_\varsigma^t \sum_\varsigma \sum_i \sum_{r \neq \varsigma} {}_\nu^\varsigma p_{c_\varsigma i_r}^t + {}_c\overset{*}{B}_\varsigma^t + \sum_r \sum_i \sum_\varsigma {}_\nu^\varsigma p_{c_\varsigma i_r}^t$$

We check whether:

$$(i)\qquad {}_c\mathcal{U}_\varsigma^t - {}_cU_\varsigma^t - {}_cF_\varsigma^{t-1} \geq 0$$

In case (i):

$$ {}_c\Gamma_\varsigma^t = {}_c\mathcal{U}_\varsigma^t - {}_cU_\varsigma^t - {}_cF_\varsigma^{t-1}$$

$$(III.9.6a)\quad {}_cF_\varsigma^t = 0$$

$$ {}_c\tilde{F}_\varsigma^t = 0$$

If $\neg$ (i) we compare:

(ii) $$ {}_c\overline{F}_s^{t-1} > 0 $$

where we set ${}_c\overline{F}_s^{t-1}$, if $\neg$ (ii) holds.

If $\neg$ (i) $\wedge$ (ii) we check whether:

(iii) $$ {}_c\overline{\mathcal{O}}_s^{t} \geqslant {}_c\overline{F}_s^{t-1} $$

If $[\neg$ (i) $\wedge$ $\neg$ (ii)$]$ $\vee$ $[\neg$(i) $\wedge$ (ii) $\wedge$ (iii)$]$:

$$ {}_c\overline{\Gamma}_s^{t} = 0 $$

(III.9.6b) $$ {}_c\overline{F}_s^{t} = {}_c\overline{\mathcal{U}}_s^{t} - {}_c\overline{U}_s^{t} $$

$$ {}_c\widetilde{F}_s^{t} = 0 $$

If, however, $\neg$ (i) $\wedge$ (ii) $\wedge$ $\neg$ (iii):

$$ {}_c\Gamma_g^t = 0 $$

(III.9.6c) ${}_cF_g^t$ is determined at the beginning of period (t+1); see (III.2.6a)

$$ {}_c\tilde{F}_g^t = {}_c\mathcal{U}_g^t - {}_cU_g^t - {}_cF_g^{t-1} $$

In case (III.9.6c) the government of country g must be informed of the recurring existence and amount of uncovered bills of exchange. If the government does not subsidize the full amount of the uncovered bills of exchange the respective firm is considered bankrupt and excluded from further gaming and ${}_c\tilde{F}_g^t$ is deducted from L^t in all subsequent periods.

(9.3) The balance sheet

For the balance sheet we need the following data:

(9.3.1) Quantity of machines still in operation:

$$ {}_cZ_g^t = \overset{*}{N}{}_{c_g}^t + \overset{*}{N}{}_{c_g}^{t-1} + \ldots\ldots\ldots + \overset{*}{N}{}_{c_g}^{t-\frac{1}{d_c}+1} $$

(9.3.2) The depreciation is:

$$ {}_{c}D_{\varsigma}^{t} = d_c\, p_c \left(\overset{*}{N}_{c_\varsigma}^{t-1} + \ldots\ldots + \overset{*}{N}_{c_\varsigma}^{t-\frac{1}{d_c}} \right) $$

(9.3.3) The value of the stock of machinery is:

$$ {}_{c}R_{\varsigma}^{t} = p_c \left[\overset{*}{N}_{c_\varsigma}^{t} + (1-d_c) \overset{*}{N}_{c_\varsigma}^{t-1} + \ldots + d_c \overset{*}{N}_{c_\varsigma}^{t-\frac{1}{d_c}+1} \right] $$

(9.3.4) Liabilities for orders which could not be executed in period t:

$$ \sum_i \sum_r \sum_{\varsigma} {}^{\varsigma}\nu\, p_{c_\varsigma i_r}^{t} \qquad \forall \nu : {}^{\varsigma}\nu_{c_\varsigma i_r}^{t} > {}^{\varsigma}\overset{*}{\nu}_{c_\varsigma i_r}^{t} $$

$$ r \in \{1,2,3\} $$

The accumulated loss is:

$$ (III.9.7a) \qquad {}^{L}_{c}\widetilde{\Pi}_{\varsigma}^{t} = {}^{L}_{c}\widetilde{\Pi}_{\varsigma}^{t-1} + {}^{L}_{c}\Pi_{\varsigma}^{t} $$

The accumulated profit is:

(III.9.7b) $$c\tilde{\tilde{\Pi}}_{\varsigma}^{t} = c\tilde{\tilde{\Pi}}_{\varsigma}^{t-1} + c\bar{\Pi}_{\varsigma}^{t}$$

For the purpose of evaluating the amount of over-indebtedness we compare whether:

(i) $$cC_{\varsigma} + c\tilde{\tilde{\Pi}}_{\varsigma}^{t} < {}^{L}c\tilde{\tilde{\Pi}}_{\varsigma}^{t}$$

If (i) holds, the over-indebtedness amounts to:

$$cH_{\varsigma}^{t} = {}^{L}c\tilde{\tilde{\Pi}}_{\varsigma}^{t} - cC_{\varsigma} - c\tilde{\tilde{\Pi}}_{\varsigma}^{t}$$

and will explicitly be referred to in the balance sheet.

If, however, $\neg$ (i) holds: $cH_{\varsigma}^{t} = 0$

(9.4) List of machinery

(9.4.1) Total of machinery in use during period t (equal to the stock of machinery at the end of period t-1)

(i) quantity cZ_{ς}^{t-1}

(ii) value after allowance for depreciation

$${}_cR_s^{t-1}$$

(9.4.2) Depreciation in period t

$${}_cD_s^t$$

(9.4.3) Value of the machinery used during period t at the end of period t

$${}_cR_s^{t-1} - {}_cD_s^t$$

(9.4.4) Age structure of machinery produced in period $t-\Theta$ (where $\Theta = 1, \ldots . 1/d_c$)

(i) quantity

$$\overset{*}{N}{}_{c_s}^{t-\Theta}$$

(ii) value after allowance for depreciation

$$(1-\Theta d_c)\, p_c\, \overset{*}{N}{}_{c_s}^{t-\Theta}$$

(9.4.5) Machinery scrapped at the end of period t

$$\overset{*}{N}{}_{c_s}^{t-\frac{1}{d_c}}$$

(9.4.6) Machinery for own use actually produced during period t

(i) quantity $\overset{*}{N}{}^{t}_{c_g}$

(ii) value $p_c \overset{*}{N}{}^{t}_{c_g}$

(9.4.7) Stock of machinery for own use at the end of period t (equal to the stock actually in operation during period t+1).

(i) quantity ${}_{c}Z^{t}_{g}$

(ii) value ${}_{c}R^{t}_{g}$

(10) The accountancy of the government

For the budget we need the following data:

(10.1) The budget of government

(10.1.1) Receipts from license fees

$$\sum_i {}^{*t}_{i}q_{\varsigma}\, m_{\varsigma} + \sum_{\varsigma} m_{\varsigma} \left(\sum_i {}^{\varsigma}\overset{*}{N}{}^{t}_{c_{\varsigma} i_r} + \sum_{r \neq \varsigma} \sum_i {}^{\varsigma}\overset{*}{N}{}^{t}_{c_{\varsigma} i_r} \right) + m_c \overset{*}{N}{}^{t}_{c_{\varsigma}}$$

(10.1.2) Receipts from pay-roll-tax

$$\sum_i {}_{i}\overset{*}{W}{}^{t}_{\varsigma}\, {}_{i}w^{*t}_{\varsigma}\, w\, \gamma^{t}_{\varsigma} + {}_{c}\overset{*}{W}{}^{t}_{\varsigma}\, {}_{c}w^{*t}_{\varsigma}\, w\, \gamma^{t}_{\varsigma}$$

(10.1.3) Receipts from turnover-tax

$$\sum_i {}_{i}\overset{*}{M}{}^{t}_{\varsigma}\, {}_{i}p^{t}_{\varsigma}\, m\, \gamma^{t}_{\varsigma}$$

(10.1.4) Receipts from property tax

$$\sum_i {}_{i}A^{t}_{\varsigma a}\, \gamma^{t}_{\varsigma} \left({}_{i}C^{t}_{\varsigma} + {}_{i}\tilde{\pi}^{t-1}_{\varsigma} - {}^{L}_{i}\tilde{\pi}^{t-1}_{\varsigma} \right) + {}_{c}A^{t}_{\varsigma a}\, \gamma^{t}_{\varsigma} \left({}_{c}C^{t}_{\varsigma} + {}_{c}\tilde{\pi}^{t-1}_{\varsigma} - {}^{L}_{c}\tilde{\pi}^{t-1}_{\varsigma} \right)$$

(10.1.5) Receipts from duties

$$\sum_i \sum_{\substack{r \\ r \neq s}} {}_i \overset{*}{M}{}^t_{rs} \; {}_i p^t_{rs} \; \vartheta^t_{rs} + \sum_i \sum_{\substack{r \\ r \neq s}} {}_i \overset{*}{M}{}^t_{rs} \; \vartheta^t_{rs}$$

(10.1.6) Receipts from fee for branches

$$\sum_i \sum_{\substack{r \\ r \neq s}} {}_i A^t_{rs} \; {}_i f^t_{rs}$$

(10.1.7) Receipts from advertising

$$\sum_i {}_i a^t_s + \sum_{\substack{r \\ r \neq s}} \sum_i {}_i a^t_{rs}$$

(10.1.8) Receipts from income-tax:

$$\sum_i {}_i T^t_s + {}_c T^t_s + \sum_i {}_i \overset{*}{W}{}^t_s \; {}_{w_i} T^t_s + {}_c \overset{*}{W}{}^t_s \; {}_{w_c} T^t_s + \\ + {}_u W^t_s \; {}_u T^t_s + {}_s W_s \; {}_s T^t_s$$

where the amount of taxes is determined in the following way:

We compare whether*)

$$\text{(i)} \qquad {}_i\overset{*}{W}{}_s^t - \tilde{\sigma}_s^t > 0$$

In case (i) holds:

$$\text{(III.10.1a)} \qquad {}_{w_i}\tau_s^t = {}_i\overset{*}{W}{}_s^t - \tilde{\sigma}_s^t$$

If $\neg$ (i) holds:

$$\text{(III.10.1b)} \qquad {}_{w_i}\tau_s^t = 0$$

Now the tax rate can be determined by:**)

$$\text{(III.10.2)} \qquad {}_{w_i}\sigma_s^t = \frac{{}_1\varepsilon_s^t}{1 + th\,{}_2\varepsilon_s^t\,{}_3\varepsilon_s^t}\left[th\,{}_2\varepsilon_s^t\,({}_{w_i}\tau_s^t - {}_3\varepsilon_s^t) + th\,{}_2\varepsilon_s^t\,{}_3\varepsilon_s^t\right]$$

---

*) The same procedure is applied to ${}_{w_c}\tau_s^t$, ${}_{v}\tau_s^t$ and ${}_{s}\tau_s^t$.

**) th means tangens hyperbolicus.

Hence the amount of income-tax for an individual worker is:

(III.10.3) $$_{w_i}T_g^t = {}_{w_i}\sigma_g^t \; {}_{w_i}\tau_g^t$$

For the firms we can immediately determine*):

(III.10.4) $$_i\sigma_g^t = \frac{{}_1\varepsilon_g^t}{1 + th_{\,2}\varepsilon_g^t \; {}_3\varepsilon_g^t}\left[th_{\,2}\varepsilon_g^t\left({}_i\tau_g^t - {}_3\varepsilon_g^t\right) + th_{\,2}\varepsilon_g^t \; {}_3\varepsilon_g^t\right.$$

Hence the amount of income-tax for firm i is:

(III.10.4) $$_iT_g^t = {}_i\sigma_g^t \; {}_i\tau_g^t$$

(10.1.9) Salaries for civil servants:

$$_sW_g \; {}_sW_g$$

(10.1.10) Expenditure on public consumption other than salaries

$$\hat{p}_g^{*t}$$

*) The same holds for $_c\tau_g^t$

(10.1.11) Unemployment benefits

$$ {}_{u}W_{s}^{t} \cdot v \cdot \min_{i,c} \left({}_{i}\overset{*}{W}_{s}^{t}, {}_{c}\overset{*}{W}_{s}^{t} \right) $$

(10.1.12) Subsidies

a) per man employed

$$ \sum_{i} {}_{i}\overset{*}{W}_{s}^{t} {}_{w}\tilde{O}_{s}^{t} + {}_{c}\overset{*}{W}_{s}^{t} {}_{w}\tilde{O}_{s}^{t} $$

b) per money unit of non-liquid assets

$$ {}_{a}\tilde{O}_{s}^{t} \left[\sum_{i} \left({}_{i}R_{s}^{t} + {}_{i}\tilde{O}_{s}^{t} + \sum_{s} \sum_{\varsigma} {}_{\varsigma}^{s}p_{c_s i_r}^{t} \right) + {}_{c}R_{s}^{t} \right] $$

c) per money unit of turnover

$$ {}_{m}\tilde{O}_{s}^{t} \left[\sum_{i} \left({}_{i}\overset{*}{M}_{s}^{t} {}_{i}p_{s}^{t} + \sum_{r} {}_{i}\overset{*}{M}_{sr}^{t} {}_{i}p_{sr}^{t} \right) + \right. $$

$$ \left. + \left(\sum_{\varsigma} \sum_{i} {}_{\varsigma}^{s}p_{c_s i_r}^{t} + \sum_{s} \sum_{i} \sum_{\substack{r \\ r \neq s}} {}_{\varsigma}^{s}p_{c_s i_r}^{t} \right) \right] $$

d) per money unit of exports

$$ {}_{e}\tilde{O}_{s}^{t} \left(\sum_{i} \sum_{r} {}_{i}\overset{*}{M}_{sr}^{t} {}_{i}p_{sr}^{t} + \sum_{s} \sum_{i} \sum_{\substack{r \\ r \neq s}} {}_{\varsigma}^{s}p_{c_s i_r}^{t} \right) $$

e) paid as a lump sum

$$ \sum_{i} {}_{i}\tilde{O}_{s}^{t} + {}_{c}\tilde{O}_{s}^{t} $$

(10.1.13) Interest

$$b_s^t L_s^t \frac{1}{100}$$

(10.1.14) Re-payment of credits

$$\bar{\beta} L_s^{t-1} + \bar{L}_s^t$$

(III.10.5)
$$\begin{aligned}
\mathcal{M}_s^t = {} & \sum_i {}_i\overset{*}{q}_s^t \, m_0 + \sum_s m_{0s} \left(\sum_i {}^s\overset{*}{N}_{c_s i_r}^t + \sum_{\substack{r \\ r \neq s}} \sum_i {}^s\overset{*}{N}_{c_s i_r}^t \right) \\
& + m_{0c} \overset{*}{N}_{c_s}^t + \sum_i {}_i\overset{*}{W}_s^t \, {}_i w_s \, {}_w q_s^t + \\
& + {}_c\overset{*}{W}_s^t \, {}_c w_s \, {}_w q_s^t + \sum_i {}_i\overset{*}{M}_s^t \, {}_i p_{s_m} \, {}_f q_s^t + \\
& + \sum_i {}_i A_{s_a}^t \, {}_f q_s^t \left({}_i C_s^t + {}_i\tilde{\pi}_s^{t-1} - {}^L{}_i\tilde{\pi}_s^{t-1} \right) + \\
& + \sum_i \sum_r {}_i\overset{*}{M}_{r_s}^t \, {}_i p_{r_s}^t \, \vartheta_{r_s}^t + \sum_i \sum_{\substack{r \\ r \neq s}} {}_i\overset{*}{M}_{r_s}^t \, \vartheta_{r_s}^t + \\
& + \sum_i \sum_{\substack{r \\ r \neq s}} {}_i A_{r_s}^t \, {}_i f_{r_s}^t + \sum_i a_s^t + \sum_{\substack{r \\ r \neq s}} \sum_i {}_i a_{r_s}^t + \\
& + \sum_i {}_i T_s^t + {}_c T_s^t + \sum_i {}_i\overset{*}{W}_s^t \, {}_{w_i} T_s^t + \\
& + {}_c\overset{*}{W}_s^t \, {}_{w_c} T_s^t + {}_u W_s^t \, {}_u T_s^t + {}_s W_s \, {}_s T_s^t + \\
& + {}_c A_{s_a}^t \, {}_f q_s^t \left({}_c C_s^t + {}_c\tilde{\pi}_s^{t-1} - {}^L{}_c\tilde{\pi}_s^{t-1} \right)
\end{aligned}$$

$$(III.10.6)\quad V_s^t = {}_sW_s\,{}_sw_s + R_s^t + {}_uW_s^t \cdot v \cdot \min_{i,c}\left({}_i\overset{*}{W}{}_s^t, {}_c\overset{*}{W}{}_s^t\right) +$$

$$+ \sum_i {}_i\overset{*}{W}{}_s^t\,{}_w\tilde{O}_s^t + {}_c\overset{*}{W}{}_s^t\,{}_w\tilde{O}_s^t +$$

$$+ {}_a\tilde{O}_s^t\left[\sum_i \left({}_iR_s^t + {}_i\tilde{M}_s^t + \sum_s \sum_{\substack{s \\ \nu}} {}_\nu^s p\, c_{si_r}^t\right) +\right.$$

$$\left. + {}_cR_s^t\right] + {}_m\tilde{O}_s^t\left[\sum_i \left({}_i\overset{*}{M}{}_s^t\,{}_ip_s^t + \sum_r {}_i\overset{*}{M}{}_{sr}^t\,{}_ip_{sr}^t\right) +\right.$$

$$\left. + \left(\sum_s \sum_i \sum_{\substack{r \\ r\neq s}} {}_\nu^s p\, c_{si_r}^t + \sum_s \sum_i \sum_{\substack{r \\ r\neq s}} {}_\nu^s p\, c_{si_r}^t\right)\right] +$$

$$+ {}_e\tilde{O}_s^t\left(\sum_i \sum_r {}_i\overset{*}{M}{}_{sr}^t\,{}_ip_{sr}^t + \sum_s \sum_i \sum_{\substack{r \\ r\neq s}} {}_\nu^s p\, c_{si_r}^t\right) +$$

$$+ \sum_i {}_i\tilde{O}_s^t + {}_o\tilde{O}_s^t + b_s^t\, L_s^t \frac{1}{100} + \overline{\beta} L_s^{t-1} +$$

$$+ \overline{\Gamma}_s^t$$

In order to determine whether the budget is over- or underbalanced we compare:

$$(ii)\qquad \mathcal{R}_s^t - V_s^t \geq 0$$

In case (ii) holds:

$$\tilde{\partial P}_s^t = \partial P_s^t - V_s^t$$

(III.10.7)

$$\tilde{V}_s^t = 0$$

If $\neg$ (ii), holds:

$$\tilde{V}_s^t = V_s^t - \partial P_s^t$$

(III.10.8)

$$\tilde{\partial P}_s^t = 0$$

In both cases we must check whether:

(iii) $$F_s^{t-1} > 0$$

(iv) $$F_s^{t-1} = 0$$

If (ii) $\wedge$ (iv):

$$\bar{\mathcal{D}}_s^t = \bar{\mathcal{D}}_s^{t-1} + \tilde{\mathcal{D}}_s^t$$

(III.10.9a)

$$F_s^t = 0$$

If (ii) $\wedge$ (iii) we compare whether

(v) $$\tilde{\mathcal{D}}_s^t \geq F_s^{t-1}$$

In case (ii) $\wedge$ (iii) $\wedge$ (v) holds*):

$$\bar{\mathcal{D}}_s^t = \bar{\mathcal{D}}_s^{t-1} + \tilde{\mathcal{D}}_s^t - F_s^{t-1}$$

(III.10.9b)

$$F_s^t = 0$$

In case (ii) $\wedge$ (iii) $\wedge$ $\neg$(v) we check whether:

(vi) $$\tilde{\mathcal{D}}_s^t \geq \bar{v} F_s^{t-1}$$

---

*) The reader is reminded that $\bar{\mathcal{D}}_s^{t-1} = 0$

In case (ii) $\wedge$ (iii) $\wedge$ $\neg$ (v) $\wedge$ (vi) holds:

$$\bar{\mathcal{D}}_s^t = 0$$

(III.10.9c)

$$F_s^t = F_s^{t-1} - \tilde{\mathcal{D}}_s^t$$

If, however, $\neg$ (ii) $\wedge$ (iv) we check whether:

(vii) $$\tilde{V}_s^t \leq \bar{\mathcal{D}}_s^{t-1}$$

In case $\neg$ (ii) $\wedge$ (iv) $\wedge$ (vii) holds:

$$\bar{\mathcal{D}}_s^t = \bar{\mathcal{D}}_s^{t-1} - \tilde{V}_s^t$$

(III.10.9d)

$$F_s^t = 0$$

In case $\neg$ (ii) $\wedge$ (iv) $\wedge$ $\neg$ (vii) holds:

$$\bar{\mathcal{D}}_s^t = 0$$

(III.10.9e)

$$F_s^t = \tilde{V}_s^t - \bar{\mathcal{D}}_s^{t-1}$$

In cases $[\neg(ii) \wedge (iii)] \vee [(ii) \wedge (iii) \wedge \neg(v) \wedge \neg(vi)]$ it turns out that the government of country ϱ has repeatedly failed to meet its current financial obligations and consequently is considered bankrupt. Therefore the players of the state as well as those of the firms residing in it are excluded from further gaming (this means $\varrho, r \in \{1,2\}$ for all subsequent periods and all formulae have to be corrected accordingly). If the direction of the game intends in spite of this fact to continue the game with all players it could of course change the value of the variable λ (in order to increase the amount of cash).

If $\neg(ii) \wedge (iii)$:

$$\bar{\partial D}_\varrho^t = 0$$

(III.10.9f)

$$F_\varrho^t = F_\varrho^{t-1} + \tilde{V}_\varrho^t$$

If $(ii) \wedge (iii) \wedge \neg(v) \wedge \neg(vi)$

$$\bar{\partial D}_\varrho^t = 0$$

(III.10.9g)

$$F_\varrho^t = F_\varrho^{t-1} - \tilde{\partial D}_\varrho^t$$

If the direction of the game <u>does not</u> intend to keep the players of the bankrupt state in the game it must set $F_s^t = \overset{*}{F}_s^{t+1}$ for all subsequent periods.

(10.2) Reserves and liabilities of the state

(10.2.1) Liabilities of the state

$$L_s^t$$

(10.2.2) Uncovered bills of exchange

$$F_s^t$$

(10.2.3) Reserves of the state

$$\partial D_s^t$$

TABLE 1

Budget – Receipts

(10.1.1)	Receipts from licence fees	$\sum_i {}^{*t}_{i}q_{s}\, m_{s} + \sum_{s} m_{s} \left(\sum^{s} {}^{*t}_{c_s i_r}N + \sum_r \sum_i {}^{s} {}^{*t}_{c_s i_r}N\right) + m_c\, {}^{*t}_{c_s}N$
(10.1.2)	Receipts from pay-roll tax	$\sum_i {}^{*t}_{i}W_{s}\, {}^{t}_{i w_s}\lambda_{s} + {}^{*t}_{c}W_{s}\, {}^{t}_{c w_s}\lambda_{s}$
(10.1.3)	Receipts from turnover tax	$\sum_i {}^{*t}_{i}M_{s}\, {}^{t-}_{i p_s}\lambda_{s}$
(10.1.4)	Receipts from property tax	$\sum_i {}^{t}_{i A_{s a}}\lambda_{s} \left({}^{t}_{i}C_{s} + {}^{t-1}_{i}\tilde{\Pi}_{s} - {}^{L}_{i}\tilde{\Pi}^{t-1}_{s}\right) + {}^{t}_{c A_{s a}}\lambda_{s} \left({}^{t}_{c}C_{s} + {}^{t-1}_{c}\tilde{\Pi}_{s} - {}^{L}_{c}\tilde{\Pi}^{t-1}_{s}\right)$
(10.1.5)	Receipts from duties	
	a) Receipts from ad valorem duty	$\sum_i \sum_r {}^{*t}_{i}M_{r_s}\, {}^{t}_{i p_{r_s}}\, \vartheta^{t}_{r_s} \quad r \neq s$
	b) Receipts from specific duty	$\sum_i \sum_r {}^{*t}_{i}M_{r_s}\, \vartheta^{t}_{r_s} \quad r \neq s$
	Total receipts from duties	$\sum_i \sum_r {}^{*t}_{i}M_{r_s}\, {}^{t}_{i p_{r_s}}\, \vartheta^{t}_{r_s} + \sum_i \sum_r {}^{*t}_{i}M_{r_s}\, \vartheta^{t}_{r_s}$
(10.1.6)	Receipts from fees for branches	
	a) Receipts from country r	$\sum_i {}^{t}_{i}A_{r_s}\, {}^{t}_{i}f_{r_s}$
	b) Receipts from country R	$\sum_i {}^{t}_{i}A_{R_s}\, {}^{t}_{i}f_{R_s}$
	Total receipts from fees for branches	$\sum_i {}^{t}_{i}A_{r_s}\, {}^{t}_{i}f_{r_s} + \sum_i {}^{t}_{i}A_{R_s}\, {}^{t}_{i}f_{R_s}$
(10.1.7)	Receipts from advertising	
	a) Receipts from domestic firms	$\sum_i {}^{t}_{i}a_{s}$
	b) Receipts from foreign firms	$\sum_r \sum_i {}^{t}_{i}a_{r_s} \quad r \neq s$
	Total receipts from advertising	$\sum_i {}^{t}_{i}a_{s} + \sum_r \sum_i {}^{t}_{i}a_{r_s}$
(10.1.8)	Receipts from income tax	
	a) income tax paid by corporations	$\sum_i {}^{t}_{i}T_{s} + {}^{t}_{c}T_{s}$
	b) income tax paid by workers	$\sum_i {}^{*t}_{i}W_{s}\, {}^{t}_{w_i}T_{s} + {}^{*t}_{c}W_{s}\, {}^{t}_{w_c}T_{s}$
	c) income tax paid by unemployed	${}^{t}_{u}W_{s}\, {}^{t}_{u}T_{s}$
	d) income tax paid by civil servants	${}^{t}_{s}W_{s}\, {}^{t}_{s}T_{s}$
	Total receipts from income tax	$\sum_i {}^{t}_{i}T_{s} + {}^{t}_{c}T_{s} + \sum_i {}^{*t}_{i}W_{s}\, {}^{t}_{w_i}T_{s} + {}^{*t}_{c}W_{s}\, {}^{t}_{w_c}T_{s} + {}^{t}_{u}W_{s}\, {}^{t}_{u}T_{s} + {}^{t}_{s}W_{s}\, {}^{t}_{s}T_{s}$
(III.10.8)	Current budget deficit	∇^{t}_{s}

TABLE 1

Budget - Spendings

(10.1.9)	Salaries for civil servants	${}_{s}W_{g}\ {}_{s}w_{g}$
(10.1.10)	Expenditure on public consumption other than salaries	$\overset{*}{p}{}^{t}_{g}$
(10.1.11)	Unemployment Benefits	${}_{u}W^{t}_{g} \cdot v \cdot \min_{i,c}\,({}_{i}\overset{*}{W}{}^{t}_{g}, {}_{c}\overset{*}{W}{}^{t}_{g})$
(10.1.12)	Subsidies	
	a) per man employed	$\sum_{i} {}_{i}\overset{*}{W}{}^{t}_{g}\ {}_{w}\mathcal{O}^{t}_{g} + {}_{c}\overset{*}{W}{}^{t}_{g}\ {}_{w}\mathcal{O}^{t}_{g}$
	b) per money unit of non-liquid assets	${}_{a}\mathcal{O}^{t}_{g}\ [\sum_{i}({}_{i}R^{t}_{g} + {}_{i}\mathcal{OO}^{t}_{g} + \sum_{\varsigma}\sum_{\varsigma} {}^{\varsigma}_{\nu}p^{t}_{c_g i_r}) + {}_{c}R^{t}_{g}]$
	c) per money unit of turnover	${}_{m}\mathcal{O}^{t}_{g}\ [\sum_{i}({}_{i}\overset{*}{M}{}^{t}_{g}\ {}_{i}p^{t}_{g} + \sum_{r} {}_{i}\overset{*}{M}{}_{g_r}\ {}_{i}p^{t}_{g_r}) + (\sum_{\varsigma}\sum_{i}{}^{\varsigma}_{\nu}p^{t}_{c_g i_r} + \sum_{\varsigma}\sum_{i}\sum_{r}{}^{\varsigma}_{\nu}p^{t}_{c_g}$
	d) per money unit of exports	${}_{e}\mathcal{O}^{t}_{g}\ (\sum_{i}\sum_{r} {}_{i}\overset{*}{M}{}^{t}_{g_r}\ {}_{i}p^{t}_{g_r} + \sum_{\varsigma}\sum_{i}\sum_{r}{}^{\varsigma}_{\nu}p^{t}_{c_g i_r})$
	e) paid as a lump sum	$\sum_{i} {}_{i}\mathcal{O}^{t}_{g} + {}_{c}\mathcal{O}^{t}_{g}$
(10.1.13)	Interest	$b^{t}_{g}\ L^{t}_{g}\ \frac{1}{100}$
(10.1.14)	Repayment of credits	$\bar{\beta}\ L^{t-1}_{g} + \bar{L}^{t}_{g}$
	a) compulsory repayment	$\bar{\beta}\ L^{t-1}_{g}$
	b) voluntary repayment	$\bar{L}^{t}_{g}$
(III.10.7)	Current Budget Surplus	$\mathcal{R}^{t}_{g}$

TABLE 2

Reserves and Liabilities (for period t)

Reserves

(10.2.3) Accumulated Budget Surplus $\bar{D}_s^t$

Liabilities

	at the end of period t-1	repayment in t		borrowings in per. t	at the end of t
		comp.	vol.		
Total of liabilities	L_s^{t-1}	$\bar{\beta} L_s^{t-1}$	$\bar{L}_s^t$	$\bar{B}_s^t$	L_s^t

	at the end of per. t-1	change + or -	at the end of t
Amount of uncovered bills of exchange	F_s^{t-1}		F_s^t

TABLE 3 : Information provided by the Statistical Bureau of the Country

	total		Firms							
			producing consumer goods						producing capital goods	
			1		2		3			
	qu 1	val 2	qu 3	val 4	qu 5	val 6	qu 7	val 8	qu 9	val 10
Imports of consumer goods (excluded goods still in bond)	$\sum_i {}^{*}M^{t}_{r_s} + \sum_i {}^{*}M^{t}_{R_s}$	12 + 14								
Imports of capital goods	$\sum_s \sum_i {}^{R}_{c_i s_r}{}^{t} + \sum_c \sum_i {}^{R}_{c_i}{}^{t}$	$\sum_s \sum_i {}^{r}p^{c}_{c_i s_r}{}^{t} + \sum_c \sum_i {}^{R}p^{c}_{c_i s_R}$								
Exports of consumer goods (excluded goods still in bond)	11 + 13	12 + 14	${}_1{}^{*}M^{t}_{s_r} + {}_1{}^{*}M^{t}_{s_R}$	${}_1M^{t}_{s_r}{}_1p^{t}_{s_r} + {}_1{}^{*}M^{t}_{s_R}{}_1p^{t}_{s_R}$	${}_2{}^{*}M^{t}_{s_r} + {}_2{}^{*}M^{t}_{s_R}$	${}_2M^{t}_{s_r}{}_2p^{t}_{s_r} + {}_2M^{t}_{s_R}{}_2p^{t}_{s_R}$	${}_3{}^{*}M^{t}_{s_r} + {}_3{}^{*}M^{t}_{s_R}$	${}_3M^{t}_{s_r}{}_3p^{t}_{s_r} + {}_3M^{t}_{s_R}{}_3p^{t}_{s_R}$		
Exports of capital goods	11 + 13	12 + 14							11 + 13	12 + 14
Total domestic production a) consumer goods b) capital goods	$\sum_i {}^{*}q^{t}_{s}$ 9		${}_1{}^{*}q^{t}_{s}$		${}_2{}^{*}q^{t}_{s}$		${}_3{}^{*}q^{t}_{s}$		$\sum_s \sum_i \sum_r {}^{*}N^{t}_{c_i s_r} + N^{t}_{c_s}$	
Labour force employed	3+5+7+9	4+6+8+10	${}_1{}^{*}W^{t}_{s}$	${}_1W^{t}_{s}{}_1{}^{*}w^{t}_{s}$	${}_2{}^{*}W^{t}_{s}$	${}_2W^{t}_{s}{}_2{}^{*}w^{t}_{s}$	${}_3{}^{*}W^{t}_{s}$	${}_3W^{t}_{s}{}_3{}^{*}w^{t}_{s}$	${}_c{}^{*}W^{t}_{s}$	${}_cW^{t}_{s}{}_c{}^{*}w^{t}_{s}$
Unemployed	${}_u W^{t}_{s}$									
Population (civil servants not included)	W^{t}_{s}									
Wage rate of an individual worker (for total and for foreign countries: average)		$\frac{\sum_i {}^{*}W^{t}_{s}\,{}^{*}w^{t}_{s} + {}_c{}^{*}W^{t}_{s}\,{}^{*}w^{t}_{s}}{\sum_i {}^{*}W^{t}_{s} + {}_c{}^{*}W^{t}_{s}}$		${}_1{}^{*}w^{t}_{s}$		${}_2{}^{*}w^{t}_{s}$		${}_3{}^{*}w^{t}_{s}$		
Domestic prices of consumer goods				${}_1p^{t}_{s}$		${}_2p^{t}_{s}$		${}_3p^{t}_{s}$		
Rates of duty										

TABLE 3 (continued)

	Foreign Countries			
	r		R	
	quantity 11	value 12	quantity 13	value 14
Imports of consumer goods (excluded goods still in bond)	$\sum_i {}^{*}M_{r_s}^{t}$	$\sum_i {}^{*}M_{r_s}^{t}[{}_i p_{r_s}^{t}(1+\vartheta_{r_s}^{t})+\vartheta_{r_s}^{t}]$	$\sum_i {}^{*}M_{R_s}^{t}$	$\sum_i {}^{*}M_{R_s}^{t}[{}_i p_{R_s}^{t}(1+\vartheta_{R_s}^{t})+\vartheta_{R_s}^{t}]$
Imported capital goods	$\sum_s\sum_i {}^{s}{}^{*}N_{c_r i_s}^{t}$	$\sum_s\sum_i {}^{s}_{\nu}p_{c_r i_s}^{t}\quad \nu \leqslant {}^{*}\nu$	$\sum_s\sum_i {}^{s}N_{c_R i_s}^{t}$	$\sum_s\sum_i {}^{s}_{\nu}p_{c_R i_s}^{t}\quad \nu \leqslant {}^{*}\nu$
Exports of consumer goods (excluded goods still in bond)	$\sum_i {}^{*}M_{s_r}^{t}$	$\sum_i {}^{*}M_{s_r}^{t}[{}_i p_{s_r}^{t}(1+\vartheta_{s_r}^{t})+\vartheta_{s_r}^{t}]$	$\sum_i {}^{*}M_{s_R}^{t}$	$\sum_i {}^{*}M_{s_R}^{t}[{}_i p_{s_R}^{t}(1+\vartheta_{s_R}^{t})+\vartheta_{s_R}^{t}]$
Exports of capital goods	$\sum_s\sum_i {}^{s}{}^{*}N_{c_s i_r}^{t}$	$\sum_s\sum_i {}^{s}_{\nu}p_{c_s i_r}^{t}\quad \nu \leqslant {}^{*}\nu$	$\sum_s\sum_i {}^{s}{}^{*}N_{c_s i_R}^{t}$	$\sum_s\sum_i {}^{s}_{\nu}p_{c_s i_R}^{t}\quad \nu \leqslant {}^{*}\nu$
Total domestic production a) consumer goods b) capital goods				
Labour force employed				
Unemployed	${}_u W_r^t$		${}_u W_R^t$	
Population (civil servants not included)	W_r^t		W_R^t	
Wage rate of an individual worker (for total and for foreign countries: average)		$\dfrac{\sum_i {}^{*}W_r^t\ {}_i {}^{*}w_r^t + {}_c {}^{*}W_r^t\ {}_c {}^{*}w_r^t}{\sum_i {}^{*}W_r^t + {}_c {}^{*}W_r^t}$		$\dfrac{\sum_i {}^{*}W_R^t\ {}_i {}^{*}w_R^t + {}_c {}^{*}W_R^t\ {}_c {}^{*}w_R^t}{\sum_i {}^{*}W_R^t + {}_c {}^{*}W_R^t}$
Domestic prices of consumer goods				
Rates of duty	$\vartheta_{s_r}^t$	$\mathcal{J}_{s_r}^t$	$\vartheta_{s_R}^t$	$\mathcal{J}_{s_R}^t$

TABLE 4

Balance Sheet of the Consumer goods industry (for period t)

Assets			Liabilities				
(8.3.3)	Stock of machinery		Capital				${}_iC_s$
	a) of kind 1	${}^1{}_iR_s^t$	Liabilities: at the end of period t	repayment		borrowings	
	b) of kind 2	${}^2{}_iR_s^t$		comp.	vol.		
	c) of kind 3	${}^3{}_iR_s^t$	${}_iL_s^{t-1}$	${}_i\bar{L}_s^t$	$\bar{\beta}\,{}_iL_s^{t-1}$	${}_i\overset{*}{B}_s^t$	${}_iL_s$
	total	${}_iR_s^t$	(III.8.6 a,b)	Uncovered bills of exchange			${}_iF_s$
(8.3.5)	Value of the unsold stocks		(III.8.6 c)	Bad debts			${}_i\tilde{F}_s$
	a) on the home market	${}_im_s^t\ {}_ip_s^t$	(III.8.7 b)	Accumulated profit			${}_i\tilde{\Pi}_s$
	b) on market r	${}_im_{s_r}^t\ {}_ip_{s_r}^t$					
	c) on market R	${}_im_{s_R}^t\ {}_ip_{s_R}^t$					
	total	${}_i\mathcal{M}_s^t$					
(8.3.4)	Prepayment for machinery not delivered	$\sum_s \sum_{s_y} {}_{s_y}p c_s\, i_r$					
(III.8.6)	Cash	${}_i\Gamma_s^t$					
(III.8.7 a)	Accumulated loss	${}_i\tilde{\Pi}_s^t$					
Sum			Sum				

TABLE 5

Balance Sheet of the Capital goods industry (for period t)

Assets			Liabilities		
(9.3.3)	Stock of machinery	${}_cR_g^t$		Capital	${}_cC$
(III.9.6)	Cash	${}_c\Gamma_g^t$		Liabilities at the end of period t: ${}_cL_g^{t-1}$	repayment: comp. ${}_cL_g^t$; vol. $\bar{\beta}_cL_g^{t-1}$	borrowings ${}_c\bar{B}_g^t$	${}_cL$
(III.9.7a)	Accumulated loss	${}_c\tilde{\Pi}_g^t$	(9.3.4)	Liabilities for orders which could not be executed	$\sum_i \sum_r \sum_g {}_{g\nu}p$
			(9.1.11)	Penalty	$n \sum_g \sum_i \sum_r {}_{g\nu}p^t_{c_g i_r}$
			(III.9.6 a,b)	Uncovered bills of exchange	${}_c\Gamma_g^t$
			(III.9.6c)	Bad debts	${}_c\tilde{\Gamma}_g^t$
			(III.9.7b)	Accumulated profit	${}_c\tilde{\Pi}_g^t$
Sum			Sum		

TABLE 6

Profit and Loss Account of the Consumer goods industry (for period t)

Expenses		Returns	
(8.1.7)	Wages $i\overset{*}{W}_g^t \; i\overset{*}{w}_g^t$	(8.1.1)	Total home sales $i\overset{*}{M}_g^t \; ip_g^t$
(8.1.8)	Depreciation iD_g^t	(8.1.2)	Export sales
(8.1.9)	Licence fees for raw material $i\overset{*t}{q}_g \; m$		a) to country r $i\overset{*}{M}_{gr}^t [ip_{gr}^t (1+\vartheta_{gr}^t) + \nu_{gr}^t]$
(8.1.10)	Interest $iL_g^t \; ib_g^t \cdot \frac{1}{100}$		b) to country R $i\overset{*}{M}_{gR}^t [ip_{gR}^t (1+\vartheta_{gR}^t) + \nu_{gR}^t]$
(8.1.11)	Pay-roll tax $i\overset{*}{W}_g^t \; i\overset{*}{w}_g^t \; w\varphi_g^t$	(8.1.3)	Subsidies
(8.1.12)	Fee for branches in foreign markets $\sum_{r\neq g} iA_{gr}^t \; if_{gr}^t$		a) per man employed $i\overset{*}{W}_g^t \; w\sigma_g^t$
(8.1.13)	Advertising		b) per money unit of non liquid assets $_a\sigma_g^t (iR_g^t + i\overline{\overline{M}}_g^t + \sum_g \sum_\gamma^g$
	a) on the home market ia_g^t		c) per money unit of turnover $_m\sigma_g^t (i\overset{*}{M}_g^t \; ip_g^t + \sum_{r\neq g} i\overset{*}{M}_{gr}^t$
	b) on market r ia_{gr}^t		d) per money unit of exports $_e\sigma_g^t \sum_r i\overset{*}{M}_{gr}^t \; ip_{gr}^t$
	c) on market R ia_{gR}^t		e) paid as a lump sum $i\sigma_g^t$
(8.1.14)	Turnover tax $i\overset{*}{M}_g^t \; ip_g^t \; m\varphi_g^t$	(8.1.4)	Penalty $n \sum_g \sum_\gamma^g {}_\gamma p c_g i_r^{t-1} \quad \forall \gamma : {}^g\nu c_g i_r^{t-1} > {}^{g*}\nu c_g i_r^{t-1}$
(8.1.15)	Duties	(8.1.5)	Change of stocks $i\overline{\overline{M}}_g^t - i\overline{\overline{M}}_g^{t-1}$
	a) ad valorem duty $\sum_{r\neq g} i\overset{*}{M}_{gr}^t \; ip_{gr}^t \; \vartheta_{gr}^t$	(III.8.3)	Loss $i\overset{L}{\pi}_g^t$
	b) specific duty $\sum_{r\neq g} i\overset{*}{M}_{gr}^t \; \vartheta_{gr}^t$		
(8.1.16)	Property tax $iA_g^t \; a\varphi_g^t (iC_g^t + i\tilde{\pi}_g^{t-1} - {}^L i\tilde{\pi}_g^{t-1})$		
(8.1.5)	Change of stocks $i\overline{\overline{M}}_g^{t-1} - i\overline{\overline{M}}_g^t$		
(III.10.4)	Income tax iT_g^t		
(III.8.3)	Net Profit $i\overline{\pi}_g^t$		
	Sum		Sum

TABLE 7

Profit and Loss Account of the Capital goods industry (for period t)

Expenses			Returns		
(9.1.6)	Wages	${}_{c}\overset{*}{W}{}_{\varsigma}^{t}\ {}_{c}\overset{*}{w}{}_{\varsigma}^{t}$	(9.1.1)	Total home sales	$\sum_{\varsigma}\sum_{i}{}^{\varsigma}{}_{\nu}p_{c_\varsigma i_r}^{t}$
(9.1.7)	Depreciation	${}_{c}D_{\varsigma}^{t}$	(9.1.2)	Export Sales	
(9.1.8)	Licence fees for raw material	$\sum_{\varsigma} {}_{m}\mathcal{O}_{\varsigma}\left(\sum_{i}{}^{\varsigma}\overset{*}{N}{}_{c_\varsigma i_r}^{t}+\sum_{r}\sum_{i}{}^{\varsigma}\overset{*}{N}{}_{c_\varsigma i_r}^{t}\right)+{}_{m}\mathcal{O}_{c}\,\overset{*}{N}{}_{c_\varsigma}^{t}$		a) to country r	$\sum_{\varsigma}\sum_{i}{}^{\varsigma}{}_{\nu}p_{c_\varsigma i_r}^{t}$
				b) to country R	$\sum_{\varsigma}\sum_{i}{}^{\varsigma}{}_{\nu}p_{c_\varsigma i_r}^{t}$
(9.1.9)	Interest	${}_{c}L_{\varsigma}^{t}\ {}_{c}b_{\varsigma}^{*t}\ \frac{1}{100}$	(9.1.3)	Subsidies:	
(9.1.10)	Pay-roll tax	${}_{c}\overset{*}{W}{}_{\varsigma}^{t}\ {}_{c}\overset{*}{w}{}_{\varsigma}^{t}\ {}_{w}\mathcal{O}_{\varsigma}^{t}$		a) per man employed	${}_{c}\overset{*}{W}{}_{\varsigma}^{t}\ {}_{w}\mathcal{O}_{\varsigma}^{t}$
(9.1.11)	Penalty	$n\sum_{\varsigma}\sum_{i}\sum_{r}{}^{\varsigma}{}_{\nu}p_{c_\varsigma i_r}^{t}$		b) per money unit of non liquid assets	${}_{a}\mathcal{O}_{\varsigma}^{t}\ {}_{c}R_{\varsigma}^{t}$
(9.1.12)	Property tax	${}_{c}A_{\varsigma}^{t}\ {}_{a}\mathcal{O}_{\varsigma}^{t}\left({}_{c}C_{\varsigma}^{t}+{}_{c}\tilde{\pi}_{\varsigma}^{t-1}-{}_{c}^{L}\tilde{\pi}_{\varsigma}^{t-1}\right)$		c) per money unit of turnover	${}_{m}\mathcal{O}_{\varsigma}^{t}\left(\sum_{\varsigma}\sum_{i}{}^{\varsigma}{}_{\nu}p_{c_\varsigma i_r}^{t}+\sum_{\varsigma}\sum_{i}\sum_{r\neq}\right.$
(III.10.4)	Income tax	${}_{c}T_{\varsigma}^{t}$		d) per money unit of exports	${}_{e}\mathcal{O}_{\varsigma}^{t}\sum_{\varsigma}\sum_{i}\sum_{r}{}^{\varsigma}{}_{\nu}p_{c_\varsigma i_r}^{t}$
(III.9.3)	Net Profit	${}_{c}\bar{\pi}_{\varsigma}^{t}$		e) paid as a lump sum	${}_{c}\mathcal{O}_{\varsigma}^{t}$
			(9.1.4)	Value of the machines produced for own use	$\overset{*}{N}{}_{c_\varsigma}^{t}\ p_{c}$
			(III.9.3)	Loss	${}_{c}^{L}\pi_{\varsigma}^{t}$
Sum			Sum		

TABLE 8

Government Decision Form for period t

I Parameters to be published						
Tax rates	rate of pay-roll tax	rate of turnover tax	rate of property tax	parameters of the income tax function		
	$\tau_{w\varphi}^{t}$	$\tau_{m\varphi}^{t}$	$\tau_{a\varphi}^{t}$	${}_1\varepsilon_{\varphi}^{t}$	${}_2\varepsilon_{\varphi}^{t}$	${}_3\varepsilon_{\varphi}^{t}$
Income tax allowances	for individuals		for firms			
	$\tilde{\delta}_{\varphi}^{t}$		$\bar{\delta}_{\varphi}^{t}$			
Fees paid by firms for maintaining a branch in country φ	fees paid by firms residing in r		fees paid by firms residing in R			
	$if_{r\varphi}^{t}$		$if_{R\varphi}^{t}$			
Rates of duty	ad valorem duty on imports from		specific duty on imports from			
	r	R	r	R		
	$\vartheta_{r\varphi}^{t}$	$\vartheta_{R\varphi}^{t}$	$\nu_{r\varphi}^{t}$	$\nu_{R\varphi}^{t}$		
Subsidy paid as a lump sum	to firms					
	1	2	3	c		
	${}_1\sigma_{\varphi}^{t}$	${}_2\sigma_{\varphi}^{t}$	${}_3\sigma_{\varphi}^{t}$	${}_c\sigma_{\varphi}^{t}$		
Other subsidies	per employee	fraction of the total of non-liquid assets	value of total sales	value of total exports		
	${}_w\sigma_{\varphi}^{t}$	${}_a\sigma_{\varphi}^{t}$	${}_m\sigma_{\varphi}^{t}$	${}_e\sigma_{\varphi}^{t}$		
Other parameters	minimum wage rate		amount of public consumption			
	${}_{min}W_{\varphi}^{t}$		R_{φ}^{t}			
II Parameters not to be published						
Public debt	amount of loans desired		rate of interest offered		voluntary redemtion	
	B_{φ}^{t}		b_{φ}^{t}		$\bar{L}_{\varphi}^{t}$	

TABLE 9

Financial Status of the Consumer goods industry (for period t)

Disbursements		Receipts	
(8.2.3)	Prepayment of machinery $\sum_{\varsigma}\sum_{\varsigma}{}_{\nu}^{\varsigma} p^{t} c_{\varsigma} i_{r}$	(8.2.1)	Cash brought forward ${}_{i}\Gamma_{\varsigma}^{t-1}$
(8.1.7)	Wages ${}_{i}W_{\varsigma}^{*t}\ {}_{i}w_{\varsigma}^{*t}$	(8.1.1)	Total home sales ${}_{i}M_{\varsigma}^{*t}\ {}_{i}p_{\varsigma}^{t}$
(8.1.9)	Licence fees for raw material ${}_{i}q_{\varsigma}^{*t}$	(8.1.2)	Exports $\sum_{r} {}_{i}M_{\varsigma r}^{*t}\left[{}_{i}p_{\varsigma r}^{t}(1+\vartheta_{\varsigma r}^{t})+\vartheta_{\varsigma r}^{t}\right]$
(8.1.10)	Interest ${}_{i}L_{\varsigma}^{t}\ {}_{i}b_{\varsigma}^{*t}\ \frac{1}{100}$	(8.1.3)	Subsidies ${}_{i}W_{\varsigma}^{*t}\ {}_{w}\mathcal{O}_{\varsigma}^{t}+{}_{a}\mathcal{O}_{\varsigma}^{t}({}_{i}R_{\varsigma}^{t}+{}_{i}\mathcal{M}_{\varsigma}$
(8.1.11)	Pay-roll tax ${}_{i}W_{\varsigma}^{*t}\ {}_{i}w_{\varsigma}^{*t}\ {}_{w}\phi_{\varsigma}^{t}$		$+\sum_{\varsigma}\sum_{\varsigma}{}_{\nu}^{\varsigma} p^{t} c_{\varsigma} i_{r})+{}_{m}\mathcal{O}_{\varsigma}^{t}({}_{i}M_{\varsigma}^{*t}\ {}_{i}p_{\varsigma}^{t}+\sum_{r}{}_{i}M_{\varsigma r}^{*t}\ {}_{i}p$
(8.1.12)	Fee for branches in foreign markets $\sum_{r\neq\varsigma}{}_{i}A_{\varsigma r}^{t}\ {}_{i}f_{\varsigma r}^{t}$		${}_{e}\mathcal{O}_{\varsigma}^{t}\sum_{r}{}_{i}M_{\varsigma r}^{*t}\ {}_{i}p_{\varsigma r}^{t}+{}_{i}\mathcal{O}_{\varsigma}^{t}$
(8.1.13)	Advertising $a_{\varsigma}^{t}+\sum_{r}{}_{i}a_{\varsigma r}^{t}$	(III.3.4)	Borrowings ${}_{i}B_{\varsigma}^{*t}$
(8.1.14)	Turnover tax ${}_{i}M_{\varsigma}^{*t}\ {}_{i}p_{\varsigma}^{t}\ {}_{m}\phi_{\varsigma}^{t}$	(8.1.4)	Penalty $n\sum_{\varsigma}\sum_{\varsigma}{}_{\nu}^{\varsigma} p^{t-1} c_{\varsigma} i_{r}$
(8.1.15)	Duties $\sum_{r}{}_{r\neq\varsigma}{}_{i}M_{\varsigma r}^{*t}\ {}_{i}p_{\varsigma r}^{t}\ \vartheta_{\varsigma r}+\sum_{r}{}_{r\neq\varsigma}{}_{i}M_{\varsigma r}^{*t}\ \vartheta_{\varsigma r}^{t}$	(8.2.2)	Reimbursement of the price of machinery $\sum_{\varsigma}\sum_{\varsigma}{}_{\nu}^{\varsigma} p^{t-1} c_{\varsigma} i_{r}$
(8.1.16)	Property tax ${}_{i}A_{\varsigma}{}_{a}\phi_{\varsigma}^{t}({}_{i}C_{\varsigma}^{t}+{}_{i}\tilde{\pi}_{\varsigma}^{t-1}-{}_{L}{}_{i}\tilde{\pi}_{\varsigma}^{t-1})$	(III.8.6 a,b)	Uncovered bills of exchange ${}_{i}F_{\varsigma}^{t}$
(III.10.4)	Income tax ${}_{i}T_{\varsigma}^{t}$	(III.8.6 c)	Bad debts ${}_{i}\tilde{F}_{\varsigma}^{t}$
	Compulsory debt repayment $\bar{\beta}\,{}_{i}L_{\varsigma}^{t-1}$		
	Voluntary debt repayment ${}_{i}\bar{L}_{\varsigma}^{t}$		
(III.8.6)	Cash at the end of period t ${}_{i}\Gamma_{\varsigma}^{t}$		
Sum		Sum	

TABLE 10

Financial Status of the Capital good industry (for period t)

Disbursements			Receipts		
(9.1.6)	Wages	$_c\overset{*}{W}_\varsigma^t \; _c\overset{*}{w}_\varsigma^t$	(9.2.1)	Cash brought forward from period t-1	$_c\Gamma_\varsigma^{t-1}$
(9.1.8)	Licence fees for raw material	$\sum_\varsigma m_\varsigma \left(\sum_i {}^\varsigma N_{c_\varsigma i_r}^t + \sum_r \sum_i {}^\varsigma \overset{*}{N}_{c_\varsigma i_r}^t\right) + m_c \overset{*}{N}_{c_\varsigma}^t$	(9.2.2)	Prepayment received for the machinery ordered	$\sum_r \sum_i \sum_\varsigma {}^\varsigma_\gamma p_{c_\varsigma i_r}^t$
(9.1.9)	Interest	$_cL_{\varsigma\,c}^t \overset{*}{b}_\varsigma^t \frac{1}{100}$	(9.1.3)	Subsidies	$_c\overset{*}{W}_\varsigma^t \, _w\mathcal{O}_\varsigma^t + {}_a\mathcal{O}_\varsigma^t \, {}_cR_\varsigma^t +$
(9.1.10)	Pay-roll tax	$_c\overset{*}{W}_\varsigma^t \; _c\overset{*}{w}_\varsigma^t \, {}_w\mathcal{O}_\varsigma^t$			$+ {}_m\mathcal{O}_\varsigma^t \left(\sum_\varsigma \sum_i \sum_\varsigma {}^\varsigma_\gamma p_{c_\varsigma i_r}^t + \sum_\varsigma \sum_i \sum_r {}^\varsigma_\gamma p_{c_\varsigma i_r}^t\right) +$
(9.2.3)	Penalty	$n \sum_\varsigma \sum_i \sum_r {}^\varsigma_\gamma p_{c_\varsigma i_r}^{t-1}$			$+ e\mathcal{O}_\varsigma^t \sum_\varsigma \sum_i \sum_{r\neq\varsigma} {}^\varsigma_\gamma p_{c_\varsigma i_r}^t + {}_c\mathcal{O}_\varsigma^t$
(9.2.4)	Repayment of funds received for ordered machinery which could not be delivered	$\sum_r \sum_i \sum_\varsigma {}^\varsigma_\gamma p_{c_\varsigma i_r}^{t-1}$			
(9.1.12)	Property tax	$_c\mathcal{A}_\varsigma^t \, {}_a\mathcal{O}_\varsigma^t \left({}_cC_\varsigma^t + {}_c\tilde{\pi}_\varsigma^{t-1} - {}_L{}_c\tilde{\pi}_\varsigma^{t-1}\right)$	(III.3.4)	Borrowings	$_c\overset{*}{B}_\varsigma^t$
(III.10.4)	Income tax	$_c\mathcal{T}_\varsigma^t$	(III.9.6 a,b)	Uncovered bills of exchange	$_cF_\varsigma^t$
	Compulsory debt repayment	$\beta \, {}_cL_\varsigma^{t-1}$	(III.9.6 c)	Bad debts	$_c\tilde{F}_\varsigma^t$
	Voluntary debt repayment	$_cL_\varsigma^t$			
(III.9.6)	Cash at the end of period t	$_c\Gamma_\varsigma^t$			
Sum			Sum		

TABLE 11

List of Machinery of the Consumer Goods Industry (for period t)

Kind of machinery	Total of machinery in use during period t = stock of machinery at the end of period t-1			Depreciation in period t	Value of the machinery in use at the end of period t	Age of machinery in use since the beginning of period									
						t			t - 1			...	$t - 1/d_g + 1$		
	quantity	value				quantity	value		quantity	value		...	quantity	value	
		initial value	value after allowance for depreciation				initial value	value after allowance for depreciation		initial value	value after allowance for depreciation			initial value	value after allowance for depreciation
1	${}^1_i Z^{t-1}_g$	$\sum_r {}^1_y p^{t-1}_{c_r i_g} + \sum_r {}^1_y p^{t-2}_{c_r i_g} + \ldots \sum_r {}^1_y p^{t-\frac{1}{d_1}}_{c_r i_g}$	${}^1_i R^{t-1}_g$	${}^1_i D^t_g$	${}^1_i R^{t-1}_g - {}^1_i D^t_g$	$\sum_r {}^1 \overset{*}{N}{}^{t-1}_{c_r i_g}$	$\sum_r {}^1_y p^{t-1}_{c_r i_g}$	$(1-d_1) \sum_r {}^1_y p^{t-1}_{c_r i_g}$	$\sum_r {}^1 \overset{*}{N}{}^{t-2}_{c_r i_g}$	$\sum_r {}^1_y p^{t-2}_{c_r i_g}$	$(1-2d_1) \sum_r {}^1_y p^{t-2}_{c_r i_g}$	...	$\sum_r {}^1 \overset{*}{N}{}^{t-\frac{1}{d_1}}_{c_r i_g}$	$\sum_r {}^1_y p^{t-\frac{1}{d_1}}_{c_r i_g}$	0
2 ... 3															

TABLE 11 (continued)

Stock of machinery at the end of period t = stock of machinery at the beginning of period t–1	value	value after allowance for depreciation	${}^{1}_{i}R^{t}_{g}$
		initial value	$\sum_r {}^{1}_{y}p^{t}_{c_r i_g} + \sum_r {}^{1}_{y}p^{t-1}_{c_r i_g} + \dots \sum_r {}^{1}_{y}p^{t-\frac{1}{d_1}+1}_{c_r i_g}$
	quantity		${}^{1}_{i}Z^{t}_{g}$
Machinery actually received at the end of period t	value	value after allowance for depreciation	$\sum_r {}^{1}_{y}p^{t}_{c_r i_g}$
		initial value	$\sum_r {}^{1}_{y}p^{t}_{c_r i_g}$
	quantity		$\sum_r {}^{1}\overset{*}{N}{}^{t}_{c_r i_g}$
Machinery scrapped at the end of period t	value	value after allowance for depreciation	0
		initial value	$\sum_r {}^{1}_{y}p^{t-\frac{1}{d_1}}_{c_r i_g}$
	quantity		$\sum_r {}^{1}\overset{*}{N}{}^{t-\frac{1}{d_1}}_{c_r i_g}$

TABLE 12

List of Machinery of Kind c (for period t)

Total of machinery in use during period t = stock of machinery at the end of period t-1		Depreciation in period t	Value of the machinery in use at the end of period t	Age of machinery in use since the beginning of period				...		
				t		t-1		...	$t - 1/d_c + 1$	
quantity	value after allowance for former depreciation			quantity	value after allowance for depreciation	quantity	value after allowance for depreciation	...	quantity	value after allowance for depreciation
${}_cZ_g^{t-1}$	${}_cR_g^{t-1}$	${}_cD_g^t$	${}_cR_g^{t-1} - {}_cD_g^t$	$\overset{*}{N}{}_{cg}^{t-1}$	$(1-d_c)p_c \overset{*}{N}{}_{cg}^{t-1}$	$\overset{*}{N}{}_{cg}^{t-2}$	$(1-2d_c)p_c \overset{*}{N}{}_{cg}^{t-2}$	....	$\overset{*}{N}{}_{cg}^{t-1/d_c}$	0

TABLE 12 (continued)

Machinery scrapped at the end of period t		Machinery actually produced during period t for own use		Stock of machinery at the end of period t = stock of machinery at the beginning of period t+1	
quantity	value after allowance for depreciation	quantity	value	quantity	value after allowance for depreciation
$\overset{*}{N}{}^{t-1/d_c}_{c_s}$	0	$\overset{*}{N}{}^{t}_{c_s}$	$p_c \overset{*}{N}{}^{t}_{c_s}$	${}_cZ^t_s$	${}_cR^t_s$

TABLE 13

Decision Form for firm ... producing consumer goods and residing in country ... (for period t)

Workers	number of workers desired	wage rate offered	
	$_iW_s^t$	$_iw_s^t$	
Credit	amount of loans desired	rate of interest offered	voluntary debt repayment
	$_iB_s^t$	$_ib_s^t$	$_i\overline{L}_s^t$
Prices per unit	charged on the home market	charged on export market r	charged on export market R
	$_ip_s^t$	$_ip_{s_r}^t$	$_ip_{s_R}^t$
Advertising	expenditure spent in the domestic market	expenditure spent in market r	expenditure spent in market R
	$_ia_s^t$	$_ia_{s_r}^t$	$_ia_{s_R}^t$
Quantity intended to be produced	$_iq_s^t$		
Quantity intended to be sold	on the home market	on market r	on market R
	$_iQ_s^t$	$_iQ_{s_r}^t$	$_iQ_{s_R}^t$
Share of stocks in foreign markets intended to be sold	in market r	in market R	
	$_ig_{s_r}^t$	$_ig_{s_R}^t$	

TABLE 14

Decision Form for the Capital goods industry in country ...

(for period t)

Workers	number of workers desired	wage rate offered	
	${}_cW_g^t$	${}_cw_g^t$	
Credit	amount of loans desired	rate of interest offered	voluntary debt repayment
	${}_cB_g^t$	${}_cb_g^t$	${}_cL_g^t$

TABLE 15

Contract Note (for period t)

Seller (Producer) in Country .....

Buyer ..... in Country .....

Kind of Machinery .....

Price .....

TABLE 16

$_cZ_1$	$_cZ_2$	$_cZ_3$	$_cZ_c$	$_cW_1$	$_cW_2$	$_cW_3$	$_cW_c$

Kind of machinery	Total capacity of	
	man hours+)	machine hours+)
Initial capacity		
./. capacity employed under contract concerning one machine of kind		
= remaining unemployed capacity		

+) It is assumed that each worker and each machine is during 2000 hours per year in operation. The labour force required depends upon the number of contracts taken in. It must, however, be borne in mind, that the number of workers actually recruted depends on the situation on the labour market.

TABLE 17

Contract list for seller (producer) in country ... (for period t)

Machine of kind																										price	preference index
1									2									3								c		
for firm in country 1			for firm in country 2			for firm in country 3			for firm in country 1			for firm in country 2			for firm in country 3			for firm in country 1			for firm in country 2			for firm in country 3					
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		e.g.:	e.g.:
																						/						${}^{3}_{y}p^{t}_{c_g 2_2}$	${}^{3}v^{t}_{c_g 2_2}=5$
															/													${}^{2}_{y}p^{t}_{c_g 1_3}$	${}^{2}v^{t}_{c_g 1_3}=12$
		/																										${}^{1}_{y}p^{t}_{c_g 3_1}$	${}^{1}v^{t}_{c_g 3_1}=7$
${}^{1}N^{t}_{c_g 1_1}$	${}^{1}N^{t}_{c_g 2_1}$	${}^{1}N^{t}_{c_g 3_1}$	${}^{1}N^{t}_{c_g 1_2}$	${}^{1}N^{t}_{c_g 2_2}$	${}^{1}N^{t}_{c_g 3_2}$	${}^{1}N^{t}_{c_g 1_3}$	${}^{1}N^{t}_{c_g 2_3}$	${}^{1}N^{t}_{c_g 3_3}$	${}^{2}N^{t}_{c_g 1_1}$	${}^{2}N^{t}_{c_g 2_1}$	${}^{2}N^{t}_{c_g 3_1}$	${}^{2}N^{t}_{c_g 1_2}$	${}^{2}N^{t}_{c_g 2_2}$	${}^{2}N^{t}_{c_g 3_2}$	${}^{2}N^{t}_{c_g 1_3}$	${}^{2}N^{t}_{c_g 2_3}$	${}^{2}N^{t}_{c_g 3_3}$	${}^{3}N^{t}_{c_g 1_1}$	${}^{3}N^{t}_{c_g 2_1}$	${}^{3}N^{t}_{c_g 3_1}$	${}^{3}N^{t}_{c_g 1_2}$	${}^{3}N^{t}_{c_g 2_2}$	${}^{3}N^{t}_{c_g 3_2}$	${}^{3}N^{t}_{c_g 1_3}$	${}^{3}N^{t}_{c_g 2_3}$	${}^{3}N^{t}_{c_g 3_3}$	${}^{c}N^{t}_{c_g}$		

TABLE 18 a

Parameters of the Game Direction (to be published)

Parameters concerning employment	number of civil servants		salary of a civil servant		unemployment benefit coefficient		total of workers of all countries (constant for all periods)	
	$_sW_s$		$_sw_s$		v		W	
Parameters concerning credit	compulsory repayment ratio		credit restraint ratio		fraction of minimum amortisation of the uncovered public debt		minimum rate of interest	
	$\bar{\beta}$		β		$\bar{v}$		$_{min}b$	
Licence fees	per unit of consumer good		for one machine of kind					
			1		2		3	c
	m_0		m_{01}		m_{02}		m_{03}	m_{0c}
Machine hours	per unit consumption good manufactured by machinery of kind				of machine c for the production of one machine of kind			
	1	2	3		1	2	3	c
	z_1	z_2	z_3		$_cz_1$	$_cz_2$	$_cz_3$	$_cz_c$
Hours of labour	per unit consumption good manufactured by machinery of kind				per unit capital good required for production of one machine of kind			
	1	2	3		1	2	3	c
	w_1	w_2	w_3		$_cw_1$	$_cw_2$	$_cw_3$	$_cw_c$
Rate of depreciation	for machinery of kind				Fixed amount for the valuation of the machinery for own use			
	1	2	3	c				
	d_1	d_2	d_3	d_c			p_c	
Initial Capital	of firms producing consumer goods		of firms producing capital goods		Minimum public consumption		Penalty	
	C_0		$_cC_0$		R_{min}		n	

TABLE 18 b

Parameters of the Game Direction
(not to be published)

Coefficient expressing the influence of wage differentials	k		
Fiduciary multiplier	λ		
Parameters simulating advertising behaviour	α_1	α_2	α_3
Smoothing constant	μ		
Price influence coefficient	γ		
Decision on the elimination of state ϱ	+)		

+) Information about this decision as well as about the number and structure of the participants (to be attached to table 18 a) will be inserted in FORTRAN IV symbols.