**Institut für
Volkswirtschaftslehre
und Statistik**

No. 575-00

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Beiträge zur angewandten Wirtschaftsforschung

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Empirical Macromodels Under Test

A Comparative Simulation Study of the Employment Effects of a Revenue Neutral Cut in Social Security Contributions

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JEL classification: C50, C53, E17, H55, C68

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Mannheim, January 2000

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Abstract

This paper examines the employment effects of a revenue-neutral cut in the social security contribution rate in Germany by running policy simulations in four different types of macroeconomic models. Two models are based on time-series data where the labor market is modeled basically demand oriented, whereas the other two models are supply oriented computable general equilibrium models. While the predicted employment effects of the cut in the contribution rate are qualitatively similar across models three years after the cut, they differ considerably in magnitude. These differences can to a large extent be attributed to differences in the basic structure of the models. Of special importance is how prices and wages react in each model to the cut in the social security tax rate on one side, and the necessary increase of the indirect tax rate on the other side. The results, therefore, provide a guideline for assessing the outcome of policy simulations and for the further development of macroeconomic models suitable for this kind of experiments.

I. Introduction and overview[2]

High real labor costs are often made responsible for the bad performance of the German and other European labor markets. Therefore, a reduction in the social security contribution rate became a topic as well in political as in economic discussion. The employment effects of such a reduced contribution rate have been analyzed for a number of countries in different settings and using alternative modeling approaches. The OECD [1994] job study summarizes some results for Germany. Conrad and Schmidt [1997] analyze the effects of the introduction of a CO_2 emission tax on employment when the additional tax receipts are used to reduce the contribution rate to the social security system. Within the framework of a computable general equilibrium model they report on a possible double dividend effect. Franz, Göggelmann and Winker [2000] use a macroeconometric disequilibrium model for West Germany to simulate the employment effects of a revenue neutral cut in the contribution rate of the social security system. They find regime dependend small positive employment effects.

The few references already show that employment effects of a revenue neutral cut of the social security contribution rate are analyzed in quite different settings. Both the macro models used for the simulations and the simulation designs, i.e. the assumptions on the financing of the cut in the social security contribution rate, differ and so do the results. The reasons for these deviations are manifold, but may be summarized under four headings. First, the simulation design can differ in the definition of variables, the size of the changes and the assumptions on budget neutrality. Second, the models are based on alternative behavioral assumptions and transmission mechanisms. Third, differences in model details, in particular estimated or calibrated functional parameters, which need not be based on different assumptions about the behavior of economic agents, influence the quantitative and sometimes even the qualitative outcome. Finally, differing simulation periods, data frequencies, level of aggregation etc. also influence the results.

In this paper, direct access to four macroeconomic models allows for the implementation of a homogenous simulation design. Consequently, differences in simulation outcomes have to be attributed mainly to the last three causes mentioned above. The reference scenario chosen for our comparison is a reduction of the payments to the social security system which is financed by an increase in indirect tax rates, implying that in the first year after the change the reduced

[2] We thank the seminar participants in Konstanz and Bern as well as two anonymous referees for their valuable comments. Nevertheless, all errors remain in the responsibility of the authors.

receipts to the social security system are fully compensated by a corresponding increase in the receipts of indirect taxes. We focus on the employment effects and on the economic mechanisms driving these results. The four differently structured models[3] used in this study are a macroeconometric disequilibrium model (MDM), a macroeconometric model based on time series data, the GEM-E3 model of the class of general computable equilibrium models (GEM), an overlapping generations model (OGM) and a two equations model of the labor market (LM). These four models cover in a broad sense a large part of modeling approaches used for the purpose at hand, including partial and total analyses, equilibrium and disequilibrium approaches, econometrically estimated as well as calibrated models.

The paper is organized as follows: In the next section a short description of the different models used in the simulation study is given. The following section provides an overview of potential key differences between the models which might be responsible for different simulation outcomes. The fourth section describes the simulation design, while the fifth section presents and discusses the results. In the final section we summarize the main findings and offer some suggestions for further research.

II. A brief description of the models used in the simulation study

Macroeconomic models are used to analyze, to forecast or to simulate various economic situations. They provide quantitative information on certain economic policies, and are applied to test the validity of theoretical statements as well as to develop and analyze alternative economic scenarios. However, macroeconomic models which are able to provide adequate answers to all economically relevant questions do not yet exist. Depending on the specific problem different models have to be used.

1. The General Equilibrium Model: GEM-E3 Model (GEM)

Within the class of computable general equilibrium models (CGE)[4] Fehr and Wiegard [1996] distinguish between static, sequentially dynamic as well as completely dynamic models. We consider a variant of a sequentially dynamic model. The so-called GEM-E3 General Equilibrium Model for Energy-Economy-Environment interactions[5] has been developed in coopera-

[3] For a more detailed description of the destinction between macroeconometric and CGE approaches in policy modeling see e.g. Capros, Karadeloglou and Mentzas [1990] and Fehr and Wiegard [1996].

[4] CGE-models are also used in the analysis of optimal taxation, labor market developments and foreign trade; see e.g. Bovenberg and Goulder [1996], Bovenberg and de Mooij [1994 a,b], Hansen and Heckman [1996], and Shoven and Whalley [1984, 1992].

[5] For a detailed description of the GEM-E3 model see Capros et al. [1997].

tion with various European research institutes for the European Union member states. GEM-E3 can be classified as a multi-period, multi-country, multi-sectoral computable general equilibrium model that provides details on the macroeconomy and its interactions with the environment and the energy system. The model computes the equilibrium prices of goods, labor and capital that simultaneously clear all markets under Walras' law. The model's main objective is to serve as a quantitative tool for analyzing structural change and distributional effects across countries as well as across economic and social groups within each country. The policy activities being analyzed cover general economic policies like public finance, taxation and social policy as well as environmental policy issues in particular the analysis of environmental policy instruments. GEM-E3 is an open economy model that represents fourteen EU member states, either non-linked or linked through endogenous bilateral trade flows. Thus, it can be used to compare co-ordinated versus non co-ordinated policies in the European Union. The German model is based on West German Data.

As previously mentioned, the GEM-E3 model obeys a recursive static structure which generates sequential equilibria consecutively for each period. These sequential period equilibria are functionally related to a combined stock-flow accumulation of physical capital and environmental pollution. Additional driving forces of the system dynamics result from the myopic expectations of agents and from autonomous technical progress. Although the model has no specific time horizon, it is basically a long-term model designed for analyzing the effects of policies over a period of ten to twenty years. As market equilibrium depends on relative prices only, there is one degree of freedom left. To obtain an overall equilibrium the neoclassical closure rule is chosen. The model is constructed in such a way that the sum of balances over all economic agents (including foreign sector) is hold by Walras' Law.

The economic agents considered are producers, households, government and the foreign sector. The firms aim at maximizing their profits in the short run, restricted by a fixed physical capital stock and available technology. In the medium term, the capital stock may be adjusted by investment in new capital. A representative private household aims at maximizing her intertemporal utility (modelled by a Stone-Geary-utility function) under an intertemporal budget constraint, assuming myopic expectations. For the household sector as an aggregate, a nested intertemporal linear expenditure system is derived. Firstly, the household determines an allocation of resources between present and future consumption. Then, for an expected income in period t she determines the period level of consumption and the amount of leisure preferred.

Given leisure demand, the labor supply follows as the difference between total time resources and desired level of leisure.

In the standard version of GEM-E3 the market clearing proceeds under perfect competition assumptions, in particular, it is assumed that wages are flexible. But the model also allows for wage rigidities. Contrary to labor, which is mobile across sectors but immobile across countries, installed capital is assumed to be nationally and sectorally immobile. However, new capital (i.e. investment) is modelled as internationally and sectorally fully mobile. Obviously, this modelling approach gives sector specific shadow prices for installed capital, but a unique shadow price for new capital. The latter is the one which is derived from Walras law.

The model distinguishes nine different revenue categories with exogenously given rates on alternative tax bases. Among these categories are indirect and direct taxes, VAT, social security contributions, import duties as well as energy and environmental taxes. Total government consumption consists of public consumption as well as public investment, both are assumed to vary with GDP growth. From an economic point of view the solution of the model delivers equilibrium values for the main basic macroeconomic variables such as GDP, employment, trade flows, investment or consumption. These values are reported for each country as well as for each sector within an economy. A unique welfare measure based on an equivalent variation (EV) is applied for the evaluation of alternative policy scenarios.

2. A Macroeconometric Disequilibrium Model

The macroeconometric disequilibrium model (MDM)[6] is a medium-sized quarterly macroeconometric model for the West German economy including the goods and labor markets as the main building blocks. It has been primarily developed to analyze the real activities of a small open economy. The philosophy behind the model building strategy is Neo-Keynesian macroeconomics, i.e. one of the basic assumptions relates to the idea of not permanently cleared markets. This temporary disequilibrium induces adjustment processes in the quantities traded in each market due to the corresponding excess supply or demand situation. Prices are assumed to adjust only slugglishly in the short run. A cornerstone in the model building process is the conception of the economy as being composed of many micro markets, where each single micro market refers to a homogenous product or a firm which produces a homogenous

[6] For a detailed description of the model see Franz, Göggelmann and Winker [1998,2000], Franz and König [1990], and Franz, Göggelmann, Schellhorn and Winker [2000].

good and can be characterized by excess demand or by excess supply. Explicit aggregation over these micro markets determines the share of markets being in a specific regime. Therefore, at the aggregate level different regimes can be observed at the same time and changes of regimes take place continuously.

The model was mainly constructed to analyze different causes of unemployment on an empirical basis.[7] Recent research focuses on the factors driving the demand for labor as well as on the investment behavior. The model uses quarterly data for West Germany, starting in 1960 up to 1994[8]. Almost all equations are estimated in an error-correction specification, which mirror short-term deviations from some long-term relationship, which, however, is not necessarily an equilibrium in the neoclassical interpretation. The time horizon of simulations with this model ranges between three to ten years to cover both short-run dynamics and the tendency towards the long-run solution. The disequilibrium model accounts for the openness of the West German economy by specifying the international trade via export and import equations. The model is closed by introducing explicitly some identities of national accounting.

For labor and capacities it is assumed that adjustment is possible only in the medium or in the long term, respectively. Therefore, labor demand on the micro markets is determined by the minimum of labor input necessary to satisfy the demand for goods and the number of employees which can be employed profitably for a given capacity level. Aggregate employment is determined through a CES-function,[9] using labor demand and labor supply as arguments. The central parameter of the CES-function, which can be interpreted as a mismatch parameter, relates to the variance of the disturbances in these markets. If no disturbances on the micro markets exist this parameter tends to infinity and the strong minimum condition will apply. Otherwise observed employment will be below demand and supply. A similar approach is adopted to the goods market. Again, the model starts at the micro level by determining the production, employment and investment decisions of the representative firm. Two important features of the model deserve to be mentioned here. The first feature refers to the aggregate demand for goods which consists of public and private consumption, public and private investment, exports and imports. For the first four components it is assumed that no rationing of demand will occur. Therefore, an existing disequilibrium in the good markets manifests itself

[7] A comprehensive study on the causes of the European unemployment is provided by Drèze and Bean [1990].

[8] Currently, the model is updated to cover the time period up to 1997 including East Germany.

[9] This functional form results from the explicit aggregation procedure. See Smolny (1993).

in a gap between observed and effective imports and exports, respectively. A key element of this assumption consists in dividing the imports into two parts: the first part corresponds to the effective demand for foreign goods and the second part reflects the amount of excess demand in the domestic good market. To distinguish between these two components empirically it is assumed that observed and effective imports are identical when the domestic rate of capacity utilization has reached a historical minimum.

The second main feature relates to the productivity equations. These equations model the substitution between labor and capital due to changes in the relative factor prices. These equations can be used to test the assumption of a slow adjustment of the input factors to the optimal levels as well as the assumption of a short-term limitational production technology. The optimal factor inputs are determined under the assumption of profit maximization for a given linear homogeneous CES-production technology. In a second step the estimated productivities are used to determine the maximum quantity of goods supplied for a given level of employment on one hand; on the other hand the productivities can be used to determine the quantity of labor necessary to produce the aggregate demand of goods. Based on this framework, the model endogenously determines the development of regime shares and the corresponding levels of employment over time. In particular, it allows for the classification of time periods, when a large share of firms faces demand constraints (demand regime), versus other periods, when mainly existing capacities, which cannot be extended immeadiately, limit employment (capacity regime). Furthermore, the model's reaction to exogenous shocks or policy measures depend on the prevailing regimes on goods and labor markets.

3. An Overlapping Generations Model (OLG)

This model is a computable general equilibrium model with overlapping generations in the tradition of the OLG model invented by Auerbach and Kotlikoff [1987].[10] In the current version it is a model for a closed economy. It roughly captures the main features of the German public pension system and mainly serves as a tool to investigate the long-run effects of the demographic change on the pension system, major macroeconomic variables and the welfare of different generations. These effects are considered under the current rules of the public pension system as well as under reform options for the pension system debated in Germany. One of the reform options debated and partly already enacted not only to raise employment in the

[10] For a detailed description of the model as well as an application to the German pension fund system see Buslei [1999].

short run but also to ensure long-run financial viability of the pay-as-you-go pension system is a partial subsitution of payroll taxes by consumption taxes.[11] A model in the tradition of Auerbach and Kotlikoff (1987) seems to be a natural candidate to investigate the effects of this reform proposal (see Fehr, 1997 for an application). However, the results in the short run are sometimes questioned mainly because unemployment is not taken into account in the model. As the present study investigates the effects of a partial shift from payroll taxes to consumption taxes in different models, it reveals to which extent the short-run (employment) effects in an Auerbach/Kotlikoff type model differ from models commonly used to consider those effects.

The agents in the model are representative individuals who differ in age, a representative firm and the government. Individuals maximize an intertemporal utility function with consumption and leisure as the arguments subject to an intertemporal budget constraint. They are assumed to have perfect foresight. Individuals enter the model at age 21. While individual lifetime is uncertain, the maximum age is 100. Death probabilities were calculated on the basis of tables delivered by the German Statistical Office for the year 1992. Capital markets are assumed to be perfect and individuals hold all their assets in (fair) annuities which implies that bequests are excluded. Over the life cycle individuals experience different labor productivities. The productivity increases when individuals are young, reaches a maximum at about age 45 and falls subsequently.

The representative firm behaves competitively and maximizes profits given a Cobb-Douglas technology with labor and capital as inputs. The depreciation rate is set exogenously at the long term average value in Germany. Government consumption was set exogenously at a fixed amount per capita and does not enter the utility function of the individuals. The rate of the capital income tax was set at 10 % and the rate of the excise tax at 15 %. The endogenously determined wage tax rate is about 18 % in the benchmark equilibrium. The lower rate of the capital income tax compared to the wage tax rate reflects special tax allowances for capital income. The revenue of these taxes is used to finance government consumption.

The government also rules a pension system on a pay-as-you-go basis. Simplifying, the rules of the German pension system prior to 1999 were modeled as follows: Individuals aged 61

[11] Since 1992 the government subsidy to the pension system is not only adjusted to the growth rate of mean gross labour income but also to changes in the contribution rate. Thus, the tax financed government grant increases in

and over are eligible for pension transfers. The level of the pension depends on wage income prior to pension eligibility in the following way: The wage income of a generation is set in relation to the mean wage income in each year prior to retirement. These relations are summed up and the result is multiplied by a value called current pension value („aktueller Rentenwert“). The current pension value is identical for all pensioners in a year, but is adjusted to changes in mean net labor income between the previous year and the year before last year. The starting value for the current pension value was set exogenously. The resulting replacement ratio is about 62 %. Simplifying, it is assumed that individuals consider their contributions to the pension system as taxes and do not take into account that the level of their pensions depends on their labor income. Pensioners may supply labor while receiving a pension. But three assumptions in this model imply that individuals only supply a negligible amount of labor while receiving a pension. Firstly, utility of leisure is assumed to rise sharply in the old age and secondly, productivity declines in the old age, as was already mentioned. Thirdly, it is assumed that an additional tax falls on the wage income of individuals of age 61 to 64. This tax should be considered as a proxy for the legal restriction that labor income may not exceed certain limits for the time being early retired. As the labor and the goods markets are perfectly competitive, markets clear and (unvoluntary) unemployment does not exist. Thus, employment effects of policy changes result from changes in labor supply.

The model delivers the equilibrium values for each year in the period under consideration. Among these variables are output, consumption, interest rate, wage and the contribution rate to the public pension system. Moreover, the equilibrium values of the life cycle plans for consumption, savings and labor supply result for each cohort. Based on these values, life time utility of each cohort can easily be calculated. An important strength of the model is that it points to the possibly important effects of the age distribution on the result of policy changes.

4. A small reduced form model for the German labor market

The last model we consider was developed by Steiner [1998] to analyze the employment and wage effects of social security financing and was thought as a cross check to the corresponding results of the OECD Jobs Study [1994] for West Germany. The model consists of two equations - a wage equation and a demand for labor equation. Based on annual data for West Germany from 1960 to 1995 the model simulates the wage and employment effects due to a

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abolute terms if the contribution rate rises. Moreover, in 1998 an additonal government grant was introduced which is financed by an increase in the VAT.

cut in the social security contribution rate and its financing by an increase in indirect taxes. The model distinguishes between short- and long-run effects. In the short-run the model allows a certain degree of disequilibrium which is modeled by an error-correction approach, whereas the co-integration regression delivers the corresponding long-run relationship.

The time horizon of the model is short- to medium term, but nevertheless also long-run relationships of economic policy activities can be analyzed properly by simulating the model over a long-term horizon of around ten years. The model considers a closed economy, and within this economy emphasis is put on the labor market only. All assumptions about the behavior of economic agents are given implicitly in the sense that the equations to be estimated are compatible with standard optimization behavior of economic agents under perfect foresight. In this sense the demand for labor may be derived from a cost minimizing behavior of a representative enterprise, which makes labor demand depended on the real wage, output, productivity and the employers' social security contribution rate. The wage equation can be derived under the hypothesis of collective bargaining. For the wage behavior it is assumed that employees (unions) view the employees' contribution rate like direct taxes, but do not take the employers' contribution rate into account. This is a maintained assumption of the model which cannot be tested.

An empirically testable hypothesis is that the elasticity of contract wages with respect to prices is one in the long-run, i.e. the long-run Phillips curve is vertical. Furthermore, increases in indirect taxes are fully transmitted into higher contract wages, i.e. unions do not seem to distinguish between price increases resulting from higher indirect taxes and other factors, respectively. Except for the output variable in the demand for labor equation no links to other markets are directly modeled. The model can be handled in a simple manner and delivers an explanation of the wage setting behavior in West Germany and the corresponding demand for labor. Weaknesses of this approach are partly due to econometric problems such as multicollinearity which prevent differentiation between employers' and employees' contribution rates, and due to data availability which prevent a richer specification of the corresponding equations at the macro level. Model extension might consist of including a labor supply equation as well as of taking the response of other markets into account, e.g. by integrating an output - price - equation. Using an Okun-type relationship the model can easily be extended to include the goods markets as well.

III. The basic transmission channels of the models

The brief description of the models in the previous section revealed the main differences in the basic structures of the models considered. In this section we put closer attention to the models' specific transmission mechanisms which mainly drive the results. To shed some light on these mechanisms, we consider a cut in the contribution rate to the social security system which is financed by increasing indirect tax rates in order to keep the budget balanced in the first year after the cut.

In the GEM-E3 model the cut in the social security contribution rate lowers the producer wage, but also increases the cost of living due to the corresponding increase in the value added tax rate. As a first step the increase in the price levels leads to a reduction in real disposable income. As private consumption depends on real disposable income, real private consumption also decreases. The reason for this outcome is the decline in capital income in the GEM-E3 model due to a decline in the demand for capital goods which follows from substituting capital for labor due to lower labor costs. The reduced capital demand causes the ex post shadow price of capital, the market clearing price for a period, to fall (putty-clay specified production function). In the model real capital income is defined as the product of the shadow price of capital and the (temporary fixed) capital stock deflated by the consumer price index. As consumer prices increase and (sector specific) capital prices decrease, there is an unambigious pressure on real capital income to decline. The current period investment demand depends positively on the shadow price of capital, the depreciation rate and (also positively) on expected output. The expectation on future output is driven by the current output (myopic expectations). The latter might increase even though domestic demand falls. The reason can be found in the rise of export demand: As the labor tax is replaced by an indirect tax, export prices decrease. This shift of tax burden stimulates export demand. In case that the increase in the latter overcompensates the negative income effect on private consumption, both production and GDP would increase. Moreover, if the output effect would dominate the price effect in the investment decision, investment demand would rise as well. Which of the mentioned effects are dominant depends on the parameterization of the model and will be discussed in the context of the presentation of the quantitative results.

In the disequilibrium model the cut in the contribution rate lowers the real producer wage, but increases the consumer wage. The lower real producer wage leads to an increase in the demand for labor and to higher employment. The increase in the consumer wage rate is at least

to some extent offset by the increase in consumers prices due to higher indirect taxes. But altogether real disposable income might increase and in turn real consumption and thus aggregate demand.[12] In this model (MDM) capital income is defined in terms of the national accounting system which means that this income variable is hardly comparable with the one used in the GEM-E3 model. The increase in capital income in the disequilibrium model is the result of lower labor costs on the one hand and of the increase in GDP on the other. Output affects investment decisions in the disequilibrium model via expected output as it is in the GEM-E3 model. But contrary to the assumption of myopic expectations, in the disequilibrium model expectations on output are modeled as pseudo rational.

In the OLG model, the increase of the indirect tax rate leads to a rapid increase in the price level. As profits of the represesentative firm are zero, the additional tax burden in the closed economy considered is fully borne by the two factors. The cut in the social security contribution rate reduces labor costs of the firm and increases nominal net wages of employees. The increase in the nominal wage rate of employees due to the reduction in the social security contribution rate alone is lower than the increase in the price level. But as labor demand increases due to lower labor costs, nominal wages tend to increase. Beside these effects, it can be expected that employees between about age 40 and 60 will increase their labor supply in the short run in order to offset the decrease in the real value of their assets due to the increase of the indirect tax rate. Although the change in the real wage rate and labor supply depends on the parameters of the model, especially the intertemporal elasticity of substitution between consumption and leisure, it has to be expected that the change will be small.

In the small reduced form labor market model the cut in the social security contribution rate lowers unit labor costs and thus increases the demand for labor. With respect to the wage equation the financing of the cut by increasing the rate of indirect taxes leads to a reduction in the real wage. But this temporary reduction is offset by unions passing on price increases to higher wages irrespective whether they originate from higher producer costs or higher indirect taxes. Therefore, only the reduction in the employers' contribution rate will become effective in stimulating employment, if not financed by increasing indirect taxes.

[12] For different assumptions on the behavior of unions with respect to bargaining on the one hand and the power of unions on the other, see Franz, Göggelmann and Winker [2000].

IV. Design of the simulation study

Given these different transmission mechanisms it seems reasonable and feasible to compare the models on a specific simulation. A comparative simulation study has the main advantage to reduce or even eliminate differences resulting from differing simulation designs. Using a common design of the simulation study allows to attribute the remaining differences in the simulation outcomes to the different modelling approaches. Therefore, the experiment we carry out for all four models consists of a four percentage points reduction of the contribution rates to the German social security system of currently around 42 % of gross wage income.

Since the models differ also in their treatment of the social security contribution rate, this policy measure is implemented differently according to the models' specific features. The GEM-E3 and the macroeconometric disequilibrium model consider both parts – the employers' and the employees' contributions – of the social security system as a whole. Therefore, the four percentage point cut can be modelled in a straightforward way. Since the OLG model only captures the contribution rate to the pension system, this rate is reduced by two percentage points for employers as well as employees. Finally, the labor market model restricts itself to the contribution rate of the employers. Consequently, only a two percentage point reduction is modelled. Of course, the omission of certain markets or the restriction to look at only one side of a market implies that possible feedback effects between markets or between demand and supply side within a single market are not accounted for. However, this potential source for differences in the simulations is regarded as stemming from different modeling approaches rather than different simulation designs.

A revenue-neutral cut avoids that different results are mainly driven by alternative assumptions on monetary or fiscal policies across the models. To compensate for the reduced receipts, the government increases indirect taxes simultaneously in such a way that the reduced receipts are fully compensated by the increased tax revenue in the first year or time period in which the modification takes place. For the following years the tax rates are kept constant at this new level. Consequently, budget neutrality is not guaranteed exactly over the entire simulation horizon.[13]

[13] This assumption deviates from the one in Franz, Göggelmann and Winker [2000], who assume a neutral counter-financing over the whole simulation period. But as these authors remark, this assumption implies that on a yearly base indirect tax rates have to be adjusted in order to meet the needs of a settled budget. The reason for

Again, the increase of the indirect tax rate is modelled slightly different in the four models. While the GEM-E3 model and the macroeconometric disequilibrium model differentiate various indirect taxes, the other two models consider a single aggregated tax rate only. In the latter case counter-financing proceeds via an increase in indirect taxes, and in the former case the value-added tax rate is increased to obtain budget neutrality in the first year. Consequently, different simulation outcomes may be the result of alternative treatments of indirect taxes, as economic agents may react differently to an increased value-added tax than, e.g. to increased taxes on tobacco products or beverages as well as on luxury goods.

Before turning to the results a final remark has to be made. Because of the restriction to West Germany as well as the limited time period the simulations with the macroeconometric disequilibrium model were carried out for time periods prior to unification. Therefore, qualitative statements, and not forecasts about the recent impact of such measures are given. With respect to the different regimes and their expected influences the policy measure was carried out during a period characterized by a strong goods demand regime (1982 - 1984) and a period characterized by a strong capacity regime (1988 - 1990).

V. Results of the simulation studies for the different models

The presentation of the results starts with the two most comprehensive models - the GEM-E3 model and the macroeconometric disequilibrium model. In the GEM-E3 model two different labor market specifications were applied. In the first specification a perfect labor market is assumed, i.e. the wage rate is fully flexible and labor demand matches labor supply. This market setting neglects the existence of involuntary unemployment. The imperfect labor market regime allows for unemployment by specifying an explicit bargaining rule to determine the wage rate. The wage rule is given by inflation-indexed nominal wage changes, thus keeping the real wage constant. The revenue neutral cut of the social security rate that is assumed for our simulations requires an increase of the VAT rate by 4.14 percentage points in the perfect labor market and by 4.15 in the imperfect case. In both versions there is an increase in employment three years after the cut. This increase is slightly higher in the perfect labor market setting (+0.71 %) than in the sticky wage version (+0.64 %). But, as this small gap in results shows, the labor market regimes applied have no important impact on the quantitative outcomes. One reason has to be seen in the relatively low labor market supply elasticity (0.1)

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this assumption was to avoid a mixture of the counter-financing of tax financing, government expenditure cut and/or by borrowing.

assumed for the neoclassical labor market. Another reason, even more important, is that the positive effects of the tax cut shown by the GEM-E3 results are mainly driven by export demand. As exports gain from the decrease in labor costs but are not directly affected by the increase in VAT, such a policy boosts export demand. Hence, the assumption on the openness of the economy is crucial to the results.

– insert Table 1 about here–

As with the GEM-E3 model two different simulations were run in the disequilibrium model depending on the regime prevailing in the economy. In both regimes, the demand as well as the capacity regime, a reduction of the contribution rate leads to small employment effects in the private sector. Comparing both regimes, the employment effect with an increase of 0.25 % relative to the base line is larger in the demand regime (1982 - 1984) than in the capacity regime, where employment increases by only 0.07 %, see Table 1. The reason for this outcome is that an economy being in the supply regime is constraint by the existing capacity. In such a situation a reduction of unit labor costs will only have minor employment effects in the short run. Extending the existing capacity takes too much time to be able to satisfy the additional demand in the short run.

The stronger increase in imports in the demand regime may also help to explain why real GDP growth is almost identical in both regimes although employment effects are different. In both regimes exports increase by 0.05 %, but import growth differs. Therefore, in the demand regime the expansionary effect on real GDP is somewhat dampened. The changes in the other variables listed in Table 1 show that the effect of the cut are usually stronger in the demand than in the supply regime, although differences are not so pronounced as they are for employment. The positive employment effects result from two independent sources. The first reason is that due to the increase in real disposable income, the demand for goods - consumption as well as investment - rises. The second argument comes from the capital-labor-substitution due to lower unit labor costs.

To run the simulation under comparable conditions in the OLG model the rate of the excise tax was increased from 15 % to about 19.25 %. In the benchmark equilibrium the revenue of about 4.25 percentage points of the excise tax equals the revenue of 4 percentage points of the contribution rate to the pension system. The additional revenue from the excise tax is entirely used to subsidize the pension system. Because of this subsidy, the endogenously determined contribution rate to the pension system falls. As this results in higher net wages, the pension

value increases. This increase explains why in the new long-run equilibrium the reduction in the contribution rate caused by the increase in the rate of the excise tax by 4.25 percentage points amounts to „only“ about 3.4 percentage points. Only small employment effects are obtained in the OLG model. Wages adjust rather fast to the policy change so that producer wages are lower than in the initial steady state only in the first two years after the cut in the social security rate. Three years after the cut, overall employment is only 0.28 % higher than in the initial steady state. Two years later, the difference is only 0.12 % and in the long-run steady state it is nearly zero.[14] Sensitivity analysis with respect to the intertemporal elasticity of substitution (0.25 in the base case), the intratemporal elasticity of substitution (0.8 in the base case) and the elasticity of substitution between labor and capital (1 in the base case) holding constant the labor tax rate and the replacement rate of public pensions show that the quantitative results depend to some extent on the values of the intratemporal rate of substitution and the elasticicty of substitution between labor and capital while the intertemporal elasticity of substitution only has a negligible effect. A rate of 0.5 (1.1) for the intratemporal elasticity of substitution leads to an increase of employment in year 3 of 0.17 % (0.92 %)[15]. Using a CES-production function and setting the elasticity of substitution between labor and capital to 0.8 (1.2) leads to an increase in employment of 0.18 % (0.39 %).

In the short-run, individuals of age 40 to 60 increase labor supply in order to compensate the reduction in consumption possibilities during retirement due the increase in the excise tax rate. The assumptions about the preferences for leisure and the productivity in old age imply that the policy change does not lead to a substantially higher labor supply of the retired individuals although the increase of the rate of the excise tax reduces their real income. It is an empirical question how elastically labor supply of retired people reacts to changes in income. To our knowledge this question is still unsolved. Thus, in reality the short-run increase of labor supply might be slightly higher in reality than in the model. The change in employment

[14] Fehr [1997] considers a reduction in the contribution rate by about two percentage points in a similar model. There too, the employment effect is slightly positive in the short run and zero in the longrun. Note that an even smaller effect (0.14 % in year 3) results if the pension value is not adjusted delayed to changes in mean net wages according to the rules of the German pension system but instantaneously.

[15] For higher intratemporal rates of subsitution, the employment effect in year 3 after the cut is sensitive to the adjustment mechanism of public pensions to mean net wages. The delayed adjustment according to the rules of the German pension system leads to a comparably low pension value in year 1 and year 3 and thus comparably high labor supply. Already in year 5 after the cut the rise in employment is only 0.57 % for an intratemporal rate of substitution of 1.1. If an instantaneous adjustment is assumed, the increase in employment in year 3 is only 0.39 %. Thus, one should not attach too much importance to the high employment effect reported for this rate.

does not necessarily mean that more individuals are employed. What changes are the hours worked. This is a logical consequence of the absence of unemployment in the model.

The labor market model includes the wage and the demand for labor equation and is dynamically simulated starting in 1970. Contrary to the disequilibrium model the labor market model is based on annual data. The cut in the contribution rate is set to two percentage points because only the employer's side is considered. Based on these assumptions the model predicts a 0.15 % increase in employment three years after the cut. The immediate effect of this policy is to reduce real labor costs and to increase employment. However, after 3-4 years such a policy leads to higher growth rates of labor costs for some years than under the historical policy regime, i.e. the base solution of the estimated econometric model. In the long-run, there is no effect of a revenue neutral shift on the growth rate of real labor costs and, hence, employment. Consequently, starting from a maximum employment increase of about 150 thousand persons, the effect on employment decreases rapidly and vanishes altogether after five to six years. After three years, employment has increased by about 0.15 %.

Let us now turn to some of the other aggregates shown in Table 1. Except for the labor market model which does not determine GDP, the remaining three models predict an increase in GDP, in labor income as well as in fixed investment due to the cut in the contribution rate. Opposite effects are expected for real private consumption, real disposable income and imports (the GEM-E3 and the MDM only). Capital income declines in the GEM-E3 model in the short run to an extent that disposable income declines as a whole. This might explain that, contrary to the disequilibrium model, consumption falls in the short run. In the medium term both types of income have increased in the GEM-E3 model with real labor income stronger than capital income. In the OLG model consumption falls in the short run although disposable income rises. Especially medium aged individuals increase savings in order to (at least partly) offset the negative effect of the higher excise tax on their consumption possibilities in old age. In the long run consumption rises. Welfare, measured as total life cycle income, is reduced for older and medium aged generations and rises slightly for young and future generations. Although, the contribution rate to the pension system falls, the average tax burden (including the excise tax) on wage is only slightly reduced. Thus the policy considered here can neither be seen as an effective instrument to raise employment considerably in the short run nor to ensure long run fiscal stability of the pension system during the demographic transition.

To summarize the results of this section all models indicate that a revenue neutral cut in the social security contribution rate will lead to some positive employment effects in the short to medium run. The results for different assumptions within a given model about wage flexibility (GEM-E3 model) and alternative regimes (demand or supply regime in the MDM) suggest that certain kinds of imperfections and alternative states of an economy do not lead to qualitatively different results in the models' outcomes. But the size of the employment effects differ considerably among the models on one hand, and they differ also within a model when alternative regimes are considered. The employment effects are highest in the GEM-E3 model. For the other models, the effects are half of a percentage point or even lower. These qualitatively similar results with respect to employment are encouraging if one takes into account the different purposes the models have been built for: The disequilibrium model was developed as a short run business cycle model to explain unemployment emerging from various sources of mismatch. Thus, short term disequilibria are at the core of the model and more emphasis is put on the demand side of the economy. Supply side considerations are limited to the supply of goods but not yet to labor supply. This limitation also holds for the reduced form labor market model. Contrary to this, in GEM-E3 a long-term perspective is taken and the supply side of the economy is explicitly considered as is also the case in the overlapping generations model. Thus, GEM-E3 and the OLG model ignore short run business cycle fluctuations to a large extend.

VI. Conclusions

What conclusions can be drawn with respect to employment from the results? First, all models analyzed in the paper indicate the same qualitative result of a revenue neutral cut of the contribution rate to the social security system with respect to employment. Quantitatively the results are quite different in magnitude. This suggests that from a qualitative point of view differences in the various models are of less importance than from a quantitative point of view. Secondly, care must be taken even from a qualitative point of view if more variables are considered than employment alone. Although within a model different assumptions about regimes or imperfections have a minor impact on the results, differences among the models are considerable. Most of these differences can be attributed to alternative model building philosophies. Thirdly, contrary to these findings different time horizons or different degrees of aggregation do not seem to have a significant impact on the results, at least qualitatively. Finally, from an economic policy point of view the results of the models do not suggest that a revenue

neutral cut in the social security contribution rate will lead to a considerable improvement of the present situation with high unemployment. With about 28 million employees and around 4 million unemployed the cut will lead to an additional employment after three years of around 200,000 people in the most favorable case - the GEM-E3 model with flexible wages - and of around 70,000 additional employees in the disequilibrium model for a demand regime. If the results of the overlapping generations model are considered, about 80,000 people will find additional employment. Furthermore, there is no guarantee that this additional employment will lead to a reduction in unemployment of the same order. These rather disillusioning figures call for additional and accompanying policy actions if unemployment is to be reduced to a considerable amount. This the more if one keeps in mind that the simulated reduction of the contribution rate is of a size which is unlikely to appear in practical policy in a single step action.

Comparing different macro models for some common policy action proved to be a valuable exercise for a better understanding of the underlying working mechanisms of the models. Moreover, to a certain extent the differences in the results could be traced back to the underlying behavioral assumptions and data bases. Comparisons of this kind should be helpful to clarify the different outcomes of investigations of other policy actions as well.

Appendix

Description of data

a) GEM-E3 Model

employment	total employment in private and public sector, national accounting definition
producer wage rate	real equilibrium wage rate including employers' social security
(after tax)	contribution rate, deflated by GDP-deflator
real GDP	real gross domestic product with public sector included, national accounting definition
private consumption	real, national accounting definition
fixed investment	real fixed total investment, national accounting definition
disposable income	real, deflated by private consumption deflator, private sector, national accounting definition
wage income	net wage and salary income after taxes, deflated by private consumption deflator, private sector, national accounting definition
capital income	net income from providing capital (interest payments) after taxes, deflated by private consumption deflator, private sector, national accounting definition
imports	real, imports of goods and services, national accounting definition
exports	real, exports of goods and services, national accounting definition

b) Macroeconometric Disequilibrium Model

employment	employment in the private sector, national accounting definition
producer wage	gross labor income, private sector, deflated with GDP-deflator, national accounting definition
real GDP	real gross domestic product with public sector excluded, national accounting definition
private consumption	real, national accounting definition
fixed investment	real gross fixed investment, private sector, without house rental, national accounting definition
disposable income	real, deflated by private consumption deflator, national accounting definition
wage income	net wage and salary income, deflated by private consumption deflator, private sector, national accounting definition

capital income	net income from entrepreneurship and wealth, deflated by private consumption deflator, national accounting definition
imports	real, without raw-materials and without semi-final goods, national accounting definition
exports	real, exports of goods and services, national accounting definition

c) Overlapping Generations Model

employment	hours worked
producer wage	wage rate including employers' security contribution rate (not deflated by the consumption price index (1/(1+indirect tax rate))
real GDP	gross domestic product with public sector included (not deflated by the consumption price index (1/(1+indirect tax rate))
private consumption	private consumption deflated by the consumption price index (1/(1+indirect tax rate))
fixed investment	difference in the capital stock between the benchmark equilibrium and the capital stock in the policy run (not deflated by the consumption price index (1/(1+indirect tax rate))
disposable income	wage income plus interest earnings plus pension transfers deflated by the consumption price index (1/(1+indirect tax rate))
wage income	wage income deflated by the consumption price index (1/(1+indirect tax rate))
capital income	interest payments deflated by the consumption price index (1/(1+indirect tax rate))

d) Labor Market Model

employment	total employment, national accounting system definition
producer wage	gross labor income, private sector, deflated with GDP deflator, national accounting definition.

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Table 1: Simulation results of a revenue neutral cut in the social security contribution rate after three years

Variables	GEM-E3[1]		Macroeconometric Disequilibrium Model		OLG[2]	LM[3]
	Flexible Wage	Fixed Wage	Demand Regime	Supply Regime		
employment	0.71	0.64	0.25	0.07	0.28	0.15
producer wage	-0.96	-0.84	-1.29	-1.45	0.01	-0.10
real GDP	0.46	0.42	0.25	0.25	0.29	
private consumption	-0.45	-0.45	0.68	0.48	-0.34	
fixed investment	0.19	0.17	0.49	0.33	0.32*	
disposible income	-0.48	-0.48	1.00	0.79	0.28	
wage income	0.56	0.63	1.54	1.38	1.25	
capital income	-1.25	-1.30	0.50	0.24	-3.31	
imports	-0.05	-0.06	0.75	0.16		
exports	2.01	1.89	0.05	0.05		
value-added tax	4.14	4.15			4.25	

Remarks: Figures are percentage changes against the baseline three years after the cut. For a precise definition of the variables see Appendix. For the GEM-E3 and the OLG model: value added tax indicates the increase in percentage points. 1) GEM-E3 = GEM-E3 General Equilibrium Model for Energy-Economy-Environment. 2) OLG = overlapping generations model. 3) LM = labor market model. * Measured as percentage change in the capital stock compared to initial steady state.