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# **The cost of fiscal tightening in Poland on the road to euro: does the labour market matter? (CGE model simulations) \***

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## **Abstract**

The paper gives assessment of macroeconomic and some structural consequences of the proposed fiscal consolidation necessary for Poland to fulfill the Maastricht fiscal criteria. The fiscal adjustments are assessed with a CGE model simulated over the horizon 2006 - 2008. Two sets of simulations are analyzed: rigid vs. flexible wages. We show that the fiscal tightening programme analyzed in this paper does not necessarily incur any cost in terms of aggregate GDP loss during 2006 – 2008 period. On the contrary, it may generate additional growth effects, provided that downward wage adjustments reduce unit labour costs, thus fostering the growth. We conclude that the condition for achievement of smooth and relatively low cost fiscal adjustment is to supplement it with labour market reform.

**Keywords: fiscal reform, Maastricht criteria, labour market, CGE model**

**JEL: E62, J38, H30**

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## 1. Introduction

During the whole period of transformation Poland has been experiencing the persisting deficit of the public finance. In recent years it has reached almost 5% of the GDP and has been accompanied by the sizeable public debt, currently exceeding 50% of the GDP. The continuing imbalance of the central government revenues and expenditure is of structural nature what means that the deficit results from the systemic features of the Polish economy and not from the management of the aggregated demand by the economic authorities to smooth the business cycle. Thus, although not only economists but also some politicians (e.g. the so-called Green Paper by J. Hausner, *Program uporządkowania.....*, 2003) recognize the scale of the phenomenon as well as its sources and the resultant risks, the policy measures to counter the imbalance of public finances have so far been fragmented and insufficient, while deep structural reforms are indispensable.

Persisting fiscal deficit is closely interlinked with labour market, being both the source and the result of the poor performance of the latter. On the one hand, Poland has relatively to its level of development rather large share of government in the economy (total general government expenditure amounted to almost 40.0% of GDP in 2005) and moreover, over 40% of that is social transfers. The share of social expenditures in budget<sup>1</sup> in Poland is comparable to rich, old European Union countries (average for EU-15 is 37.3%, 2005) where it has adverse effects for the labour market performance (e.g., see Scarpetta 1998; Garibaldi, Mauro 2002). However, it is a great deal above the figures for the major reformers, successful in terms improvement of labour market performance, like the Netherlands (ca. 23% of budget expenditure spent on social transfers, 2005) or Ireland (ca. 26% of respective share). Also countries in the region that lead more prudent fiscal and social policies, spent in relative terms much less on social transfers than Poland, like for instance Czech Republic (ca. 30% of the share of budget expenditure spent on social transfers, 2005) or Baltics (eg. Estonia with ca. 31% of the share of budget expenditure spent on social transfers, 2005). While general fiscal burden negatively affects economic growth rate and labour demand, social transfers act as disincentives to work. On the other hand, financing large social programmes requires heavy taxing of labour what results in relatively high tax wedge (almost 44% of average earnings, 2005), social contributions being the bulk of it. This factor increases labour cost for

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<sup>1</sup> All data on social transfers after: Commission of the European Communities (2005).

entrepreneurs and decreases their demand for labour. This combination of vast social expenditures and heavy labour taxation created a vicious circle that led to unique in Europe combination of high unemployment rate (around 18%, by the end of 2005) and low activity rate (around 55%, as of IV quarter of 2005). These facts are widely acknowledged by both most of economists in Poland (e.g. Rada Ministrów RP 2003) and foreign experts (e.g. IMF 2006; World Bank 2003).

The discussion about the need of fiscal tightening has been conducted in recent years in the context of Poland's fulfilment of the so-called nominal convergence criteria, required to be met by a country intending to join the euro area. To meet these criteria, the country is required, inter alia, to reduce its current deficit in the public finance system and its public debt to sustainable levels below 3% and 60% of the GDP, respectively. There are many benefits of possible early membership of Poland in the euro area as were analysed and quantified NBP (2004). The authors of this study estimated overall effects of euro adoption, both direct (e.g., elimination of transaction costs and of exchange rate risk, leading to the decline in interest rates) and indirect ones (e.g., impact on investment, trade expansion, integration of the financial market, increased competition) as up to 0.4% of acceleration of annual growth rate of GDP over longer run. Therefore, urgent and decisive actions are required to implement, fiscal consolidation to fulfil Maastricht criteria but also to supplement it with other structural reforms on labour and product markets to make Poland's participation in EMS sustainable. In this paper we present the results of the simulations of the fiscal consolidation programme that should be implemented in order to fulfil the public finance deficit criterion within a three-year horizon. The programme is mainly focused on the reduction of expenditure in the public finance system, including social transfers. Since this type of fiscal consolidation is expected to trigger pro-growth non-Keynesian effects through the cost channel, as discussed above, the degree of wage flexibility should have a significant impact on the costs of implementation of the analysed programme.

## **2. Fiscal consolidation programme for Poland**

### **2.1 Types of fiscal consolidation**

Various strategies for budget deficit reduction are analyzed in the macroeconomic literature (e.g. Alesina, Perotti 1996; Giavazzi, Pagano 1996; Giavazzi et al. 2000; Lane, Perotti 2001). Generally speaking, public finances may be balanced either by increasing tax revenue or by reducing expenditure, or by combining the two. In terms of the macroeconomic

and structural effects, both the method of fiscal consolidation (increase in the taxes or reduction of expenditure) and its composition (types of taxes increased or categories of expenditure reduced), as well as the scale of the programme, turn out to be important. In particular, literature advocates balancing the public finances rather by reducing government expenditure than by increasing taxes (in this case, consolidation is more sustainable and supports the economic growth — Alesina, Perotti 1996; Lane, Perotti 2001; von Hagen et al. 2001). The same authors also emphasize that the preferred ways of reducing government expenditure is rather by cuts in social transfers, wages and the employment in the government sector than by reductions in government expenditures on goods and services. Their theoretical considerations are supported by the experience of OECD countries, 1960 -1998, that clearly points out fiscal adjustment programmes that focused on curbing such categories of expenditures as social transfers and wages, as the most effective.

Reductions in the payroll fund in the public sector dampen the growth of wages in the private sector and thus positively influence unit labour costs, profitability and competitiveness of companies. Sustainable reductions in social transfers have a similar impact, since they lead to increased labour supply and weakened wage pressures. Such a strategy of reducing the budget deficit facilitates the occurrence of pro-growth (the so-called *non-Keynesian*) effects of fiscal consolidation in the short term<sup>2</sup>, that have been widely discussed in the literature in recent years<sup>3</sup>. The degree of wage flexibility is crucial to trigger this mechanism. The stronger the downward reaction of wage development to the fiscal contraction, the greater the drop in unit labour costs is through wage restraint, which in turn result in the growth of employment and output. Eventually, the balance of public finance is positively affected by lower expenditures (social transfers, wage bill in public sector) and bigger revenues (increasing employment and output). Wage mechanisms that restrict wage adjustments will curb pro-growth effects of this type of fiscal adjustments.

This adjustment mechanism represents the so-called supply (*cost-based*) channel of generating growth effects of the fiscal consolidation. The so-called *expectations channel*, that

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<sup>2</sup> It represents the so-called *supply* (cost-based) channel of generating growth effects of the fiscal consolidation. The so-called channel of *expectations* is an alternative mechanism that entails non-Keynesian effects of fiscal consolidation, more frequently referred to in the literature.

<sup>3</sup> For the latest overview of the literature and results see: Afonso (2006) for European countries and Rzońca, Cizkovicz (2005) for new Member States of the European Union.

generally speaking assumes expectations of a permanent tax reduction in reaction to significant and sustainable fiscal contraction, is an alternative mechanism that triggers this type of pro-growth effects. The literature quoted above discusses also *the exchange rate channel* that highlights the importance of currency devaluations before or during fiscal contractions to generate positive growth effects during fiscal contractions (e.g., Ireland and Denmark in the 1980s).

In this paper we will focus on quantitative analysis of potential pro-growth effects of supply (labour market) channel, triggered by fiscal consolidation programme for Poland, on the road to euro.

## 2.2 **Baseline projection of public finances for Poland, 2006 - 2008**

The baseline public finance forecast is based on the one of the NBP macroeconomic projection. The underlying assumption of the baseline forecast is “no policy change” rule, i.e. no new fiscal measures are introduced into the public finances over the forecast horizon, except for the effects of the legislation already being in force and key exogenous factors that will affect the public finance deficit in the coming years. The most important of them include:

- indexation of pensions and disability pensions in 2006 and 2008 (and its lack in 2007),
- significantly reduced payments from profit of the NBP to state budget in 2006, as compared to 2005,
- termination of the special liquidity facility received from the European Union budget for improved budget liquidity — from 2007,
- discontinuation of personal income tax allowance for house renovation — from 2006, with the effects visible in 2007.

The baseline forecast predicts GDP growth of 5.0% in 2006 and 5.3% in 2007, and slow down to 4.6% in the subsequent year. According to this forecast, the economic growth will be driven mainly by investment demand, over 10% in 2006 – 2007 and then deceleration to ca. 7.5% in 2008. The personal consumption will grow rather fast and steadily (by approximately 4% per annum), in line with the government collective consumption (by approx. 2.5%). A positive trends at the labour market are predicted, with stable growth of employment (by approx. 1% per annum), along the growth of nominal wages of 5% and a gradual decline of the unemployment rate to 14% in 2008. Table 1 presents a comparison of the public finance deficit as percentage of GDP, as resulting from our baseline forecast

against some other forecasts. All these forecasts display declining trend of the public finance deficit over the 2006 – 2008 horizon but also show that Poland not will be able to meet Maastricht criterion in the coming three years without a special fiscal consolidation programme<sup>4</sup>.

Table 1. Forecasts of general government balance for Poland (ESA'95, open pension funds classified outside the government sector<sup>5</sup>)

	2006	2007	2008
European Commission	-4.9	-4.9	
OECD	-4.7	-4.5	
Convergence Programme	-4.6	-4.1	-3.7
Baseline	-6.4	-5.1	-4.3

Source: European Commission Economic Forecasts, Spring 2006; OECD Economic Outlook No. 79, 2006; Convergence Programme of the Republic of Poland, 2005 Update; NBP projections.

In 2008, the deficit in the baseline variant is by 1.3 percentage points higher than the Maastricht criterion reference level. However, although the budget deficit criterion is clearly specified in the Maastricht Treaty as a deficit level below 3% of GDP, the practical application of the criterion is not quite clear-cut. This is due to from amendments to the Stability and Growth Pact adopted in March 2005. One of the then-introduced amendments is related to considering the impact of pension system reforms in the assessment. In the case of Poland, it means that the significant negative impact of the pension system reform on the budget deficit (resulting from the classification of Open Pension Funds outside public finances) might be considered in favour of Poland when assessing the fiscal situation. Provided that this happens, Poland might be treated as fulfilling fiscal deficit criterion even if it is temporarily over 3 per cent threshold. But on the other hand, according to the Maastricht Treaty, the reference value of government financial position should be satisfied in a sustainable manner (Art. 109). Therefore, it seems reasonable to aim at reduction of public

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<sup>4</sup> It is apparent, that meeting the fiscal deficit criterion of the Maastricht Treaty without the introduction of the necessary fiscal adjustment is possible only in the case of very liberal treatment of this criterion by the European Commission.

<sup>5</sup> In line with the Eurostat decision of March 2004 (Eurostat, 2004).

finance deficit more than required by Maastricht Treaty to take into account inevitable slowdown of the economic growth after 2008. Indeed, our baseline scenario represents economic growth characteristic for the peak of the cycle.

Finally, it was assumed in our simulations that fiscal target for 2008 is 2.5% public finance deficit to GDP ratio, i.e. it provides some cushion against unexpected slowdown of the Polish economy. This means that the total fiscal adjustment amounts to 1.8% of GDP. The data in the Table 1 show that the fulfilment of the fiscal criterion as early as in 2007 would require a deficit reduction of 2.6 percentage points during one year only. Considering the duration of the legislative process and the delayed financial effects of the adjustments assumed, it would be very difficult to achieve. Therefore, we have taken 2008 as the earliest possible date of fiscal deficit criterion fulfilment.

### **3.4 Proposed elements of fiscal consolidation in 2006-2008**

. The fiscal consolidation package simulated in this paper refers mainly to the expenditure side of the budget. The reasons for this focus of the programme have been elaborated above. The measures aimed at raising public revenues are also included but the have secondary importance, being oriented rather at expanding the tax base than on increasing tax rates. The proposed package of fiscal reforms is partly based on Burns and Yoo, 2002 and World Bank, 2003, and partly on the work of NBP experts.

The proposed fiscal measures are related to the following areas of public expenditure and revenue:

#### **1. Public aid.**

Efficiency oriented reforms of the system of assistance to the disabled employees that have the form of refunds of social security contributions for the disabled, tax relief to protected labour companies and co-financing of wages for the disabled who receive disability pensions.

#### **2. Agriculture.**

Mainly the reform of the Agricultural Social Insurance Fund (KRUS) by making social security contributions of farmers dependable on income. Co-financing of direct payments from the central budget is to be reduced and diversified. Budgetary expenses for co-financing of investment loans are to be revised. A replacement of the current agricultural tax with an income tax dependable on the actual income generated by farmers.



### 3. Social policy.

The main elements are: review and cuts of disability pensions, reduction of sickness allowances and restricting expenditure for funeral allowances (as in the, so called, Hausner plan – Rada Ministrów RP 2003). Also savings are assumed from streamlining some of the domestic expenditures on active labour market policies (e.g. refund of remuneration expenses) and instead using for that purpose the EU structural funds.

### 4. National defence.

The measures involve temporary freezing of the real volume of military expenditures. Considering the scale of expenditures for this purpose and the expected GDP growth rate, such measures will bring significant savings.

### 5. Education.

The planned savings are the effect of adjusting down the level of educational subsidies to local governments, according to the demographic forecasts, showing considerable the decrease of the number of children and youths aged 7-18 by 15.6% in 2005-2010. Our simulations take this tendency into account when establishing the level of educational subsidies, which will bring significant savings.

### 6. Public administration.

Significant savings in public administration are assumed to be achieved outside the central budget, through cutting expenditures of special-purpose funds and government agencies, e.g. voivodship offices, local governments, the Social Insurance Institution, the State Treasury Fund, the agriculture administration (including the Agricultural Market Agency and the Agency for Restructuring and Modernization of Agriculture).

It has been additionally assumed that, due to the reduction of the budget deficit and a prospective Poland's accession to the euro area in 2010, the level of Treasury securities yields will converge with that in the euro area countries, as was the case in countries that previously joined Euro area. Hence, if the fiscal criterion is met in 2008 and Poland joins the euro area in 2010, debt servicing costs may be expected to decrease by 0.1% of GDP in 2007 and another 0.1% of GDP in 2008, as compared with the scenario of no fiscal consolidation. A summary of financial consequences of the above described- package is presented in Table 2 (the difference between the base variant and the fiscal consolidation scenario in relation to GDP).

Table 2. Financial effects of consolidation in the public finance sector (as % of GDP)

	2006	2007	2008
Public aid	0.28	0.25	0.25
Agriculture	0.12	0.31	0.31
Social policy	0.14	0.29	0.30
Education	0.00	0.11	0.17
National defence	0.09	0.17	0.25
Public administration	0.03	0.31	0.32
Debt servicing costs	0.00	0.10	0.20
<b>Total</b>	<b>0.67</b>	<b>1.54</b>	<b>1.80</b>

Source: Own calculations.

### 3. The simulations of fiscal tightening programme

#### 3.4 Methodological remarks

Simulations based on the Computable General Equilibrium (CGE) model have been conducted to estimate the effects of the proposed fiscal tightening, taking into account its impact on the economic growth and some structural characteristics of the economy (e.g., labour market and incomes of the households). The CGE model used here has been developed through cooperation of several institutions: the World Bank, the National Bank of Poland, the Ministry of Finance and the Ministry of Economic Affairs and Labour (see: Gradzewicz, Griffin, Żółkiewski 2006). Considering, on the one hand the broad scope of the fiscal consolidation that includes various measures, and on the other hand the high level of detail in the CGE model, including fiscal sphere, application of the model of this type to assess the economic consequences to simulate fiscal reform seems justified<sup>6</sup>.

The CGE model (Lofgren et al. 2000; Dixon, Rimmer 2002; Hertel 1999) takes into account all flows generated in the national economy, in accordance with the national accounts (GUS 2005). It guarantees the consistency of the description of relations between various economic entities (the revenue of entity X is the expenditure of entity Y) and the balance of revenues and expenditures for individual entities. Moreover, the CGE model provides a disaggregated description of various sectors of economy, which means that data from national accounts are supplemented with information from other sources. For instance, including

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<sup>6</sup> A brief description of the model is presented in Appendix A Also, Appendix B describes the reaction of agents and the consequences to general equilibrium of a specific change in the fiscal policy (namely – a decline of social transfers). As was mentioned, the detailed description of the CGE model used here can be found in Gradzewicz, Griffin, Żółkiewski (2006).

changes in the output structure by branch in the model requires the application of the input-output tables data (Dervis et al. 1982). A detailed description of the labour market (e.g. by including various groups of the employees) is based on data from the Labour Force Survey and other statistical reports on the labour market. Further on, in order to include various groups of households in the model (e.g. in a breakdown by the income level or according to some social and occupational criteria), use of data from the Household Budget Survey is required. Data from these and other sources (e.g. the balance of payments) are integrated in the form of the Social Accounting Matrix (SAM) (see Pyatt, Round 1985; Thorbecke 2000; Roberts et al. 1998), which constitutes the main element of the database of the CGE model.

CGE - type models have been used to simulate effects of fiscal, pension system and labour market reforms for several countries. These are, for instance, works of: Knudsen et al. (1998) for the Denmark, Bassanini et al. (1999) for the United States, Germany, Sweden and the United Kingdom, Bovenberg et al. (2000) for the Netherlands, Boeters et al. (2003) for Germany and Keuschnigg and Keuschnigg (2004) for Austria.

The usage of CGE models in simulating the consequences of fiscal reforms is widespread for some reasons. Taxes and other fiscal instruments (e.g., subsidies and transfers) are parameters of agents' optimisation problems, deeply embedded into the model (they affect the relative prices that agents face when making their decisions). Thus, economic agents modify their behaviour as fiscal reform takes place (when fiscal parameters change). Also, government balance condition, which is interdependent with other macro balances in the model, enables one for analysing the impact of fiscal reform on budget equilibrium. Additionally, it allows to build scenarios in which budget neutrality condition is imposed upon the model and upon the decisions of other agents.

For our model and set of simulations discussed in this paper, the mechanism of endogenous labour supply, derived from households' optimisation problem, is crucial for understanding the final results (for some basic intuition micro-foundations and general equilibrium effects, see the Appendix B). This mechanism, combined with flexible wages regime, generates potential pro-growth (non-Keynesian) effects of fiscal consolidation in our model.

It is worth noting that the structure of the CGE model makes it possible to take into account only some transmission channel of the non-Keynesian effects of fiscal policy (cost channel). Since our model does not include the expectations on the behaviour of economic agents, we are unable to account for "expectations' channel of non-Keynesian effects of fiscal

consolidation, i.e., improved expectations on the future of businesses and consumers as a reaction to the prospect of credible fulfilment of the budget deficit criterion and of Poland's entry to the euro.

Our presented simulations were conducted subject to two alternative assumptions on the behaviour of the labour market: the regime of completely rigid, i.e. fixed wages (called in the CGE literature "Keynesian closure") or the regime of perfectly flexible wages (called "neoclassical closure"<sup>7</sup>). The former assumption is consistent with the mechanism of the labour market at which the level of employment is determined by the demand for labour at given wage. Therefore market does not clear and the unemployment that emerges has involuntary character. The latter assumption means that wages balance labour demand and supply, and it is only voluntary type of unemployment that may take place in this regime. The assumption of perfectly flexible wages may be interpreted as the postulate that the government, when introducing fiscal consolidation programme, supplements it with appropriate labour market reform to make it function smoothly<sup>8</sup>. In the base scenario, the regime of rigid (fixed) wages was applied.

All the results are presented as differences (in percentage points), as compared to the baseline scenario, unless stated otherwise.

### **3.4 Results of simulation under the assumption of rigid wages**

In 2006, the first year in the simulation, the government implements fiscal consolidation of the total size of 0,67% of GDP (composition as in Table 2). The macroeconomic effects are illustrated in Table 3. GDP growth is by 0.34 percentage points lower than in the baseline scenario, mainly due to a slowdown in total consumption by 0.82 percentage points. Budget cuts (in education, national defence and administration expenditure) decrease the growth rate of public consumption by 0.72 percentage points.

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<sup>7</sup> On closures in CGE models see, for instance: Dewatripont, Michel (1987), Robinson (2003).

<sup>8</sup> The authors do not explicitly define specific legislative measures that would improve labor market flexibility. These might be such measures usually mentioned in the literature on labour market in Poland (e.g.. Bukowski 2005; IMF 2006) as. reduction of the tax-wedge, liberalizing employment protection legislation, especially with respect to the collective dismissals, regional differentiation of c minimum wages, wider use of active labour market polices and other measures to stimulate labor supply (e.g., cuts in social transfers that create disincentives to work).

Reduced government transfers to households, included in the government programme, influenced negatively the growth rate of the private consumption (by 0.84 percentage points) and this effect was amplified by lower income from renting the capital as capital prices inflation decelerates. The negative impact of the lower growth rate of consumption on the GDP is mitigated by the acceleration of the growth rate of gross capital formation (1.68 percentage points), resulting mainly from the increased savings of the public sector.

Table 3. Results of simulation of the fiscal consolidation scenario under the assumption of rigid wages [in percentage points, in relation to the baseline scenario]

	2006	2007	2008	2006-2008
GDP	-0.34	-0.15	0.31	-0.18
Total consumption	-0.82	-1.21	-0.09	-2.12
Private consumption	-0.84	-0.74	0.16	-1.42
Government consumption	-0.72	-2.97	-1.04	-4.73
Investments	1.68	3.8	1.55	7.03
Export	-0.14	0.96	0.65	1.47
Import	-0.07	1.03	0.71	1.67
Capital	0	0.13	0.42	0.55
Employment	-0.77	-0.62	0.11	-1.28
Wages	0	0	0	0
Labour costs	1.04	0.12	0	1.16
Unemployment rate (change)	1.35	1.93	1.43	1.43
Participation rate (change)	0.85	1.33	-0.35	1.83
GG deficit/GDP*	-4.05	-1.85	-0.67	
GG deficit/GDP**	-5.95	-3.75	-2.57	
GG deficit/GDP (change to the baseline in percentage points)	-0.49	-1.34	-1.69	

\* GG including open pension funds

\*\* GG excluding open pension funds

Source: Own calculations.

Because of the lower than in the baseline scenario level of economic activity, foreign trade slightly decelerated both on imports (by 0.07 percentage points) and exports (by 0.14 percentage points) sides. The reaction of imports was weaker since composition of GDP changed in favour of investments which is relatively more import intensive than consumption. A slight decline of exports is attributed to an increased costs of production in agriculture (induced by the reform of Agricultural Social Insurance Fund), which reduces the relative competitiveness of domestic agriculture products and pushes the overall exports down. As the

decline of exports is a bit more pronounced than the decline in imports, exchange rate appreciates slightly to balance the resulting trade deficit.

Employment is by 0.77 percentage points lower than in as the baseline scenario as the result of slower GDP growth. On the other hand, additional growth of 0.85 percentage points in the labour participation rate is observed that is favourable to potential growth in the long run. It indicates higher flows of people from economic inactivity to the labour market, as social transfers were reduced and wages were kept constant. That increased the attractiveness of work in comparison to leisure. As a consequence of a lower level of employment and a higher participation rate, the unemployment rate was by 1.35 percentage points higher than in the baseline scenario.

The lower growth in employment occurs on all of the analyzed labour sub-markets (cf. Table 4). Mostly affected are medium- and low-qualified labour force segments. This is mainly the result of the lower (than in the baseline) demand for labour in the large food and agriculture sectors where there is relatively large share of medium and low – skilled workers. These sectors were negatively influenced by deceleration of consumption, and in particular by the weaker demand for food. The growth of disposable income is also slower than in the baseline, both in the case of low-income and high-income households<sup>9</sup>.

Table 4. Results of simulation of the fiscal consolidation scenario under the assumption of rigid wages for the disaggregated labour market and the household sector [in percentage points, in relation to the baseline scenario]

	2006	2007	2008	2006-2008	Category	Households	2006	2007	2008	2006-2008
Total employment	-0.77	-0.62	0.11	-1.28	Disposable income	high income	-0.92	-0.59	0.18	-1.33
Employment (higher ed.)	-0.5	-1.16	-0.25	-1.91		low income	-0.88	-0.98	0.22	-1.64
Employment (sec. ed.)	-0.83	-0.46	-0.46	-1.75	Consumption	high income	-0.84	-0.67	0.16	-1.35
Employment (primary ed.)	-1.27	-0.22	0.38	-1.11		low income	-0.93	-1.53	0.2	-2.26
Wages (total)	0	0	0	0	Prices	high income	-0.06	0.06	0.06	0.06
Wages (higher ed.)	0	0	0	0		low income	-0.02	0.46	0.03	0.47
Wages (sec. ed.)	0	0	0	0						
Wages (primary ed.)	0	0	0	0						

Source: Own calculations.

<sup>9</sup> For the sake of brevity, we discuss the simulation results aggregated into high-income and low-income households, and not for ten groups of households represented in the CGE model.

As for the aggregate effect of the fiscal policy measures, introduced in 2006, the general government deficit was reduced of by 0.49 percentage points more than in the baseline scenario.

In the second year of the simulation, in which the bulk of the proposed reforms is implemented, the GDP growth is again lower than in the baseline scenario (by 0.15 percentage points). However, the negative influence of reforms on the GDP growth rate is smaller than in the first year of reforms, partially due to a higher capital growth rate related to the higher capital formation in the preceding year. Moreover, although the employment growth rate is lower by 0.62 percentage points with respect to baseline, the distance to the baseline is smaller than in 2006 and labour participation rate increases even more than before (1.33 percentage points above the baseline). These are the reasons for continuing tendency of increasing unemployment rate (by 1.93 percentage points higher than in the baseline scenario).

The lower total consumption growth rate (by 1.21 percentage points) results mainly from a decrease in the public consumption by 2.97 percentage points, accompanied by the decline in the private consumption growth by 0.74 percentage points. The reaction of capital formation is positive — it grows by 3.8 percentage points faster than in baseline scenario as a result of higher savings in the economy, as the public finance deficit decreases. Exports and imports increase by 0.96 percentage points and 1.03 percentage points, respectively. The latter is spurred by the growing investment demand.

The labour market reports a slump in the growth rate of employment of people with higher education qualifications as compared to the growth rate of unqualified labour force. It results from the reduced government expenditure on education and administration, sectors with a relatively high share of qualified labour force. Moreover, lower growth is recorded for private consumption, which has a relatively high share of market and non-market services where the share of qualified labour force is also relatively high. On the other hand, investment demand grows rapidly. It translates mainly into output of manufacturing and construction — sectors with relatively high share of unqualified labour in the production process.

The disposable income of households, both high-income and low-income, reports a slowdown, following unfavourable situation at the labour market and cuts in government transfers. A stronger reaction is recorded in the group of low-income households, which are more dependent on government transfers. The consumption growth is also slower in both groups, with the bigger slump reported in the group of low-income households. The main

reason for that is the higher growth in the prices of consumer goods basket of low-income households (especially of foodstuffs).

The overall effect of fiscal consolidation for the public finance sector is the decrease of the deficit to GDP ratio to 3.75%, i.e. 1.34 percentage points below the baseline scenario.

The model predicts that the growth trends in the economy change in 2008. GDP grows faster by 0.31 percentage points comparing to baseline. The growth is mainly driven by investment demand (by 1.55 percentage points faster than in baseline) and also private consumption accelerates above baseline path (by 0.16 percentage points). Public consumption growth is still considerably below the baseline scenario (by percentage points) because of the another phase of cuts in government expenditures. The performance of exports and imports is noticeably above the baseline (by 0.65 and 0,71 respectively), with stronger import reaction as domestic demand accelerates.

On the supply side, higher GDP growth is caused by an increased supply of capital (by 0.42 percentage points), triggered by the previously higher investments outlays and by the employment that in the third year of reforms accelerates above the baseline scenario.

The unemployment rate in 2008 is still by 1.43 percentage points higher than in the baseline scenario. However, by the end of the simulation horizon, the worsening of unemployment rate with respect to the baseline scenario slows down by 0.5 percentage points. As for the composition of the labour market, acceleration of employment growth is concentrated within the primary education sector. It results mainly from an accelerated growth in the output of capital goods and in construction, i.e. in the sectors where this group of the employees is concentrated. On the other hand, the disposable income and consumption of households grow faster than in the baseline solution, in particular in the case of low-income households, mainly as the result of the improved situation at the labour market. Richer households take advantage of and growing incomes from capital. .

As for the public finance sector performance, fiscal consolidation measures bring down deficit to 2.6% of GDP, i.e. down by 1.69 percentage points as compared with the baseline scenario.

The package of fiscal reforms implemented in 2006-2008, results in the overall GDP growth lower by 0.18 percentage points, as compared to the baseline solution. It is caused primarily by a lower growth of the public consumption (down by 4.73 percentage points throughout the period), resulting from the fiscal reform package. The positive effect,



especially from the long term growth perspective, of fiscal reform is 7.03 percentage points acceleration of the growth of gross capital formation as the scale of public sector dissavings decreases. Following a slow-down in 2006, exports and imports grow steadily above baseline path in the subsequent years.

A weaker than in baseline scenario economic activity adversely affects the employment growth rate (down by 1.28 percentage points with respect to the baseline). Only towards the end of the period the employment growth rate slightly exceeds that from the baseline scenario. As a result, the unemployment rate in 2008 is by 1.43 percentage points higher. A positive long-run aspect of the development of the labour market is overall growth of the participation rate by almost 2% as compared to the baseline so work as social transfers creating disincentives to work were reduced.

As a result of the simulated fiscal reforms, the deficit of the public finance sector decreases to 2,6% of GDP. The total impact of the fiscal consolidation on the public finance sector deficit is slightly weaker than expected, due to a lower than in the baseline solution level of economic activity what results in the decrease of the other revenues of the general government that were not included in the reform package.

### **3.4 Results of simulation under the assumption of perfectly flexible wage adjustments**

The scenario described in the above section assumes rigidity of wages which reflects the short-run Keynesian labour market mechanism. Under this assumption, economy adjusts at the labour market to the simulated shock exclusively in terms of quantities, i.e. by correcting downward employment to weaker economic activity and by increasing the pool of economically active people (meaning in this case unemployed) as fiscal disincentives to work are reduced, and on the other hand wages do not decline. Now let us discuss the polar case when we assume perfect adjustment of wages to changes in demand and supply at the labour market. As pointed out above, behind this scenario there is implicit the assumption of legislative changes that lead to a significant increase of the flexibility of the labour market. We may expect that assuming a perfectly flexible labour market will trigger different than before adjustment on the labour market to the fiscal tightening scenario, potentially leading to pro – growth effects. Hence, abandoning the assumption of rigidity of wages and making them perfectly elastic serves testing whether fiscal consolidation may lead to the so-called “non-Keynesian” effects and what might be its size. The scenario with assumed flexibility of the labour market leads to an increase in economic activity — the cumulated (over 3 years)

GDP growth is up by 0.28 percentage points as compared to the baseline solution (cf. Table 5). The economy starts to grow faster than in the baseline scenario already from 2007 on., i.e. one year earlier than in the wage rigidity scenario. The GDP growth composition shows trends similar to those in the case of rigid wages. The growth takes - off because of the investment acceleration : up by 8.39 percentage points in total, as compared to the baseline solution, and up by approx. 1.36 percentage points against a comparable simulation under the assumption of wage rigidity. As in the previous simulations, it is an effect of increased savings in the economy, stemming mainly from the consolidation of the public finance sector. Paths of consumption growth, both public and private, lay below the baseline. As for the public consumption, it's performance is by construction identical to that in the case of rigid wages, as we assume the same size and scope of consolidation as regards government consumption in both scenarios. The growth of private consumption is lower than in the baseline scenario (by 1.21 percentage points over 2006 - 2008) but slightly higher than in the case of rigid wages (where by 1.42 percentage points as compared to the baseline scenario). It is the result of both lower than in the baseline employment growth rate (by 0.5 percentage points over 2006 – 2008) and downward adjustment of wages (by 1.19 percentage points against the baseline).

Table 5. Results of simulation of fiscal consolidation scenario under the assumption of flexible wages [in percentage points, in relation to the baseline solution]

	2006	2007	2008	2006-2008
GDP	-0.13	0.09	0.32	0.28
Total consumption	-0.75	-1.1	-0.1	-1.95
Private consumption	-0.76	-0.58	0.13	-1.21
Government consumption	-0.72	-2.98	-1.04	-4.74
Investments	2.41	4.41	1.57	8.39
Export	0.26	1.42	0.58	2.26
Import	0.28	1.43	0.66	2.37
Capital	0	0.19	0.53	0.72
Employment	-0.3	-0.15	-0.05	-0.5
Wages	-0.85	-0.8	0.46	-1.19
Labour costs	0.19	-0.68	0.46	-0.03
Unemployment rate (change)	0.04	-0.88	-0.87	-0.87
Participation rate (change)	-0.25	-0.05	0.08	-0.22
GG deficit/GDP*	-3.98	-1.71	-0.49	
GG deficit/GDP**	-5.88	-3.61	-2.39	

GG deficit/GDP (change to the baseline in percentage points)	-0.58	-1.51	-1.88	
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\* GG including open pension funds

\*\* GG excluding open pension funds

Source: Own calculations

Therefore under flexible labour market conditions negative effect of fiscal consolidation on employment is alleviated but at lower level of wages. In the last year of the fiscal consolidation programme, as economic recovery strengthens, the downward trend in wages is reversed and they grow by 0.46 percentage points above the baseline. Employment growth resumes as well in 2008 (only 0.05 percentage points below the baseline). The flow between economic activity and inactivity on the labour market is contrary to that in the case of the simulation with rigid wages — the participation rate decreases by a total of 0.22 percentage points against the baseline as compared with the respective increase by 1.83 percentage points. It results mainly from lower wages that reduce the willingness to accept a job. Given higher employment growth (as compared to the simulation with rigid wages) and the reduced participation rate, the unemployment rate for 2008 (the end of the simulation period) is by 0.87 percentage points lower than in the baseline scenario.

Table 6. Results of simulation of fiscal consolidation scenario under the assumption of flexible wages, for the aggregated labour market and the household sector [in percentage points, in relation to the baseline scenario]

	2006	2007	2008	2006-2008	Category	Households	2006	2007	2008	2006-2008
Total employment	-0.3	-0.15	-0.05	-0.5	Disposable income	high income	-0.74	-0.33	0.17	-0.9
Employment (higher ed.)	-0.05	-0.64	-0.35	-1.04		low income	-0.7	-0.96	-0.63	-2.29
Employment (sec. ed.)	-0.39	-0.01	-0.01	-0.41	Consumption	high income	-0.75	-0.49	0.2	-1.04
Employment (primary ed.)	-0.39	0.52	0.22	0.35		low income	-0.84	-1.67	-0.66	-3.17
Wages (total)	-0.85	-0.8	0.46	-1.19	Prices	high income	0.01	0.15	0.15	0.31
Wages (higher ed.)	-1.07	-1.31	0.3	-2.08		low income	0.06	0.53	-0.02	0.57
Wages (sec. ed.)	-0.74	-0.62	0.55	-0.81						
Wages (primary ed.)	-1.28	-0.73	0.22	-1.79						

Source: Own calculations.

Since the changes of the pattern of growth are similar as compared to the simulation with rigid wages, i.e. with the investment being the engine of growth, changes in the structure of employment, broken down by the education level of the labour force (cf. Table 6), is similar as well. Generally, the growth rate of employment of high skilled (educated) workers is lower than in the baseline, whereas the growth in the employment of low skilled (primary education) is up by 0.35 percentage points in 2006-2008, as compared to the baseline solution.

These changes in the labour market composition can also be explained by the nature of the proposed fiscal changes. The consolidation is partially achieved by reducing transfers to households, what mainly affects poor households that largely rely on them. These households constitute a large source of the supply of low-qualified labour. Reduction of transfers to households triggers different reactions of the employment and wages of the labour force with higher education qualifications and with primary education. In the former case, lower employment is accompanied by lower wages, which suggests the dominating effect of reduced demand for labour on this market. On the other hand, labour market for unqualified employees records an increased employment with a lower growth in wages, which shows that the effect of increased labour supply as a response to the reduced government transfers (especially social transfers) prevails.

A decrease in the labour income (in spite of the increased employment, a lower wage growth prevails) combined with the reduced government transfers lead to a lower growth in disposable income and consumption in both groups of households. However, in the case of poor households, the growth in both categories is considerably lower than in the case of higher-income households. The effect is strengthened by the growth in the costs of living (consumer goods basket prices) for poor households. Thus, the redistributive nature of the proposed reform is similar to the results obtained with assumed wage rigidities.

The fiscal consolidation with the assumption of flexible wages has led to the total reduction of the public finance deficit by approx. PLN 22 bn (up by approximately 2 bn as compared to the simulation with wage rigidities assumed). Due to a higher economic growth and larger budget revenues from other sources, the public finance deficit to GDP ratio is reduced to 2.4%. Therefore, fiscal consolidation accompanied by additional institutional changes leading to enhanced flexibility of the labour market causes a reduction of the general government deficit to a level below the assumed one, and facilitates the fulfilment of the budget deficit criterion with a larger margin.

### **3.4 Comparison of the results of simulations conducted under the assumptions of rigid and flexible wages**

The assumption on functioning of the labour market mechanism has turned out to have a strong impact on the results of the proposed fiscal consolidation, both in terms of fiscal target achieved and with respect to the cost of fiscal consolidation as measured by economic growth slowdown.

Under the assumption of rigid wages, the proposed tightening of the public finance sector expenditure leads to a lower GDP growth as compared to the baseline scenario ( for the whole 2006-2008 period). The consequence of this assumption given negative demand shock is that the wages are kept at a level above the fully flexible labour market equilibrium. On the one hand, it leads to a smaller demand for labour reported by companies and eventually to lower rate of growth of employment. On the other hand, relatively higher wages enhance the attractiveness of job search to households, thus increasing the participation rate. As a result, a slump in employment combined with weak total demand in the economy, strengthened by greater flows from the state of occupational inactivity to the labour market, lead to an increase in the number of unemployed and in the unemployment rate.

When the labour market is perfectly flexible, wages adjust downwards to the shock, lessening this way negative employment effects. By the end of the simulation horizon, adverse tendencies at the labour market are reversed as economy clearly rebounds. Lower than in the baseline wage trajectory creates, subject to ceteris paribus condition, disincentive to change inactivity into job search and as a result, participation rates decrease under this scenario. As in the previous scenario, unemployment rate deteriorates although to a lesser extent.

Structural changes on the labour market are similar in both analysed cases, since they stem to a large extent from a similar adjustment of the economic growth composition to the simulated fiscal consolidation. In other words, the employment of high-skilled decreases at a higher rate (as compared with the baseline scenario) than the employment of medium- and low-skilled. The basic difference is that under the assumption of flexible wages, where there is more room for supply and demand adjustments, the changes on the demand side prevail on the market of highly qualified labour (mainly in response to a relative decrease in the share of the services sector), whereas labour supply movements prevail on the market of unqualified labour (mainly in response to reduced social transfers).

Table 7. Planned and actual fiscal adjustment (percentage of GDP)

	2006	2007	2008
Scale of planned adjustment	0.64	1.51	1.76
Scale of tightening under the assumption of rigid wages	0.49	1.34	1.69
Difference	-0.15	-0.17	-0.07
Scale of tightening under the assumption of flexible wages	0.56	1.48	1.87
Difference	-0.08	-0.03	0.11

Source: Own calculations

Different implications of the wage mechanism for the economic growth also result in a different impact of the proposed reform on the effective reduction of the deficit of public finance sector (cf. Table 7). In the variant assuming wage rigidity, a lower GDP growth resulted in — through lower tax revenues — a decrease in the public finance sector deficit by 1.7% of GDP, i.e. by 0.07% GDP less than the scale of planned consolidation. On the other hand, under the assumption of flexible wages, the effective scale of tightening is by 0.11% of GDP higher than planned. In both cases, the achieved consolidation scale is sufficient to meet the public finance sector deficit criterion of the Maastricht Treaty, regardless of the classification of budget expenditure entailed by the pension scheme reform. Since the public finance sector deficit criterion is fulfilled with the safe margin of about 0.5 percentage points. As it is achieved by structural reform, concentrated at cutting government expenditures, in particular affecting incentives to work, we would call it sustainable fulfilment of the Maastricht fiscal criterion.

#### **4. Conclusions**

The above presented results of simulated effects of the fiscal tightening programme indicate that these effects depend largely on the flexibility of the wage mechanism. The total effect for the gross domestic product ranges from – 0.2 percentage points deviation from the baseline path, in the case of perfectly rigid wages, to the positive deviation of 0.3 percentage points, in the case of perfectly flexible wages. Thus, the fiscal tightening programme analysed in this paper does not have necessarily to incur any cost in terms of aggregate GDP lost during 2006 - 2008. On the contrary, it may generate additional growth effects, provided that downward wage adjustments reduce unit labour costs, thus fostering the growth of employment and business activity. It means that for the purpose of minimizing the costs of fiscal tightening, the programme should be complemented with a reform of the labour market that would increase wage flexibility. The latter mechanism is crucial not only for the preparations to the adoption of the euro but also later, during Poland's participation in the euro area, when it becomes a mechanism of adjustment to external shocks in the case of inactive foreign exchange and interest rate policies, and constraints on the fiscal policy.

## References

- Afonso A. (2006), *Expansionary Fiscal Consolidations in Europe. New Evidence*, , “Working Paper”, No. 675, ECB, Frankfurt.
- Alesina A., Perotti R. (1996), *Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects*, “Working Paper”, No. 5730, NBER, Cambridge.
- Bassanini A., Rasmussen J.H., Scarpetta S. (1999), *The Economic Effects of Employment-Conditional Income Support Schemes for The Low-Paid : An Illustration From a CGE Model Applied to Four OECD Countries*, “Working Paper”, No. 224, Economics Department, OECD, Paris.
- Boeters S., Görtzgen N., Schnabel R. (2003), *Reforming Social Welfare in Germany – An Applied General Equilibrium Analysis*, “Discussion Paper”, No. 03-70, Centre for European Economic Research (ZEW), Mannheim.
- Bovenberg A.L., Graafland J.J., de Mooij R.A. (2000), *Tax Reform and the Dutch Labour Market: An Applied General Equilibrium Approach*, “Journal of Public Economics”, Vol. 78, No. 1-2, p. 193-214.
- Burns A., Yoo K.Y. (2002), *Public Expenditure Management in Poland*, OECD Working Paper No. 346.
- Dervis K., de Melo J, Robinson S. (1982), *General equilibrium models for development policy*, Cambridge University Press, New York:
- Dewatripont M., Michel G. (1987), *On Closure Rules, Homogeneity and dynamics in Applied General Equilibrium Models*, “Journal of Development Economics”, Vol. 26, p. 65–76.
- Dixon P.B., Rimmer M. T. (2002), *Dynamic, General Equilibrium Modelling for Forecasting and Policy: a Practical Guide and Documentation of MONASH*, North-Holland, Amsterdam
- Eurostat (2004), *Eurostat decision on deficit and debt. Classification of funded pension schemes in case of government responsibility or guarantee*.
- Garibaldi P., Mauro P. (2002), *Anatomy of Employment Growth*, “Economic Policy”, vol. 17, No. 34, p. 67-113.
- Giavazzi F., Japelli T., Pagazzi M. (2000), *Searching for Non-linear Effects of Fiscal Policy: Evidence From Industrial and Developing Countries*, “Working Paper”, No. 7460, NBER, Cambridge.

- Giavazzi F., Pagano M. (1996), *Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience*, "Swedish Economic Policy Review", vol. 3, No. 1, p. 67-103.
- Gradzewicz M., Griffin P., Zólkiewski Z. (2006), *An Empirical Recursive-Dynamic General Equilibrium Model of Poland's Economy. Including Simulations of the Labor Market Effects of Key Structural Fiscal Policy Reforms*, Document of the World Bank and National Bank of Poland, Warsaw.
- Hertel T.W. (1999), *Global Trade Analysis: Modelling and Applications*, Cambridge University Press, Cambridge (UK).
- IMF (2006), *Assessing the flexibility of the Polish economy*, mimeo, Washington.
- Knudsen M.B., Pedersen L.H., Petersen T.W., Stephensen P., Trier P. (1998), *Modelling structural reform: A dynamic CGE analysis of the Danish Tax Reform Act of 1993*, in: P. van Bergeijk, B. Vollaard and J. van Sinderen (red.), *Structural reform in open economies*, Edward Elgar, Cheltenham (UK), Northampton (USA).
- Lane P., Perotti R. (2001), *The Importance of Composition of Fiscal Policy: Evidence from Different Exchange Rate Regimes*, "CEG Working Papers", No. 200111, Trinity College Dublin, Department of Economics.
- Lofgren H., Harris R.L., Robinson S. (2002), *A standard computable general equilibrium (CGE) model in GAMS*, International Food Policy Research Institute, <http://www.ifpri.org/pubs/microcom/micro5.htm>
- Rada Ministrów RP (2003), *Program uporządkowania i ograniczenia wydatków publicznych (2003)*, Warszawa.
- Pyatt G., Round, J. (eds.), (1985), *Social Accounting Matrices: A Basis for Planning*, The World Bank, Washington, D.C.
- GUS (2005), *Rachunki narodowe według sektorów i podsektorów instytucjonalnych 2000 – 2003*, Warszawa.
- NBP (2004), *Costs and benefits of Poland's adoption of the Euro*, (2004), Warsaw.
- Roberts B.M., Round J.I., Zólkiewski Z. (1998), *Structural Features of Economic Reform in Poland*, "Review of Development Economics", Vol. 2, No. 2, p. 211-230.



- Robinson S. (2003), *Macro Models and Multipliers: Leontief, Stone, Keynes, and CGE Models*, International Food Policy Research Institute, [http://www.ifpri.org/events/seminars/2003/20031014/robinson\\_thorbecke\\_EPIAM.pdf](http://www.ifpri.org/events/seminars/2003/20031014/robinson_thorbecke_EPIAM.pdf)
- Rzońca A., Ciżkowicz P. (2005), *Non-Keynesian Effects of Fiscal Contraction in New Member States*, “Working Paper”, No. 519, ECB, Frankfurt.
- Scarpetta, S. (1998), *Labour Market Reforms and Unemployment: Lessons from the Experience of the OECD Countries*, “Working Paper”, No. 382, Inter-American Development Bank, Washington, D.C.
- Commission of the European Communities (2005), *The EU Economy: 2005 Review*, Brussels.
- Thorbecke E. (2000), *The use of Social Accounting Matrices in Modelling*, “Conference Paper”, 6th General Conference of The International Association for Research in Income and Wealth, 27 August -2 September 2000, Cracow.
- von Hagen J., Hughes H.A., Strauch R. (2001), *Budgetary Consolidation in EMU*, “European Economy - Economic Papers”, No. 148, European Commission, Brussels.
- World Bank (2003), *Poland — Toward a fiscal framework for growth — a public expenditure and institutional review*, “Economic report”, Washington, D.C.

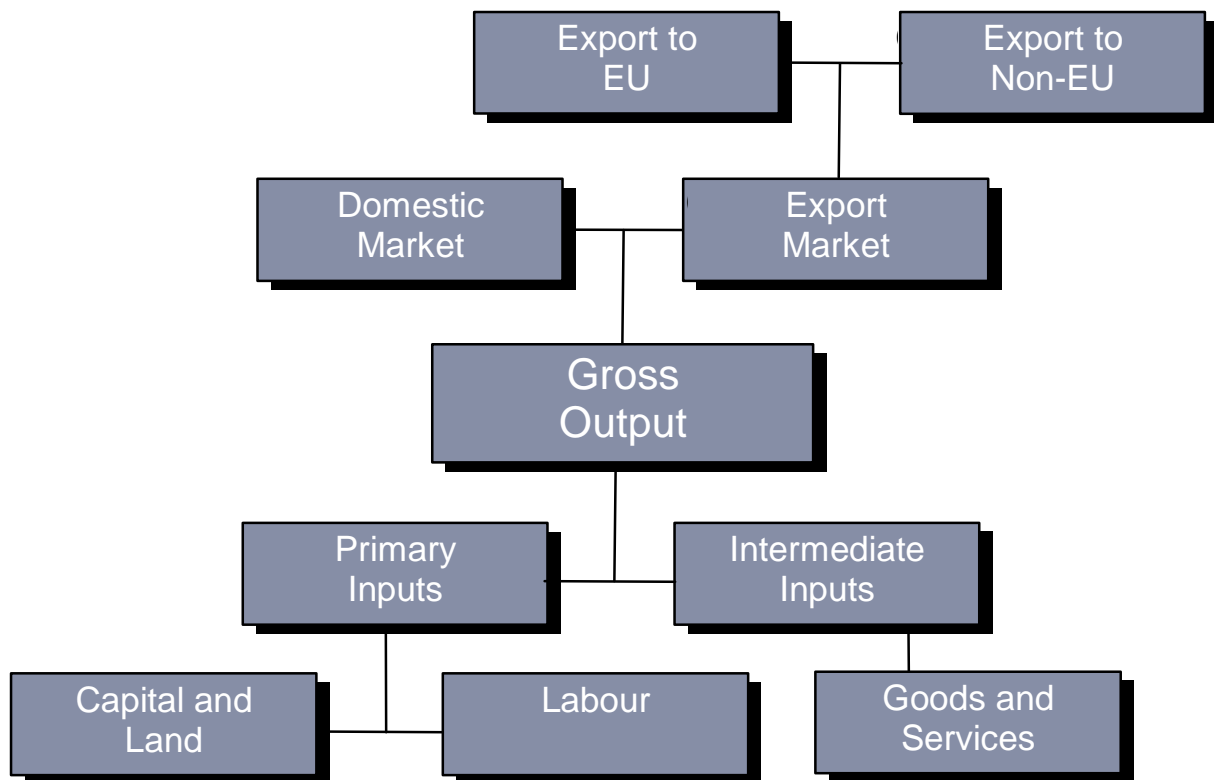
## **Annex. Brief description of the CGE model**

This annex delivers a brief description of the CGE model, that was used to perform the simulations presented in this paper. The details of the model can be found in Gradzewicz, Griffin, Żółkiewski (2006).

The model describes the allocations and flows of funds in the economy populated by optimising economic agents, subject to their budget constraints. The model assures that the resulting optimal behaviour of the individual agents is harmonized at economy-wide level by equilibrium conditions on all markets. Therefore, all the quantities and prices are the result of competitive allocation that supports the general equilibrium in the economy.

The structure of the model is quite detailed – there are 39 types of producers (and goods that are traded), that use a bundle of intermediate products and a bundle of primary inputs to transform them into the tradable product (see picture A.1), subject to the CES technology. Primary inputs consists of capital good and 3 types of labour (with basic, medium and higher education), supplied by the households. The demands for factors of production is a result of cost minimization by producers. The produced goods are sold by enterprises either to domestic or to foreign markets (EU or non-EU) in a way that maximise producers' profits subject to demand constraints and relative prices that are given to an individual producer.

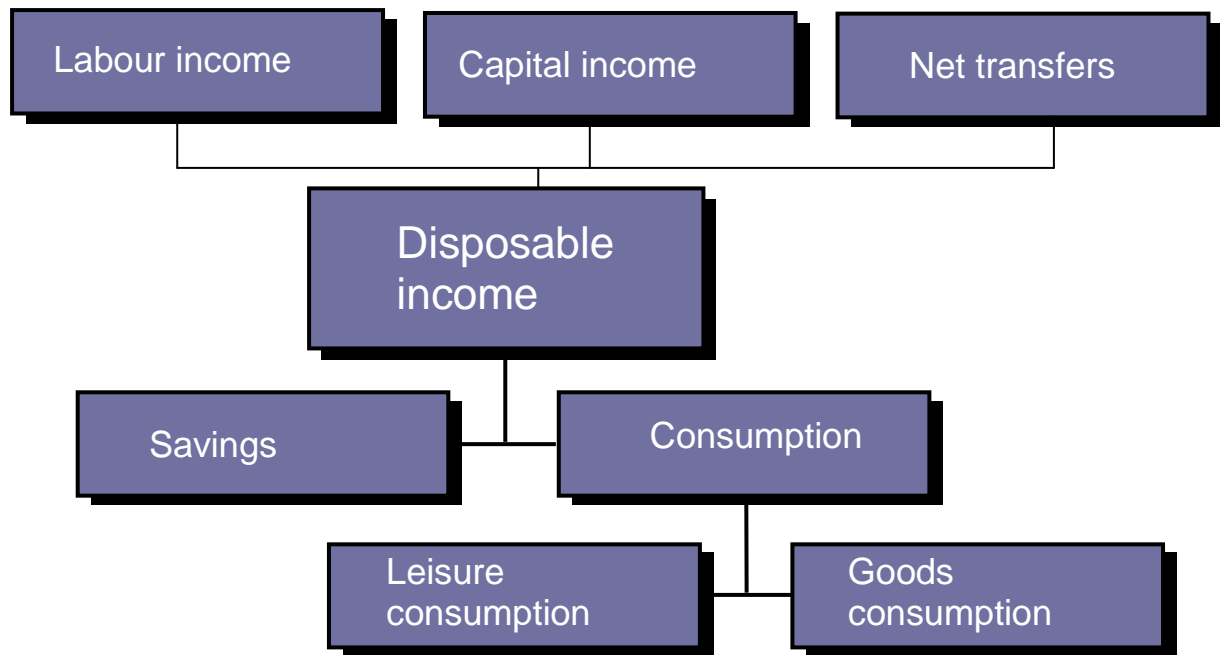
Picture A.1. Production activity scheme



Source: Gradzewicz, Griffin, Żółkiewski, 2006

There are 10 types of households in the model, divided by socio-economic features (employees, self-employed, farmers, employers and other) and their income (poor and non-poor). Households pool their income from renting labour and capital to the producers and net transfers with other entities in the economy (e.g. social transfers from the government) and spend it on consumption of goods and leisure. The rest of the disposable income is saved. As the model does not describe the allocation of consumption in time, the households' propensity to consume (and save) is constant. The inclusion of leisure in the utility function assures that the households' labour supply is endogenous and is affected by the stance of the economy and by the government interventions (labour tax and social transfer changes).

Picture A.2. Households' decision scheme



Source: Gradzewicz, Griffin, Żółkiewski, 2006

Investments in the model are determined by the available savings and the price of investment good. Total savings constitutes of pooled savings of households, government, firms and banks and the rest of the world.

The households' demand for goods, combined with the general government's demand (public consumption), the investment and intermediate demand is satisfied either by domestic or by foreign producers (imports), in proportions that depend on the relative prices of domestic goods and imports (so called. Armington specification).

The government (the general government sector) collects taxes from producers, taxes on goods (VAT, excise, import tariffs), corporate income taxes from companies and banks, personal income taxes from household and social security contributions (treated as a tax wedge on wages). The government expenditures include government consumption, subsidies and transfers to other sectors of the economy (including social transfers to the households that are treated as a disincentive to work in the model).

Model solves in terms of relative prices, i.e. they are defined against some reference price (numéraire). General price level (GDP deflator) was used as numéraire.