

# A World Link CGE Model Applied to the Economic Reform in the Slovak Republic and EU Enlargement

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## Abstract

The objective of this paper is to analyze the consequences of Slovak Republic's EU integration by identifying the positive and negative impacts of this process. Specifically, the research is aimed to directly evaluate the impacts of EU accession based on a World Link Standard Computable General Equilibrium Model, in the short-, medium-, and long-term, and to confirm (or reject) a general opinion that integration should bring positive effects to the economy. Common EU market with free movement of commodities, labor and capital, structural reforms of Slovak Republic consequential to EU integration, and FDI flows, are the main policies under consideration. By developing a link CGE model applicable to the conditions and structure of not only the Slovak economy but of EU and the world, this paper identifies problems and based on the outcomes tries to make suggestions for policy measures. The research presented in this paper is new in several aspects. Source of data for each region is GTAP 6 database, with Slovak data supplemented by 2000 Social Accounting Matrix, Input-output and other data. Strong feature of the model is that it extends the concept of single-country CGE model into a world model, with each region having its own economy, and interconnected by international linkages. The model solves for equilibrium in each individual region and for the whole world at the same time. The world in the model is divided into several regions (countries), where the regional models are based on an individual Standard CGE model used by the World Bank. Every region is linked together and international flows are provided via channels of trade, labor, capital, labor remittances, and returns from capital. The link CGE model in this research has been designed to allow sectoral, regional (country), or international impact analyses. The model allows to carry out static and dynamic simulations; range for dynamic simulations is a period of 10 years with year 2001 as benchmark. Model functions are either of CES or CET type.

**Keywords:** Computable General Equilibrium, CGE, World Link Model, Slovak Republic, European Union, EU, EU Enlargement, Slovak Economic Reform, System of National Accounts, Social Accounting Matrix, SAM, Input-output.

## 1. Introduction

Slovak Republic has successfully joined the European Union (EU) on May 1st, 2004, creating a

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unique chance to overcome its social and economic lag with developed countries. The integration itself is a multidimensional process including complex political, economic, and social factors, and invites a wide participation of the society, beginning with the government and its integration activities, social institutions, organizations, employee and employer associations, private businesses, down to individuals. This process is in its early stage and gives therefore only a potential chance for development. It has, however, no comparable alternative in the age of world globalization.

Experience of foreign countries shows that in order to participate efficiently in building a new, enlarged EU, the Slovak Republic urgently needs to create a mechanism allowing to systematically process and analyze policy impacts, programs, plans, and concepts. Unfortunately, such system is at the moment very disperse or often completely absent.

The objective of this paper is to analyze the consequences of Slovak Republic's EU integration by identifying the positive and negative impacts of this process. Specifically, the research is aimed to directly evaluate the impacts of EU accession based on a World Link Standard Computable General Equilibrium Model, in the short-, medium-, and long-term, and to confirm (or reject) a general opinion that integration should bring positive effects to the economy. Several works have been published about Slovak Republic's integration process and its economic impacts. However, most of the single-country analyses are based on qualitative methods, and there is a lack of quantitative analysis. Other works accomplished mainly by foreign institutions utilizing quantitative and/or CGE approach, do not consider the Slovak Republic as a separate region, but as part of a greater integration (e. g. the Central European region), or neglect it completely because of data shortage. By developing a link CGE model applicable to the conditions and structure of not only the Slovak economy but of EU and the world, this paper identifies problems and based on the outcomes it tries to make suggestions for policy measures.

The research presented in this paper is new in several aspects. Source of data for each region is GTAP 6 database, with Slovak data supplemented by 2000 Social Accounting Matrix, Input-output and other data. The model is not a single-country model, but is solved for the entire world. The world in the model is divided into several regions (countries), where the regional models are based on an individual Standard CGE model used by the World Bank. Every region is linked together and international flows are provided via channels of trade, labor, capital, labor remittances, and capital payments. The link CGE model in this research has been designed to allow sectoral, regional (country), or international impact analyses. The model allows to carry out static and dynamic simulations; range for dynamic simulations is a period of 10 years with year 2001 as benchmark. Model functions are CES (Constant Elasticity of Substitution), or CET (Constant Elasticity of Transformation) type.

Strong feature of the model is that it extends the concept of single-country CGE model into a world model, with each region having its own economy, and interconnected by international linkages.

The model solves for equilibrium in each individual region and for the whole world at the same time.

In order to evaluate the impacts of Slovak Republic's EU integration<sup>1</sup>, the following policy simulations are carried out:

1. Access to common market for goods and services - free movement of commodities between EU regions;
2. Access to common labor market - free movement of labor between EU regions, counter flows in form of remittances;
3. Access to common capital market - free movement of capital between EU regions, and counter flows in form of dividends (or returns from capital);
4. Structural reforms in the Slovak Republic - tax reform (introduction of a flat value added tax (VAT) and its increase/reduction, reduction of corporate income tax), foreign capital inflow, structural reform of the labor market and reduction of unemployment, etc.

## 2. Model description

The link CGE model of presented in this research is constructed for the benchmark year 2001. The world economy is divided between 10 regions/countries<sup>2</sup>, which are linked together through trade relations, labor and capital movement, and labor remittances from abroad and flows of dividends (returns from capital). Country models of each separate region consist of 10 industrial sectors<sup>3</sup>, 10 homogenous composite goods<sup>4</sup>, 3 production factors<sup>5</sup>, 3 institutions<sup>6</sup>, a capital account<sup>7</sup>, 3 tax accounts<sup>8</sup>, and a rest of the world account. Depending on availability of data, it is possible to further disaggregate households (e.g. into urban and rural) for income distribution analysis, to disaggregate production factors (into more types of labor and to introduce land), and to implement a range of various taxes (value added taxes, excise taxes, taxes on factors, import and export taxes, consumption taxes, etc.).

The data is based on Social Accounting Matrices (SAMs) for each individual region, constructed mainly from GTAP 6 database. The SAM of the Slovak Republic is based on Koronczí (2005a). The SAM in its detailed structure is in Koronczí, and Ezaki (2005), and is similar for all 10 model regions. The database is supplemented by additional data, such as labor and capital stock, various substitution and transformation elasticities, population data, unemployment data, data on economically active labor, direct taxes, depreciation, etc.

The model is quite extensive, consisting of 6 993 equations<sup>9</sup> and endogenous variables, about the same number of parameters, and tens of thousands output variables. Here, we mainly refer only to results of only one region - the Slovak Republic, although simulations give a complex solution for each region separately.

The theoretical side of the model is based on the open economy model of Dervis, de Melo, and

Robinson (1982) further enhanced by Robinson, Yúnez-Naude, Hijonosa-Ojeda, Lewis, and Devarajan (1999). For the technical structure and solution of the model we closely follow the work of Löfgren, Harris, and Robinson (2001), and Koronczí (2005b). Major differences from these models are the heterogeneous labor market definition (in disequilibrium), specification of the numéraire (DPI), specification of the Walras' law (by S-I balance), and enhancement of the static model into a dynamic one (factor growth, factor movement across regions, money flows across regions - remittances, dividends from invested capital), and the world-linkage part of individual regional models together.

Extended by several specific features, the country-based CGE model is based on a Standard CGE model used by the World Bank. The model developed in this research has been designed to analyze the whole economy with any sector. The model is designed to allow to carry out static and dynamic simulations at the same time, and to do simulations with detailed disaggregated data without the need of simplifying production and other functions. Static version of the model explains direct impacts of an economic policy (or shock), regardless of time element. The dynamic version is designed to follow the economic development induced by a shock within a certain range of time, in this case period of 10 years with 2001 as the benchmark year. Industrial structure is dependent mostly on availability of data and here is disaggregated into 10 homogenous sectors. The various kinds of functions implemented are either of CES, or CET type. Specifically, the model applies a CES production function of quantities between value-added and aggregate intermediate input. Alternatively, the production function can be defined in a Cobb-Douglas form; however this alternative is not implemented. Value added is defined by another CES function of quantities between production factors, i.e. labor and capital. Output aggregation is defined by CES function between activity-specific marketed production of a given commodity. The aggregate output is then transformed by CET function between exports and domestic sales. There is another CES function for aggregation of domestic production sold at domestic market and imports, also called as Armington function.

A strong feature of the model implemented in this research is the linkage of individual country-based model into a world model. Specific stress is put to relations within the three EU regions, i.e. the Slovak Republic, rest of countries accessing in 2004, and the former EU member countries. The CGE model of each individual region with economy in equilibrium is linked to the world, which is in equilibrium, too. Country models are linked through bilateral trade flows. The model allows for import (and also exports, if not zero, payments of which are bared by the importer side) tariff differentiation by country of origin, import price varies depending on source of import. Particularly, the import price at the domestic market is equal to the export price of the country of origin time the corresponding tariff rate. Domestic consumers and producers differentiate imports by sources, i.e. imports from various countries are treated as imperfect substitutes, and is modeled by Armington function. At the aggregate level, total import is a CES function of imports from different sources,



demand for which is derived from the cost minimization condition. On the export side, exporters do not differentiate exports by destination, i.e. commodities supplied to foreign (destination) countries are perfectly homogenous and are sold at a same price. For consistency in trade, total exports supplied by source countries are made equal to the sum of imports by destination countries, i.e. imports from a country sum up to total exports by that country.

The dynamic part of the model assumes intertemporal labor growth (increments defined by an explicit growth rate), and capital growth (increments defined by investment quantities). The model has been designed to allow for labor and capital movement between EU regions<sup>10</sup>, i.e. labor and capital are mobile internationally, depending on factor wage distortion between regions. However, assumption of perfect mobility especially in case of labor is not very reasonable, due to geographical and legislative barriers within EU; therefore elasticity of adjustment has been introduced. Besides movement, labor mobility between regions has been designed to affect also unemployment because of the labor market that is in disequilibrium. Unemployment of a country with labor outflows will decrease by the amount of labor (supply) that has left the region. However, in order not to allow the labor market to clear perfectly due to the only factor of labor movement, unemployment is affected only to a certain level (natural unemployment rate), and not below it<sup>11</sup>. Another strong feature of the model is disaggregating the foreign savings account. The exogenously fixed part of foreign savings is extended by introduction of labor remittances from/to abroad as payments of labor that has internationally relocated, and dividends (or interest from invested capital) as counter-flows to capital movement. Thus, there are 5 channels that transmit effects of economic policy and demographic changes of one country to other regions, i.e. trade flows, labor movement, capital movement, labor remittances, and flows of dividend payments.

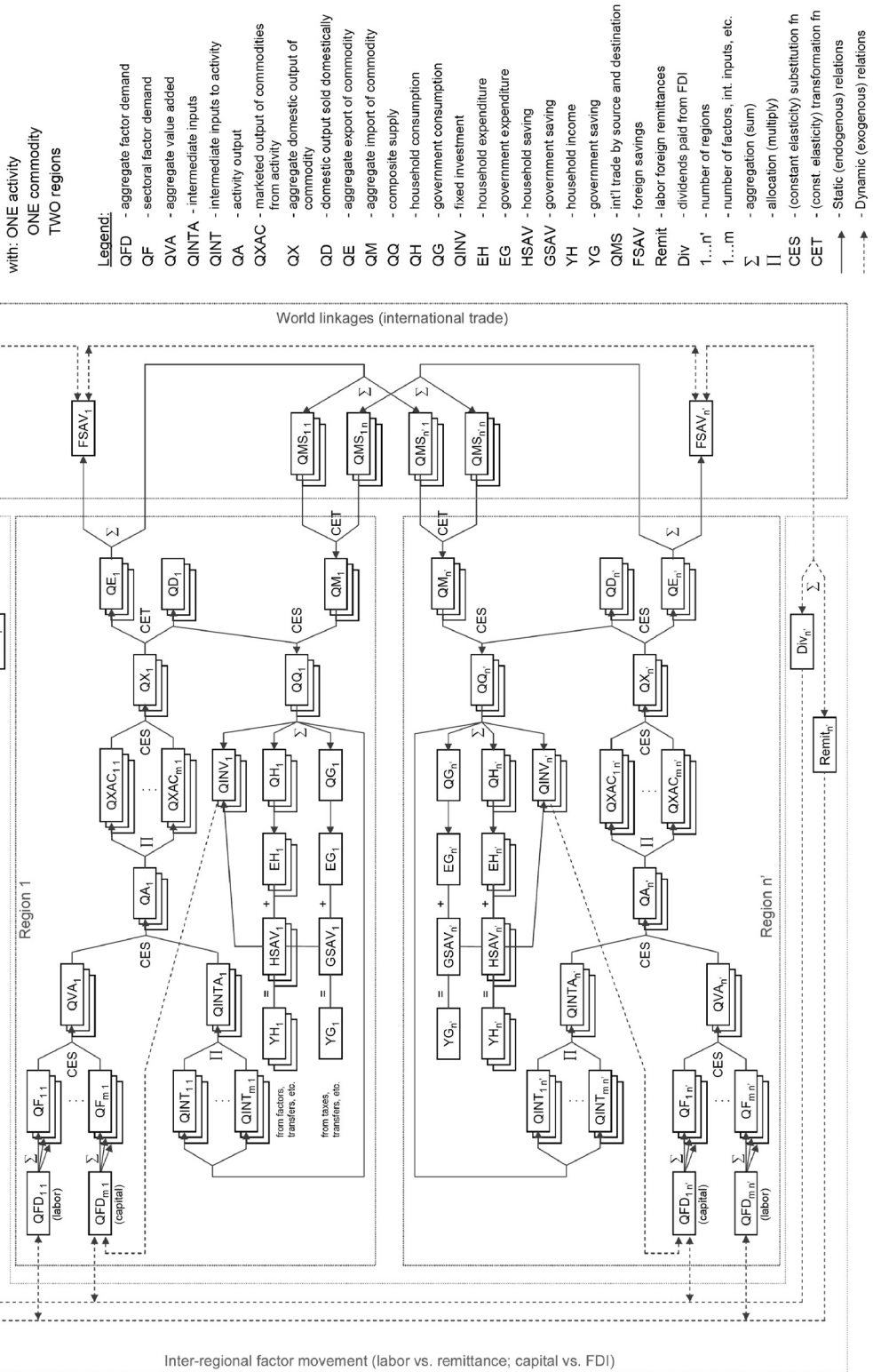
Model flows and relations between individual subjects are in Figure 1. Details about the model, equation description, behavioral functions, linkages, system constraints and model closures are in Koronczai, and Ezaki (2005).

### 3. Simulations and results

Besides the baseline, 16 policy simulations have been carried out. Their brief description is in Table 1. The simulations may be divided into the following groups: 1) baseline simulation (Sim 0); 2) simulations related to the process of EU enlargement (Sim 1 through Sim 4); 3) simulations related to economic reforms in the Slovak Republic (Sim 5 through Sim 9); and 4) combination of previous simulations (Sim 10 through Sim 16).

The simulations were carried out for 10 years, starting with 2001 as benchmark. Long-term results for EU regions are in Table 2, and for the Slovak Republic in Table 3. The detailed simulation results for the Slovak Republic in the short-, medium-, and long-term are in Koronczai, and Ezaki

Figure 1:  
Link CGE model flows



**Table 1 Simulation scenarios**

Simulation	Content
Base-run simulation:	
Sim 00 (BASE)	base simulation (baseline scenario)
EU-enlargement related simulations:	
Sim 01 (TARCUTSR)	100 % SR's cut of EU tariffs
Sim 02 (TARCUTEU)	100 % EU's cut of EU tariffs (unified commodity market)
Sim 03 (REMEU)	EU labor market liberalization + allowing labor foreign remittances in EU
Sim 04 (FREECAP)	EU capital market liberalization (unified capital market with free movement)
SR-reform related simulations:	
Sim 05 (FLSTAX100)	introducing a flat indirect tax rate in SR
Sim 06 (FLSTAX050)	FLSTAX100 + 50 % decrease in tax rate
Sim 07 (FLSTAX150)	FLSTAX100 + 50 % increase in tax rate
Sim 08 (YTAXCONEW)	60% cut of SR's Corporate income tax to about 19 % from 48 %
Sim 09 (UNEMPDN)	5 % gradual decrease of SR's unemployment each year
Combined simulations:	
Sim 10 (COMBINE1)	EU enlargement: TARCUTEU+REMEU+FREECAP
Sim 11 (COMBINE2)	SVK reforms: FLSTAX100+YTAXCONEW
Sim 12 (COMBINE3)	SVK reforms: FLSTAX050+YTAXCONEW
Sim 13 (COMBINE4)	SVK reforms: FLSTAX150+YTAXCONEW
Sim 14 (COMBINE5)	EU enlargement + SVK reforms: COMBINE1+COMBINE2
Sim 15 (COMBINE6)	EU enlargement + SVK reforms: COMBINE1+COMBINE3
Sim 16 (COMBINE7)	EU enlargement + SVK reforms: COMBINE1+COMBINE4

Source: Author

(2005). Short-term in this case means that the simulations measure the impacts of only static shocks, i.e. results for the benchmark year 2001. Medium-term combines the effect of the static shock with a short-term dynamic impact, i.e. results for the second year 2002. Long-term results show impacts of the static shock and of an afterward dynamic development for 10 years, i.e. results for 2010, the last year of the period under evaluation.

Sim 0 - BASE is the baseline simulation, and serves as base for comparison with other simulations. This simulation is calibrated to give the initial (input) values in the benchmark year. The assumption for the following years is that the economy will develop according to this scenario, if no policy measures are taken or no shocks occur.

### 3.1 Simulations directly related to EU enlargement

Under Sim 1 - TARCUTSR, a static initial shock abolishing all tariffs of the Slovak Republic in relation to EU countries is applied. The simulation has been carried out to show the pure effect of Slovak Republic's entry to the unified EU commodity market. Impacts especially at the macroeconomic level are not very extensive, due to the fact that SR has been preparing and adjusting the structure of its economy especially in trade for EU accession long before the actual entry. Real GDP growth is visible already in the short-term, and slowly increasing in the long-term. Because of the lost income from import tariffs, the impacts are negative to government consumption. Positive impact to the trade balance can be observed, which in absolute terms, however, still remains negative

Table 2 Long-term(2010) impacts in EU regions, %-age changes

Region	SVK	EU09	EU15	SVK	EU09	EU15	SVK	EU09	EU15
Indicator \ Simulation	BENCHmark (2001) values (Bill.USD)			Simulation 5.FLSTAX100			Simulation 11.COMBINE2		
Real private cons	11.23	217.07	4651.22	4.103	0.053	0.002	8.114	0.064	0.003
Real gov't cons	4.19	56.50	1623.63	-14.280	0.030	0.000	-25.961	0.036	0.000
Real fixed inv	6.41	83.06	1612.33	7.942	0.036	0.005	12.465	0.043	0.006
Real export	14.47	157.76	2578.86	12.184	0.053	-0.003	14.585	0.068	-0.002
Real import	-16.25	-171.99	-2566.75	9.177	0.123	0.002	10.965	0.151	0.005
Exchange rate	1.00	1.00	1.00	-1.565	-0.009	0.002	-1.094	-0.013	0.002
Real GDP (market price)	20.05	342.40	7899.28	3.441	0.012	0.000	4.934	0.014	0.000
Real GDP/Pop (GDRPrCAP)	3709.18	4923.40	20855.70	3.441	0.012	0.000	4.934	0.014	0.000
Real GDP/LAB (GDRPrLAB)	7727.45	9324.63	35468.87	3.441	0.012	0.000	4.934	0.014	0.000
Income EV (EVTOT)	-	-	-	3.842	0.053	0.002	7.849	0.064	0.003
Indicator \ Simulation	Simulation 0.BASE			Simulation 6.FLSTAX050			Simulation 12.COMBINE3		
Real private cons	40.942	33.363	29.749	6.089	0.063	0.003	10.176	0.074	0.003
Real gov't cons	43.830	61.743	43.376	-20.515	0.036	0.000	-32.479	0.042	0.000
Real fixed inv	38.430	6.805	15.755	9.999	0.042	0.005	14.603	0.049	0.006
Real export	46.021	30.489	26.311	14.430	0.064	-0.003	16.893	0.079	-0.001
Real import	37.748	27.329	26.933	10.846	0.146	0.004	12.673	0.175	0.006
Exchange rate	1.062	-1.864	-2.305	-1.394	-0.012	0.002	-0.919	-0.016	0.002
Real GDP (market price)	46.996	33.310	29.486	4.196	0.014	0.000	5.711	0.016	0.001
Real GDP/Pop (GDRPrCAP)	22.999	11.548	8.348	4.196	0.014	0.000	5.711	0.016	0.001
Real GDP/LAB (GDRPrLAB)	18.176	9.119	8.305	4.196	0.014	0.000	5.711	0.016	0.001
Income EV (EVTOT)	41.762	33.548	29.697	5.818	0.063	0.003	9.900	0.074	0.003
Indicator \ Simulation	Simulation 1.TARCUTSR			Simulation 7.FLSTAX150			Simulation 13.COMBINE4		
Real private cons	2.229	-0.003	0.003	2.143	0.044	0.002	6.081	0.055	0.002
Real gov't cons	-7.447	-0.005	0.003	-8.209	0.025	-0.001	-19.614	0.031	0.000
Real fixed inv	2.857	0.000	0.004	5.913	0.030	0.004	10.356	0.037	0.005
Real export	4.179	-0.014	0.003	9.974	0.042	-0.003	12.315	0.056	-0.002
Real import	3.170	-0.017	0.010	7.530	0.101	0.001	9.280	0.128	0.003
Exchange rate	1.526	0.019	-0.005	-1.735	-0.006	0.002	-1.268	-0.010	0.002
Real GDP (market price)	1.124	-0.001	0.001	2.685	0.010	0.000	4.156	0.012	0.000
Real GDP/Pop (GDRPrCAP)	1.124	-0.001	0.001	2.685	0.010	0.000	4.156	0.012	0.000
Real GDP/LAB (GDRPrLAB)	1.124	-0.001	0.001	2.685	0.010	0.000	4.156	0.012	0.000
Income EV (EVTOT)	2.232	-0.003	0.003	1.894	0.044	0.002	5.827	0.055	0.002
Indicator \ Simulation	Simulation 2.TARCUTEU			Simulation 8.YTAXCNEW			Simulation 14.COMBINE5		
Real private cons	3.007	1.646	0.029	3.785	0.009	0.000	13.512	1.553	0.228
Real gov't cons	-7.058	-4.331	-0.027	-10.790	0.005	0.000	-32.143	-3.813	0.189
Real fixed inv	3.823	0.556	0.023	4.101	0.005	0.001	31.751	15.882	-0.619
Real export	4.925	3.051	0.036	2.034	0.013	0.001	20.425	0.569	0.388
Real import	4.453	2.785	0.067	1.550	0.024	0.002	21.047	7.056	-0.060
Exchange rate	0.852	1.120	-0.028	0.470	-0.004	0.000	-1.045	-0.420	0.061
Real GDP (market price)	1.472	0.325	0.006	1.344	0.002	0.000	8.908	0.180	0.207
Real GDP/Pop (GDRPrCAP)	1.472	0.325	0.006	1.344	0.002	0.000	25.258	14.178	-2.177
Real GDP/LAB (GDRPrLAB)	1.472	0.325	0.006	1.344	0.002	0.000	10.560	4.767	-0.320
Income EV (EVTOT)	3.011	1.641	0.029	3.783	0.009	0.000	13.172	1.548	0.228
Indicator \ Simulation	Simulation 3.REMEU			Simulation 9.UNEMPDN			Simulation 15.COMBINE6		
Real private cons	1.469	-0.439	0.209	3.580	0.015	0.001	11.582	1.552	0.227
Real gov't cons	2.178	0.128	0.237	3.685	0.008	0.001	-26.362	-3.814	0.188
Real fixed inv	14.015	15.009	-0.640	3.395	0.009	0.001	29.378	15.885	-0.619
Real export	-0.668	-2.800	0.364	4.036	0.018	0.001	20.485	0.566	0.387
Real import	4.454	3.919	-0.126	3.048	0.037	0.003	21.075	7.053	-0.062
Exchange rate	-1.043	-1.613	0.093	0.546	-0.006	0.000	-1.306	-0.420	0.061
Real GDP (market price)	1.594	-0.479	0.217	4.277	0.003	0.000	8.359	0.179	0.207
Real GDP/Pop (GDRPrCAP)	17.155	13.495	-2.180	4.277	0.003	0.000	24.579	14.178	-2.177
Real GDP/LAB (GDRPrLAB)	3.160	4.141	-0.312	-4.372	0.003	0.000	9.998	4.767	-0.321
Income EV (EVTOT)	1.469	-0.439	0.209	3.578	0.015	0.001	11.234	1.547	0.227
Indicator \ Simulation	Simulation 4.FREECAP			Simulation 10.COMBINE1			Simulation 16.COMBINE7		
Real private cons	0.282	0.227	-0.011	4.930	1.483	0.226	11.283	1.542	0.227
Real gov't cons	0.319	0.372	-0.016	-4.803	-3.854	0.192	-25.362	-3.820	0.190
Real fixed inv	0.272	0.061	-0.005	18.507	15.820	-0.624	29.366	15.871	-0.619
Real export	0.298	0.204	-0.009	4.781	0.499	0.390	17.875	0.558	0.388
Real import	0.237	0.159	-0.006	9.313	6.895	-0.065	19.166	7.030	-0.062
Exchange rate	0.062	0.036	-0.002	-0.026	-0.409	0.059	-1.264	-0.417	0.061
Real GDP (market price)	0.332	0.246	-0.012	3.595	0.160	0.208	7.978	0.177	0.208
Real GDP/Pop (GDRPrCAP)	0.332	0.246	-0.012	19.346	14.158	-2.179	24.249	14.175	-2.177
Real GDP/LAB (GDRPrLAB)	0.332	0.246	-0.012	5.182	4.749	-0.320	9.621	4.765	-0.320
Income EV (EVTOT)	0.282	0.227	-0.011	4.934	1.478	0.226	10.955	1.537	0.227

Source: Authors' calculations

Notes:

1. BASEline (2001) values are in USD billions
2. BASEline simulation results are %-age changes from the BENCHmark year (2001) of the same simulation
3. Simulation results show %-age changes from the same year (2010) of the BASELINE scenario
4. Equivalent variation (EVTOT) comparisons are made with household income (EH)
5. Region notations are as follows: SVK - Slovak Republic; EU09 - Rest of new EU members (joining in 2004); EU15 - Old EU members (before 2004)
6. Results for Russia, Rest of Europe, Japan, China, Rest of Asia, United States, Rest of the World are not listed in this table

in the long-term. Real depreciation of the exchange rate occurs.

Sim 2 - TARCUTEU with a static shock similar to Sim 1, however all EU countries at the unified commodity market abolish their import tariffs with each other. This simulation is aimed to investigate the impact of introducing a common market for goods and services within the EU. Results, slightly different in size, have similar impacts to the Slovak economy as Sim 1. An exception is the negative impact to trade balance in short- and medium-term, size of which is, however, not so significant. Real depreciation is milder than under Sim 1.

Sim 3 - REMEU is a dynamic simulation aimed to investigate impacts of introducing a common labor market with free movement of labor between regions, including labor remittances. Remittances are payments from workers that left their home country to work in a high income region, and send part of their wage each year back to their home country. They are financial counter-flows to physical movement of labor. In an extent limited by geographic, social, economic and other conditions, labor force is free to move between regions with different wage levels. Due to the dynamic nature of the simulation (alike each following), results in the short-term show no distortion from the benchmark. However from the medium- and long-term results it is straightforward that heading for high wage regions, labor force slowly flows out of the Slovak Republic. And due to the model definition, there is positive impact on unemployment because vacancies after the labor leaving the home economy are filled from these “labor force reserves”. The model however allows this substitution only to a certain level, i.e. up to the level of natural unemployment, and never clears the labor market perfectly. The effects for the Slovak Republic in sectors are negative to production in the medium-term, but positive in the long-term, when almost all sectors show increase in production. Trade balance development is negative. There is however a significantly positive effect due to the accumulation of labor force continuously remitting over years through the increasing investment. There is also a slight increase in government consumption.

Sim 4 - FREECAP is a dynamic simulation, in a nature similar to Sim 3. The difference is in definition of counter-flows to movement of physical capital, i.e. dividends, which are assumed to stay in the country and re-invested. Capital, including FDI, is freely moving from regions with low rates of return to high return regions. And since it is reasonable to assume that barriers for free movement of capital are significantly smaller than for labor, degree of freedom is set double of that of labor. As a result, capital is crowding into the Slovak economy due to higher interest rates than the rest of EU. The speed of capital inflow however decreases in time. Simultaneously, capital rates of return between EU regions converge significantly. A divergence in foreign savings compared to Sim 3 is especially in the long-term, where while labor keeps remitting over the years (accumulation), dividend flows do not accumulate. The largest positive impact is therefore in the medium-term, while for labor movement in the long-term.

### 3.2 Simulations related to Slovak economic reforms

Sim 5 - FLSTAX100, Sim 6 - FLSTAX 050, and Sim 7 - FLSTAX 150 are simulations with a static shock, aimed to investigate the implementation of flat indirect tax rates<sup>12</sup> by the Slovak government. In Sim 5, only the effect of introducing a flat indirect tax (including subsidies) at the level of current average rate is investigated. In Sim 6, this flat rate is furthermore decreased by 50.0%, and in Sim 7 it is increased by 50.0%.

Government consumption decreases in Sim 5, and a decrease of the flat tax rate in Sim 6 causes its further drop. And even though an eventual increase of the flat tax rate in Sim 7 improves government consumption, its change still remains negative. Increase of real GDP growth, significant increase of nominal GDP growth especially due to CPI increase, real appreciation of the exchange rate occurs. The higher the increase of the tax level the higher this appreciation becomes. And in spite of strong support from economic theory and also from several international institutions including the World Bank and IMF to continue with this policy practically in the long-term will, however, require an extremely strong will of most economic segments, which is under present social and political conditions quite questionable. Large pressure on “weak” sectors and also on households, consumption of whose fall rapidly supports the hesitation about its sustainability even more. Identification of weak sectors from Table 3, by looking at activities with increasing and with decreasing production due to the flat tax introduced, propose further economic restructuring especially in agriculture, food processing, services, but also in light manufacturing<sup>13</sup>.

Sim 8 - YTAXCONEW is a static shock simulation to investigate impacts of tax reform for corporations, i.e. reduction of corporate income tax from 48.0%<sup>14</sup> to present 19.0%. As a result, reduction of government income from corporate income taxes by 60.0% causes widening of the negative impact to government consumption in the short-term. The negative pressure to government remains in the long-term, however an improvement is visible. Independent implementation of the policy is unacceptable from the point of view of quick Eurozone accession, where there is a condition that the fiscal deficit of government may not exceed 3.0% of GDP. Tax reduction must therefore be implemented as part of a whole reform package, with reductions on the expenditure side, and/or compensation of budget income from other sources.

Sim 9 - UNEMPDN is a dynamic simulation aimed at the labor market. The baseline model has been modified in definition of unemployment. In the model, the unemployment rate has been fixed and unemployment in absolute terms set flexible. The simulation is implemented on a model different from baseline, thus the results must be evaluated individually, and the simulation cannot be combined with others. Real wages of unskilled labor and skilled labor fall by 3.6% and by 3.2% respectively. Except for labor income and GDP per unit of labor force which are decreasing, the economic impacts are positive. Sectoral and aggregate production, investment, government savings, private consumption, exports, imports, and also the trade deficit, GDP per capita are growing, while there is

depreciation of the exchange rate. Results for the long-term have the same direction, only the effect is stronger.

### **3.3 Combined simulations**

Combining simulations of EU enlargement and Slovak economic reforms give the following results.

#### **3.3.1 EU enlargement**

Sim 10 - COMBINE1 is a dynamic simulation, combining simulations related to EU enlargement (Sim 2, Sim 3, and Sim 4). Goal of the simulation is to investigate the direct impacts of EU enlargement to the Slovak, but also to the rest of EU economies. Since Sim 10 is a dynamic simulation, short-term results reflect the impacts of only liberalization of commodity market, and therefore are same as Sim 2. Impacts at sectoral level in both the medium- and long-term are strict to weak industries, i.e. to agriculture and light manufacturing. On the other side, construction industry shows significant growth. Aggregate indicators such as GDP, GDP per capita, GDP per worker, all in real terms grow in the long-term. There is a decline in government consumption. Even though both exports and imports increase in volume, there is a decline in trade competitiveness causing trade deficit to increase. The exchange rate appreciation is almost negligible<sup>15</sup>. Domestic demand, i.e. private consumption and especially investment increases.

#### **3.3.2 Slovak economic reforms**

Sim 11 - COMBINE 2, Sim 12 - COMBINE 3, and Sim 13 - COMBINE 4, are dynamic simulations aimed at economic reforms in the Slovak Republic carried out during the period of EU accession. The flagship of these reforms is introduction of the 19.0% flat rate for indirect taxes, and for the corporate income tax. Because of a fiscal policy, most affected is the government budget, causing government consumption to decline. The lower the tax rate the stronger is the negative impact to the government balance. Indirect tax reduction has a positive impact on GDP growth. Export competitiveness increases, yielding the trade balance to surplus. The exchange rate is significantly appreciating. Domestic demand, i.e. private consumption and investment increases. Impacts at the sectoral level are positive for heavy and light manufacturing, and for machinery industries.

#### **3.3.3 EU enlargement and Slovak economic reforms combined**

Sim 14 - COMBINE 5, Sim 15 - COMBINE 6, and Sim 16 - COMBINE 7, is the last set of combined, dynamic simulations. These simulations cover both the impacts of EU enlargement and impacts of Slovak reforms. The difference between the three simulations is in the indirect tax rate. The results basically prove that application of economic reforms along with EU accession has positive impacts on the Slovak economy, indicating strong synergy between the reforms and EU accession. GDP increase is the strongest compared to all previous simulations.



Table 3 Long-term (2010) sectoral impacts in the Slovak Republic, %age changes

Simulation ID	Sim 0	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6	Sim 7	Sim 8	Sim 9	Sim 10	Sim 11	Sim 12	Sim 13	Sim 14	Sim 15	Sim 16
BASE	PARCOFTR	PARCOFTEU	RENEU	FREROP	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO	FRSTXNIO
CFPI	0.66	0.37	0.36	0.43	0.67	1.29	0.72	1.88	0.76	0.76	0.15	1.38	0.81	1.96	0.94	0.29	1.51
DPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EXR	1.06	1.53	0.85	-1.04	0.66	-1.57	-1.39	-1.74	0.47	0.55	-0.03	-1.09	-0.92	-1.27	-1.05	-1.31	-1.26
GAD	43.83	7.45	-7.06	2.19	0.32	-14.28	-20.52	-8.21	-10.79	3.69	-4.80	-25.96	-32.48	-19.61	-32.14	-26.36	-25.36
IADJ	39.43	2.86	3.82	14.02	0.27	7.94	10.00	5.91	4.10	3.40	18.51	12.47	14.60	10.36	31.75	29.37	29.37
MPS_HHD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MPS_CORP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MPS_BADJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MF_UnskLab	11.50	2.20	2.90	1.88	0.22	5.58	7.19	3.98	0.90	-3.61	5.16	6.64	8.28	5.01	12.12	12.83	10.39
MF_SkLab	31.17	1.47	2.12	1.69	0.18	2.72	3.56	1.66	-0.25	-3.23	4.08	2.47	3.91	1.62	6.54	7.76	5.62
REMACC	-10.19	0.87	1.39	-1.49	-0.21	2.06	2.67	1.44	-0.89	1.93	-0.44	1.14	1.75	0.53	0.41	1.76	-0.12
QUANTITIES	47.74	-0.81	0.47	0.11	0.33	4.57	6.97	2.21	3.17	4.66	1.07	7.97	10.45	5.52	9.09	8.31	6.49
QA_OtherA	45.91	1.88	2.93	0.30	0.31	2.74	4.99	0.53	2.95	4.43	3.75	5.85	8.17	3.57	9.81	9.12	7.32
QA_MiningA	55.21	5.57	5.83	-1.14	0.48	14.77	18.37	11.27	3.34	5.59	5.53	18.79	22.53	15.15	25.70	25.65	21.57
QA_FoodA	44.58	0.42	2.79	1.09	0.32	2.66	4.96	0.41	3.38	3.88	4.35	6.25	8.63	3.91	10.85	9.73	8.28
QA_LightA	50.56	2.24	0.51	-1.50	0.34	3.20	5.34	1.09	2.66	5.42	-0.35	6.05	8.26	3.87	5.87	5.38	3.53
QA_HeavyM-A	50.84	2.63	5.52	0.38	0.37	25.81	28.91	22.78	2.35	3.85	6.49	28.96	32.15	25.83	37.57	37.82	34.03
QA_MachineA	39.56	5.68	5.28	-0.24	0.22	10.77	13.08	8.50	2.00	3.82	5.45	13.06	15.43	10.73	19.03	19.21	16.48
QA_UtilityA	48.94	2.39	2.85	0.84	0.35	8.64	10.95	6.38	2.22	3.90	4.27	11.24	13.61	8.91	16.31	16.28	13.71
QA_ConstrA	40.22	2.65	3.53	10.75	0.28	7.13	9.06	5.22	3.21	3.52	14.92	10.70	12.70	8.73	26.33	24.82	24.10
QA_ServA	46.01	-0.22	0.07	1.53	0.33	-3.64	-3.98	-3.33	-1.00	3.98	2.05	-4.78	-5.16	-4.43	-2.89	-1.86	-2.58
QFD_UnskLab	24.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.48	-1.48	-1.49
QFD_SkLab	24.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.52	-1.52	-1.53
SFD_CAP	68.94	1.32	1.73	3.71	0.60	3.50	4.42	2.59	1.92	0.88	6.42	5.88	6.53	4.64	12.69	11.68	11.47
SFD_UnskLab	19.51	0.00	0.00	-13.22	0.00	0.00	0.00	0.00	0.00	0.00	-13.13	0.00	0.00	0.00	-12.94	-12.94	-12.99
SFD_SkLab	19.51	0.00	0.00	-13.43	0.00	0.00	0.00	0.00	0.00	0.00	-13.36	0.00	0.00	0.00	-13.32	-13.27	-13.34
SFD_CAP	68.94	1.32	1.73	3.71	0.60	3.50	4.42	2.59	1.92	0.88	6.42	5.88	6.53	4.64	12.69	11.68	11.47
SFD_UnskLab	0.00	0.00	0.00	-71.47	0.00	0.00	0.00	0.00	0.00	0.00	-70.96	0.00	0.00	0.00	-69.94	-69.79	-70.22
SFD_SkLab	0.00	0.00	0.00	-72.59	0.00	0.00	0.00	0.00	0.00	0.00	-72.24	0.00	0.00	0.00	-71.99	-71.75	-72.12
SFD_CAP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SFD_UnskLab	0.00	0.00	0.00	-67.13	0.00	0.00	0.00	0.00	0.00	0.00	-66.58	0.00	0.00	0.00	-65.47	-65.31	-65.77
SFD_SkLab	-16.32	0.00	0.00	-68.34	0.00	0.00	0.00	0.00	0.00	0.00	-67.96	0.00	0.00	0.00	-67.69	-67.43	-67.82
SFD_CAP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSAV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSAVGROSS	0.00	0.00	0.00	64.15	0.00	0.00	0.00	0.00	0.00	0.00	64.05	0.00	0.00	0.00	63.41	63.26	63.60
REMGHADJ	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.13	0.13	0.13
REMACC	0.00	0.00	0.00	1.15	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.00	0.00	0.00	1.13	1.13	1.14
FDI_CHRGADJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GDP_REMUNTS	40.76	0.51	1.27	5.23	0.29	1.61	2.01	1.20	1.02	3.55	6.95	2.69	3.10	2.28	9.83	9.29	9.33
Real absorption	40.94	2.23	3.01	1.47	0.28	4.10	6.09	2.14	3.79	3.58	8.11	10.18	6.08	13.51	11.58	11.28	11.28
Real fixed inv	38.43	2.86	3.82	14.02	0.27	7.94	10.00	5.91	4.10	3.40	18.51	12.47	14.60	10.36	31.75	29.37	29.37
Real govt cons	44.58	-7.45	-7.06	2.19	0.32	-14.28	-20.52	-8.21	-10.79	3.69	-4.80	-25.96	-32.48	-19.61	-32.14	-26.36	-25.36
Real export	46.02	4.18	4.93	-0.67	0.30	12.18	14.43	9.97	2.03	4.04	4.78	16.89	12.32	20.43	20.43	17.88	17.88
Real import	37.75	3.17	4.45	4.45	0.24	9.18	10.85	7.53	1.55	3.05	3.05	10.97	12.67	9.28	21.05	21.08	19.17
Real trade deficit	-16.04	-7.79	-0.64	62.55	-0.45	-25.51	-30.36	-20.82	-3.76	-8.14	60.99	-30.47	-35.54	-25.57	28.01	27.51	33.68
Real GDP	47.00	1.12	1.47	1.59	0.33	3.44	4.20	2.69	1.34	4.28	3.60	4.93	5.71	4.16	8.91	8.36	7.98
Nominal GDP	45.43	0.26	1.05	1.45	0.31	3.12	4.20	3.42	1.18	3.86	2.92	4.11	3.79	4.41	6.95	5.78	7.21
Real indirect tax	42.78	7.44	9.21	3.38	0.27	25.06	29.65	20.57	5.18	3.58	13.28	31.23	35.97	26.59	46.79	45.38	41.64
CFI (100 for base)	0.66	-0.29	-0.30	0.23	0.01	0.63	0.06	1.21	0.09	0.10	-0.50	0.72	0.15	1.30	0.28	-0.37	0.85
Real exchange rate	3.16	2.00	1.35	-1.42	0.07	-3.21	-3.09	-3.32	0.57	0.52	0.13	-2.65	-2.53	-2.76	-2.42	-2.82	-2.59
Nominal exchange rate	1.06	1.53	0.85	-1.04	0.06	-1.57	-1.39	-1.74	0.47	0.55	-0.03	-1.09	-0.92	-1.27	-1.05	-1.31	-1.26



Table 3(continued) Long-term (2010) sectoral impacts in the Slovak Republic, %-age changes

Simulation number	Sim 0	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6	Sim 7	Sim 8	Sim 9	Sim10	Sim11	Sim12	Sim13	Sim14	Sim15	Sim16
Simulation ID	BASE	PARCUTSR	TARCUFEU	REHEU	FRERECAF	FLSTAXI100	FLSTAXG50	FLSTAXG50	VTAXCONER	UNIMEDN	COMBINE1	COMBINE2	COMBINE3	COMBINE4	COMBINE5	COMBINE6	COMBINE7
MACROECONOMIC INDICATORS:	#####																
ABSORP.NOMINAL	41.80	0.34	1.04	0.30	2.84	2.55	5.12	1.14	3.66	6.48	3.80	3.51	4.08	10.14	9.00	10.38	
ABSORP.REAL	40.76	0.51	1.27	5.23	0.29	1.61	2.01	1.20	3.55	6.95	2.69	3.10	2.28	9.83	9.29	9.33	
PRVCON.NOMINAL	41.76	1.99	2.78	1.24	4.97	6.36	3.60	3.60	3.66	4.48	9.11	10.55	7.68	14.01	11.34	12.41	
PRVCON.REAL	40.94	2.23	3.01	1.47	4.28	4.10	6.09	2.14	3.79	3.58	4.93	10.18	6.08	13.51	11.58	11.28	
FIXINV.NOMINAL	40.89	2.25	2.88	13.67	0.30	4.55	5.94	3.18	3.69	4.19	10.64	7.76	26.54	23.29	24.94	29.38	
FIXINV.REAL	39.43	2.86	3.82	14.02	0.27	7.94	10.00	5.91	4.10	3.40	18.53	12.47	14.60	10.36	31.75	29.38	
GOVCON.NOMINAL	43.30	-6.92	-6.35	1.96	0.31	-5.38	-12.66	1.77	-10.92	3.63	-4.30	-18.39	-25.31	-11.00	-24.84	-18.70	
GOVCON.REAL	43.83	-7.45	-7.06	2.16	0.32	-14.28	-20.32	-6.21	-10.79	3.69	-4.80	-25.96	-32.48	-19.61	-26.36	-23.36	
EXP.NOMINAL	47.96	4.99	5.82	1.47	0.31	8.23	10.20	6.28	2.16	3.67	4.92	10.67	12.71	8.67	16.52	16.25	14.23
EXP.REAL	46.02	4.18	4.93	-0.67	0.30	12.18	14.43	9.97	2.03	4.04	4.78	14.59	16.89	12.32	20.43	20.49	17.88
IMP.NOMINAL	42.81	4.72	5.43	3.50	0.29	7.47	9.30	5.66	2.03	3.62	9.51	11.65	7.90	20.03	19.74	17.90	17.90
IMP.REAL	37.75	3.17	4.45	4.45	0.24	9.18	10.85	7.53	1.55	3.05	9.31	10.97	12.67	9.28	21.05	21.08	19.17
GDMP.NOMINAL	45.43	0.26	1.05	1.45	0.31	3.12	2.80	3.42	1.18	3.86	2.92	4.11	3.79	4.41	6.95	5.78	7.21
GDMP.REAL	47.00	1.12	1.47	1.59	0.33	3.44	4.20	2.69	1.34	4.28	3.60	4.93	5.71	4.16	8.91	8.36	7.98
NETITAX.NOMINAL	49.59	-22.41	-22.27	2.77	0.35	-22.99	-45.63	-0.68	5.79	4.42	-20.05	-21.45	-44.43	1.18	-46.23	-71.32	-22.02
NETITAX.REAL	42.78	7.44	9.21	3.38	0.27	25.06	29.65	20.57	5.18	3.58	13.28	31.23	35.97	26.59	46.79	45.38	41.64
QABSTAX	40.76	0.51	1.27	5.23	0.29	1.61	2.01	1.20	1.02	3.55	6.95	2.69	3.10	2.28	9.83	9.29	9.33
QHTOT	40.94	2.23	3.01	1.47	0.28	4.10	6.09	2.14	3.79	3.58	4.93	8.11	10.18	6.08	13.51	11.58	11.28
QINVTOT	38.43	2.86	3.82	14.02	0.27	7.94	10.00	5.91	4.10	3.40	18.51	12.47	14.60	10.36	31.75	29.38	29.37
QSTOT	43.83	-7.45	-7.06	2.16	0.32	-14.28	-20.32	-6.21	-10.79	3.69	-4.80	-25.96	-32.48	-19.61	-32.14	-26.36	-25.36
QETOT	46.02	4.18	4.93	-0.67	0.30	12.18	14.43	9.97	2.03	4.04	4.78	14.59	16.89	12.32	20.43	20.49	17.88
QWOT	37.76	3.21	4.47	4.45	0.24	9.12	10.80	7.48	1.56	3.05	9.34	10.93	12.84	9.24	21.04	21.06	19.16
FRDEFTOT	-18.84	-7.79	-0.64	62.55	-0.45	-25.51	-30.36	-20.82	-3.76	-8.14	60.99	-30.47	-33.34	-25.57	28.01	27.51	33.68
REAR	3.16	2.00	1.35	-1.42	0.07	-3.21	-3.09	-3.52	0.57	0.52	0.13	-2.65	-2.76	-2.42	-2.82	-2.59	
NEAR	1.06	1.53	0.85	-1.04	0.06	-1.57	-1.39	-1.74	0.47	0.55	-0.03	-1.09	-0.92	-1.27	-1.05	-1.31	-1.26
FWEIND	0.27	-0.75	-0.03	0.25	-0.05	-1.91	-2.13	-1.48	-0.34	-0.70	0.13	-2.15	-2.47	-1.82	-2.03	-2.04	-1.68
FWIND	3.68	1.50	0.94	-0.93	0.06	-1.55	-1.38	-1.72	0.47	0.55	0.17	-1.07	-0.90	-1.25	-0.83	-1.09	-1.05
FWIND	2.08	0.46	0.49	-0.38	0.01	-1.67	-1.72	-1.61	0.10	-0.03	0.15	-1.57	-1.63	-1.52	-1.38	-1.53	-1.34
PDIND	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CFPI	0.66	-0.29	-0.30	-0.23	0.01	0.63	0.06	0.00	0.00	0.00	0.00	0.72	0.15	1.30	0.28	0.37	0.85
TOFT	-3.29	-2.22	-0.96	1.18	-0.10	-0.26	-0.77	0.25	0.21	0.09	1.24	-0.04	-1.09	-1.59	-0.58	-1.21	-0.96
INNGDP	-3.12	1.98	1.82	12.04	-0.01	1.39	3.06	-0.24	3.13	-0.17	13.83	4.89	6.61	3.20	18.32	16.55	16.53
PRVAVGDP	-2.57	1.72	1.70	0.21	0.25	1.80	3.46	0.17	3.13	-0.19	5.29	5.29	7.00	3.61	7.09	5.24	5.33
FORAVGDP	-30.51	1.26	-0.20	60.11	-0.25	4.54	-4.08	-4.98	-0.71	-3.19	59.35	-5.00	-4.53	-5.44	51.19	52.32	50.66
FRDEFGDP	-24.82	-21.78	-22.84	45.35	-0.19	-2.77	-1.86	-3.65	-0.17	-2.42	21.83	-2.65	-1.73	-3.54	15.50	16.35	15.04
GOVAVGDP	-31.24	-0.26	-1.04	4.43	-0.31	-3.02	-2.72	-3.31	-1.17	-3.71	-2.84	-3.95	-3.65	-4.23	-6.50	-5.47	-6.73
IMTAVGDP	-1.68	-0.84	-0.79	2.88	-0.04	2.33	4.51	0.20	1.36	-0.20	-0.74	4.10	3.93	1.93	-0.71	-0.71	-0.71
DIRAVGDP	41.51	1.52	1.50	-0.11	-0.02	1.65	3.17	0.16	-0.78	-0.70	1.41	-1.91	-1.31	-2.01	-1.82	4.87	-19.12
SDENRCP	21.69	0.26	1.05	16.99	0.31	3.12	2.80	3.42	1.18	3.86	18.57	4.11	3.79	4.41	23.01	21.62	23.37
SDENRCP	21.69	0.26	1.05	16.99	0.31	3.12	2.80	3.42	1.18	3.86	18.57	4.11	3.79	4.41	23.01	21.62	23.37
GDENRCP	18.92	0.26	1.05	3.02	0.31	3.12	2.80	3.42	1.18	-4.76	4.50	4.11	3.79	4.41	8.57	7.38	8.84
GDENRCP	23.00	1.12	1.47	17.16	0.33	3.44	4.20	2.69	1.34	4.28	19.35	4.93	5.71	4.16	25.26	24.58	24.25
SDERCP	23.00	1.12	1.47	17.16	0.33	3.44	4.20	2.69	1.34	4.28	19.35	4.93	5.71	4.16	25.26	24.58	24.25
SDERPLAB	18.18	1.12	1.47	3.16	0.33	3.44	4.20	2.69	1.34	-4.37	5.18	4.93	5.71	4.16	10.56	10.00	9.62
EVTOT	41.76	2.23	3.01	1.47	0.28	3.84	5.82	1.89	3.78	3.58	4.93	7.85	9.90	5.83	13.17	11.23	10.96

Source: Authors' calculations

Table 3 (continued) Long-term (2010) sectoral impacts in the Slovak Republic, %-age changes

SIM ID	- simulation ID		at base prices)
CPI	- consumer price index (PQ-based)		- real household consumption (LCUs at base prices)
DPI	- index for domestic producer prices (PDS-based)	QHTOT	- real investment (LCUs at base prices)
EXR	- exchange rate	QINVTOT	- real government consumption (LCU at base prices)
GADJ	- government demand scaling factor	QGTOT	- total real exports (LCUs at base prices)
IADJ	- investment scaling factor	QMTOT	- total real imports (LCUs at base prices)
	(for fixed capital formation)	TRDEFTOT	- real trade deficit (LCUs at base prices)
MPS	- marginal propensity to save for dom non-gov inst ins	REXR	- PPP real exchange rate (LCUs per FCU)
MPSADJ	- savings rate scaling factor	NEXR	- nominal exchange rate (LCUs per FCU)
WF	- economy-wide wage (rent) for factor f	PWEIND	- export price index (FCUs; 100 for base)
QA	- level of domestic activity	PWIND	- import price index (FCUs; 100 for base)
QFD	- quantity of factor demand	PDIND	- world (tradables) price index (FCUs; 100 for base)
QFSUP	- quantity of factor supply	CPI	- domestic (non-tradables) price index (100 for base)
	(demand + unemployment)	TOFT	- consumer price index (100 for base)
QFUNEMP	- quantity of factor (labor) unemployment		- terms of trade (ratio pwe index & pww index)
UR	- factor (labor) unemployment rate		(100 for base)
GSAV	- government savings	INVGD	- investment (% of nominal GDP)
FSAVGROSS	- foreign savings including movement of dividends payments and labor remittances	PRYSAVGDP	- private (household + enterprise) savings (% of nominal GDP)
REMGHWADJ	- change in FSAVGROSS due to labor remittances from abroad		- foreign savings (% of nominal GDP)
REMACX	- accumulated labor remittances from the benchmark year	FORSAVGDP	- trade deficit (% of nominal GDP)
FDICHWADJ	- change in FSAVGROSS due to movement of dividend payments (in foreign currency units FCUs)	GOVSAGDP	- government savings (% of nominal GDP)
		IMPTAXGDP	- tariff revenue (% of nominal GDP)
ABSORP	- absorption	DIRTAGDP	- direct tax revenue (% of nominal GDP)
PRYCON	- private consumption	GDPNpCAP	- nominal GDP per capita (in LCUs)
FIXINV	- fixed investment	GDPNpECP	- nominal GDP per economically active person (in LCUs)
GOVCON	- government consumption		- nominal GDP per worker (in LCUs)
EXP	- exports	GDRPpCAP	- real GDP per capita (in LCUs)
IMP	- imports	GDRPpECP	- real GDP per economically active person (in LCUs)
GDPMP	- GDP at market prices	GDFRpLAB	- real GDP per worker (in LCUs)
NETITAX	- net indirect taxes	EVTOT	- total equivalent variation of household income (if EV>0 --> income increase; EV<0 --> decrease)
QABSTOT	- real absorption (local currency units LCUs)		

## Notes:

1. BASELine simulation results are %-age changes from the BENCHMARK year (2001) of the same simulation
2. Other simulation results show %-age changes from the same year (2010) of the BASELine scenario
3. EVTOT comparisons are made with household income (EH)
4. Variable notations are as follows:

Comparing between the three simulations, flat indirect tax with no increase/decrease (Sim 14) give the best results for GDP growth (gross and per-capita), private consumption, and also for income measured by equivalent variation index. This scenario can be called therefore as the “ideal” scenario, suggesting that there is no actual need for changing the overall indirect tax burden in the economy, and also justifying the application of a flat tax rate. If there was a request to ease the indirect tax burden, as done in Sim 15, economic impacts would be still very good, although not as high as in Sim 14. We can call this scenario therefore as “comfortable”, meaning that people pay less tax, but on the other side the economic performance is still good. In other words, the price of paying less tax is not so high. As done in Sim 16, increasing the indirect tax rate on one side brings much less positive impacts compared to when it is decreased or kept unchanged. Application of this scenario is therefore unsubstantiated, and can be called “futile”. At the same time it is also quite improbable that such high tax rates could be sustained in the Slovak economy for long time.

It is worth to note that while the relation between tax rates and GDP is linear<sup>16</sup>, combining tax with EU enlargement<sup>17</sup> creates a non-linear relation. Trade liberalization and tax reduction result in a mixed non-linear impact on real GDP due to their opposite impacts on exports, imports, trade balance, and exchange rate, creating the “ideal”, “comfortable”, and “futile” scenarios with different results from those of tax reduction only.

#### **4. Summary and conclusions**

In parallel with EU accession, several reforms by the Slovak government have been carried out recently. At the stage when reform of foreign trade has reached the final stage by entering EU, reform of the tax system has been introduced at the beginning of 2004. In combination with other reforms and strong support of foreign investors, the government policy on FDI seems to be picking up on speed. Although the government’s incentives in this field have to be admired, it is necessary also to say that reasons for increase in capital, mainly FDI inflow are also greatly influenced by comparative advantages of skilled but relatively cheap labor, and by privatizing the remaining state-owned enterprises with largest scale - steel, telecommunications, railways, gas, electricity, and water. Several reforms are run in parallel - reform of school system (paid schooling), health system (free health service is abolished from 2005), pension system (introduction of a three-pillar pension system, where one pillar is the traditional state-based pension, the second is private where each individual has the right to chose a private company for pension savings, and the third one is optional insurance; increase of retirement age), transportation (subsidizing of state-owned companies especially bus transport, and price regulation), public administration (decentralization of government administration, fiscal decentralization), support of employment programs. Impact analysis of all these aspects is dependent on data availability; however policies quantifiable are carried out in this work.

There are several positive factors of the reform and the economy in general seems to be on the right track. The Slovak Republic records the highest growths out of all new EU economies, the strongest currency appreciation, and has a strong vision to join the Eurozone earliest (except Slovenia), i. e. in 2009. Market economy practices come to the foreground, foreign investment (incl. speculative) flows into the economy, employment in selected regions seem to increase, slow increase is visible in real wages of some sectors, etc. Keeping the current trend inviting foreign car manufacturers, Slovak Republic will be world's number one in car production per capita in 2008. The World Bank in its recent report (World Bank, 2004) is evaluating Slovak Republic as a top number 1 reformer from between all of the 148 countries reviewed, with an overall rank 18 on the ease of doing business. According to the World Bank, Slovak Republic is leader in reducing the costs of starting a new business, lowest costs of employer dismissal, and there is a stable system of lender guarantees. The success of these reforms should directly bring an additional 2.5% GDP increase.

However radical reforms are followed by a range of negative effects with deep social impacts. Especially due to privatization of strategic sectors, there is a huge consistent pressure on price increase, and social differences are expected to grow. High unemployment rates together with constant price increases and almost no increase in real wages, payments introduced for schooling, health, public administration, increased payments to the social and pension system, radical increase of indirect tax rates on basic food products, medicine, and books, in the production sector priority given to foreign investors, all this induce a suspicion of strong social impacts. Reductions in public administration cause difficulty, inconsistency and unavailability of standard macroeconomic data collection, based on which serious policy analyses could be built. Information exchange and cooperation between strategic organizations and government, or between departments of the government itself are absolutely without mutual coordination. Different institutions provide varying reports on identical indicators. Differences are in Central Bank reports and reports of the Statistical Office. As a specific example, reporting of unemployment rates vary between the Ministry of Social Affairs and the Statistical Office by 25.0%, in absolute values about 400.000 people, which is in comparison to the Slovak population well over the line of statistical errors. Budgets of research institutes, majority of which is state owned (or state managed) are drastically reduced, causing specialists to look for jobs in other sectors or abroad. Assistance of science and development has dropped from 3.88% of GDP in 1989 to 0.69% in 2000 (Oustrata, 2002). Very similar situation is in University research with low motivating factors and poorly equipped research facilities, causing young people to search for acknowledgement abroad. And in spite of major cuts in government expenditures, the public debt in absolute values is further constantly growing.

Simulation results of the link CGE model are the main output of this research. Several simulations have been carried out in order to investigate the impacts of various policies and scenarios of Slovak Republic's EU accession. The results in general give positive impacts of EU accession,

under at least two conditions. One condition is that various, politically not always popular reforms in the Slovak Republic are run in parallel to EU accession. This has been actually done under lead of the previous government. There is, however, another condition, which is even more severe. The direct positive effect from EU enlargement is not very big and the comparative advantage is expected to faint in time. Therefore it is necessary that the accompanying Slovak reforms are correctly tuned, coordinated, continuously evaluated and if necessary, instantly reevaluated. Only the implementation of the reform objectives in the long-term will guarantee the best synergic effects from EU accession for the Slovak Republic, and at the same time for the whole region.

## Notes

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- 1 For details on EU accession and structural reforms in the Slovak Republic, see Koronczi, and Ezaki (2005), and also Section 4 of this paper.
- 2 The regions/countries are: SVK - Slovak Republic, EU09 - remaining 9 new member countries accessing in 2004, EU15 - former EU member countries, RUS - Russia, REUR - rest of Europe, JPN - Japan, CHN - China, RASIA - rest of Asia, USA - United States, ROWD - rest of the World.
- 3 The industrial sectors are: Crops-A - crop production activities, OtherA-A - other agriculture activities, Mining-A - mining industry activities, FoodP-A - food processing activities, LightM-A - light manufacturing activities, HeavyM-A - heavy manufacturing activities, Machine-A - machinery activities, Utility-A - utility sector (heat, water, trash collection, etc.) activities, Constr-A - construction industry activities, Serv-A - service activities.
- 4 The goods are: Crops-C - crop production commodities, OtherA-C - other agriculture commodities, Mining-C - mining industry commodities, FoodP-C - food processing commodities, LightM-C - light manufacturing commodities, HeavyM-C - heavy manufacturing commodities, Machine-C - machinery commodities, Utility-C - utility sector commodities, Constr-C - construction industry commodities, Serv-C - service commodities.
- 5 The factors are: UnskLab - unskilled labor, SkLab - skilled labor, Cap - capital.
- 6 The institutions are: Hhd - households, Corp - corporations, Gov - government.
- 7 This account is expressed by: S-I - savings-investment.
- 8 The tax accounts are: Ytax - direct income tax, Stax - indirect sales tax including subsidies, Tar - import tariffs on the import side (export duties on the export side).
- 9 Depending on the version of the model or simulation, the number of equations may vary.
- 10 Movement can be allowed for any other regions, if specified.
- 11 This model assumes that the supply of labor and the rate of unemployment are exogenous in each country, though the latter has a certain lower bound corresponding to the natural rate of unemployment, and that the labor market is cleared by the flexible wage in each country for each year. For the next year, total supply of labor in EU region is allocated between countries in the region based on the wage differentials with the elasticity of adjustment.
- 12 This tax is defined as sales tax in the model.
- 13 The flat tax rate causes far bigger impacts to the wage of skilled labor than to that of unskilled labor through disproportional impacts on sectors, i.e., far bigger increase in production of "strong" sectors such as heavy manufacturing, machinery, and mining than that of "weak" sectors such as light manufacturing, as seen in Sim 5, Sim 6 and Sim 7 in Table 3. These disproportional impacts are less conspicuous for the scenarios of trade liberalization, Sim 1 and Sim 2.
- 14 Level of 48.0% tax rate has been calculated from SAM (official rate was 40.0%).
- 15 In case of trade liberalization only, the exchange rate depreciates.
- 16 Set of simulations 11, 12, 13 (also simulations 5, 6, 7) show that the higher the tax rates are set, the lower the

GDP (growth) becomes.

17 Combining both impacts of same and opposite direction (for comparison, refer to sections 3.3.1 and 3.3.2).

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