Economic impact of gas supply disruptions – case of Slovakia

Lucia Fašungová [1] - Marek Radvanský[2]

Abstract

European energetic safety is belongs to the most discussed economic issues. This paper analyse impact of gas supply disruptions on the economy. This situation has been observed in real economy, more particularly in Central Europe and Balkan countries during Russia-Ukraine gas crisis at January 2009, where the gas supply was cut-off for 13 days. We will analyse the effects of this cut on Slovak economy, which belongs to one of the most affected. Economic analysis will be based on Computed General Equilibrium methodology – CGE model. Our aim is to estimate gas failure as an exogenous non-marginal supply shock with serious impact on aggregated and structural economic indicators. First quick estimation about possible daily losses at level about one third of daily GDP was confirmed. As a result of this disruption, there was implemented project in Slovakia to allow full reverse flow at main pipeline from Czech Republic. Slovakia can be now supplied from the west in case of unpredictable situation.

Abstrakt

Energetická bezpečnosť v Európe patrí k jedným z často diskutovaných ekonomických problémov. Článok analyzuje hospodársky dopad pozastavenia dodávok plynu. Túto situáciu sme mohli reálne pozorovať v krajinách strednej Európy a Balkánu počas Rusko-Ukrajinskej plynovej krízy v januári 2009, kedy prerušenie dodávok plynu trvalo 13 dní. V článku analyzujeme efekt pozastavenia zásobovania plynom na príklade Slovenska, ktoré patrilo k najviac postihnutým krajinám. Ekonomická analýza bude založená na aplikovaní metodológie všeobecnej ekonomickej rovnováhy – CGE modelu. Prerušenie dodávky plynu je simulované ako exogénny nemarginálny ponukový šok s výrazným dopadom na jednotlivé sektory hospodárstva. Prvé odhady o možnej výške škôd na úrovni 1/3 denného HDP boli modelovo potvrdené. Jedným z dôsledkov tejto krízy bolo dobudovanie plného spätného toku z Českej republiky na hlavnom plynovode. Slovensko môže byť teraz v prípade nepredvídanej situácie zásobované zo západu.

Introduction

Currently, the most discussed problem is the influence of the financial crisis on economy. In some European countries the onset of the crisis has been aggravated by the interruption of gas supplies

---

[1]Faculty of Mathematics Physics and Informatics, Comenius University, Mlynska dolina, 842 48 Bratislava, Slovakia; lucia.panikova@gmail.com

[2] Institute of Economic Research, Slovak Academy of Sciences, Sancova No. 56, 811 05 Bratislava, Slovakia; marek.radvansky@savba.sk.

from Russia. Due to its full dependence on Russian gas Slovakia was one of the countries most affected. As a result of unsuccessful negotiations between Russia and Ukraine, on 6th January 2009 gas supply from Russia to Slovakia has been stopped. Slovakia started to supply households and firms from strategic reserves, but gas consumption of the largest consumers was restricted by the authorities. Large producers reduced or completely interrupted their production. The economy of gas-thirsty Slovakia had started to return to its normal pulse on January 19th when reverse flows through the pipeline from the Czech Republic was established. This supply route bypassed Ukraine and allowed the restrictions in Slovakia to be lifted. The cut-off gas supply and production lasted for 13 days. On January 21st gas supply through the standard Ukrainian route was resumed.

An estimation of the macroeconomic influence of the interruption or restriction of the gas supply to the national economy is the main objective of this paper. Both long-term and short-term effects will be discussed. This study reflects generally the situation in countries of East and Central Europe which were most hit by worsened relations between Russia and Ukraine. The paper is focused on the Slovak economy, which was completely dependent on Russian gas supply during this „gas crisis". The study serves as a forecast for other countries for the case of a cut-off of gas supply.

Besides the crisis, in January 2009, the countries of Central and Eastern Europe faced and additional problem. Negotiations between Russia and Ukraine about the gas price (both for transfer and consumption) collapsed. Gas transfer via gas pipes in Ukraine to other European countries was reduced and then fully interrupted at 6th of January. This situation lasted 15 days, until the gas transfer was fully resumed after successful negotiation on 21st of January.

The structure of this paper is as follows. The next section looks at the dependency of EU countries on gas imports. Afterwards, we will explain situation in Slovakia during "gas crisis" and continue to theoretical model. Empirical estimation will illustrate the possible impact on economy, which will be concluded at discussion part.

Dependence on Gas Imports in EU

According to OECD (2006), more than 80 % of Russian gas export to Europe goes via pipelines in Ukraine[3] (see figure 1).

Figure 1. Dependencies of selected European Countries on gas import from Russia and other countries in 2006

---

[3] .
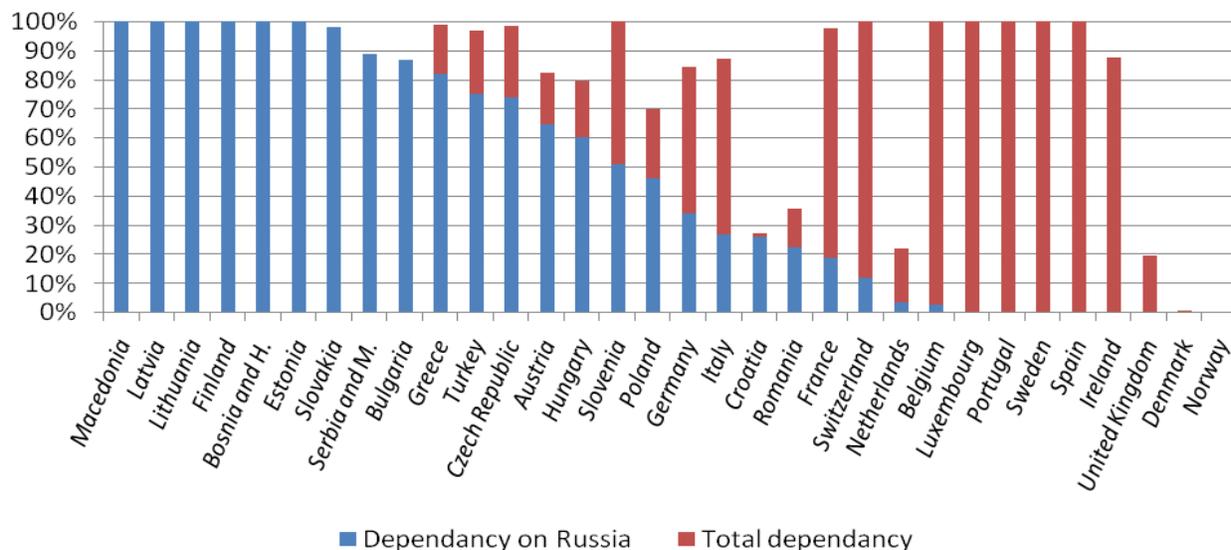
According to Eurostat (2008), the total dependence of the European Union countries (EU 27) on external supply of natural gas amounts to 60 % (60,8 % in 2006)[4], about 25 % of the deliveries are coming from Russia. The crisis naturally affected in the first place countries, which were nearly 100 % dependent on gas from Russia via pipelines in Ukraine. Those were the Central European and Baltic countries: Slovakia, Hungary, Bulgaria, Romania, Macedonia, Bosnia and Herzegovina, Serbia and Montenegro.

Only few countries were not able to supply households in January. Bulgaria had to reduce the gas consumption in industries sharply after few days after the interruption of gas supplies. One week later Bulgaria had to reduce also the supply to households. Things were even worse in Moldavia. Their enterprises and households were totally cut from gas supplies after just few hours from the beginning of the crisis, because of no gas reserves in that country. Other countries were able to supply households and a part of industries either from their own reserves, from other's countries aid, or via pipelines which bypassed Ukraine (Yamal via Poland or Bluestream via Turkey, see Picture 1).

The European Union, despite of its oil reserves (90-ty days[5]), does not regulate strategic reserves of natural gas. The last European document about security of gas supplies was a Council directive[6] of 2004, which merely suggests building up reserves to avoid short gas supply and price shocks in Europe. The supply crisis from January 2009 renewed the dialogue about mandatory gas strategic reserves in EU.

Picture 1 – Main existing and planned gas pipelines in Europe

---

[4]

[5] In the European union, according to Council directive 98/93/ES from 14 December 1998, all 27 members must have a strategic oil reserves equal to at least 90 days of average daily consumption.
[6] Council Directive 2004/67/EC of 26 April 2004 concerning measures to safeguard security of natural gas supply

Case of Slovakia

The effect of the interruption of gas supply from Ukraine to Slovakia was almost immediate. In January 2009, Slovakia had gas reserves, but its larger part was not controlled by state, because the reserve storage places were sold to private companies during the privatization. The rest of them were able to compensate missing gas for about 30 % of consumption only. Restrictions in Slovakia were put in place on January 6th. Large commercial customers and businesses whose contracted gas consumption exceeded 60,000 cubic metres per year had to reduce their gas usage to a minimum safety level. Estimations about available gas reserves varied from too pessimistic 10 to rather too optimistic 30 days and were uncertain. Because of the threat of the failure of electricity generators powered by gas the government considered the activation of the nuclear plant in Mochovce as a controversial policy option, although this nuclear power plant has been closed following the EU accession agreement.

A partial solution came on January 19th. Slovakia began receiving deliveries via the Czech Republic by the reverse flow in the pipeline by a route which bypassed Ukraine. This allowed restrictions on natural gas use to be lifted. This reverse flow was activated for the first time during over 40 years of the pipeline. The cut-off gas supply and production lasted for 13 days. On January 21st gas supply via the normal route through Ukraine was resumed. The estimation of the economic costs began.

Modelling Approach

Our initial rough estimation was based on a simple calculation under the assumption of a lower economic output. Information from main Slovak producers indicated, that the economy was working only at about 60 % of its potential. National regulation degree eight[7] meant that producers had to cut their gas energy consuming activities to the minimum safety level. Based on information from the producers we have estimated the drop of production to about 40%. This amounts the total daily losses of about 33-38 million Euros. The 13 day interruption of gas-supply, excluding any other external influences (e.g. impact of world economic crisis), thus might represent 0.6-0.7 percentage point slowdown in GDP growth compared to earlier prognoses. We estimate that total losses from restricted production represent 430 million - 500 million Euros[8]. For the case of a longer interruption of gas supplies, we estimate and increase of daily GDP losses to about €103 million. This is equivalent to a daily drop of 0.1 percentage points of GDP. We will discuss these results in concluding part of this paper.

Introduction to the CGE model

In order to quantify the macroeconomic impact of interrupted gas supply to the economy, a computational general equilibrium (CGE) model is used. Computable General Equilibrium model is a macroeconomic tool widely used in economic modeling for quantifying short – term (possibly also mid – term) impacts of shocks to the economy. These shocks are considered to have fiscal character (tax changes, changes in government consumption, etc.), or character of supply shock (the case of gas crises) or price shocks.

The main advantage of these models is their deeper structural character which is allowed by the inclusion of the SAM (Social Accounting Matrix) table. The latter enables us to analyze non-marginal changes not only in main macroeconomic indicators (GDP, employment, value-added, consumer's income), but in the indicators of disaggregated production (NACE classification) as well.

Model structure in context of scenario

Our aim is to estimate gas failure as an exogenous non-marginal supply shock with serious impact on aggregated and structural economic indicators. A procedure to assess the effect of gas reduction by a CGE model was developed earlier in 2007 (see [5]), where cut import in mining sector was simulated. After certain time, this scenario appears to be realistic, because in the beginning of year 2009, gas supplies to Slovak Republic have been interrupted. After the gas crisis we rebuilt our model with more actual data and enhanced it structurally to describe relations among consumers more deeply.

---

[7] National Regulation degree of gas consumption indicates the amount of current supply for consumers. The normal degree of unlimited supply to all consumers is 3, emergency level is 10, when gas supplies are fully terminated for all consumers.

[8]

The model is based on a SAM, which has its origin in the Supply and Use tables and National Accounts for Slovakia in 2005[9]. Production is aggregated into seven main production sectors (agriculture, mining, heavy industry, light industry, power industry, construction and services)[10]. The sector of mining has been considered separately because it includes gas extraction[11]. Production is based on a nested production function divided into two levels. The upper level represents aggregate output (Y_i) based on a Leontief production function. This output uses aggregated net production (VA_i) and intermediate consumption (IC_i) which enters as production factors (obtained in the lower level of the nested production function). Factor inputs include labour (L_i) and capital (K_i), which are substitutable to some degree[12] (represented by Constant Elasticity of Substitution function CES). Intermediate consumption of factors ($X_{1i} - X_{ni}$) in the particular sector i are not substitutable at all; therefore it is represented by the Leontief function[13].

International trade is modeled by the Armington concept. That means that the total output (O_j) of the economy is divided into commodities for export (EX_j) and for domestic market (DP_j). This is reflected by the Constant Elasticity of Transformation function (CET). Imports (IM_j), with commodities for the domestic market (DP_j) are aggregated into the supply (A_j) of jth commodity on domestic market using the CES function. Greek symbols ϖ_j, ε_j, σ_j, μ_j (Scheme 1) represent weights of inputs for particular output (called also "shares").

The equations of the Armington concept are crucial for the model because it enable us to simulate gas interruptions through the change of share value of import in the mining sector.

$$A_j = \left[\alpha_j IM_j^{\rho_j} + (1 - \alpha_j) DP_j^{\rho_j} \right]^{\frac{1}{\rho_j}} , \qquad (1)$$

$\rho_j \leq 1$ ^ $\rho_j \neq 0$, j = {set of commodities}.

The parameters $\rho_{j,}$, α_j represent the elasticity of substitution and the share of the imported value of the jth commodity to supply j^{th} commodity on domestic market, respectively.

The second block of the equations consists of consumption and income redistribution[14] balances. The final consumption of households (HC_j) is modeled by maximizing the Cobb-Douglass utility function under budget constraints. The constraints consist of the total (mainly wage, domestic and foreign) income of households, social benefits and income from capital ownership. Demand for

---

commodities is determined by the Marshallian demand functions maximizing utility under the income constraint. Government's final consumption (GC_j) is modeled by maximizing the Leontief utility function under the budgetary constraints. Government income consists mainly of taxes, social contributions and income from property. Investments (INV_j) are represented by demand for capital. Demand is derived by maximizing the Leontief utility function under the budgetary constraints. Households are equipped by investments which yield them annual revenues from enterprises.

Parameters in our model do not change in time; therefore our model is static, results, the non-marginal changes, should be understood as short-term changes.

The model structure is schematically described by the following diagram (Scheme 1):

Scheme 1: Structure of a static CGE model
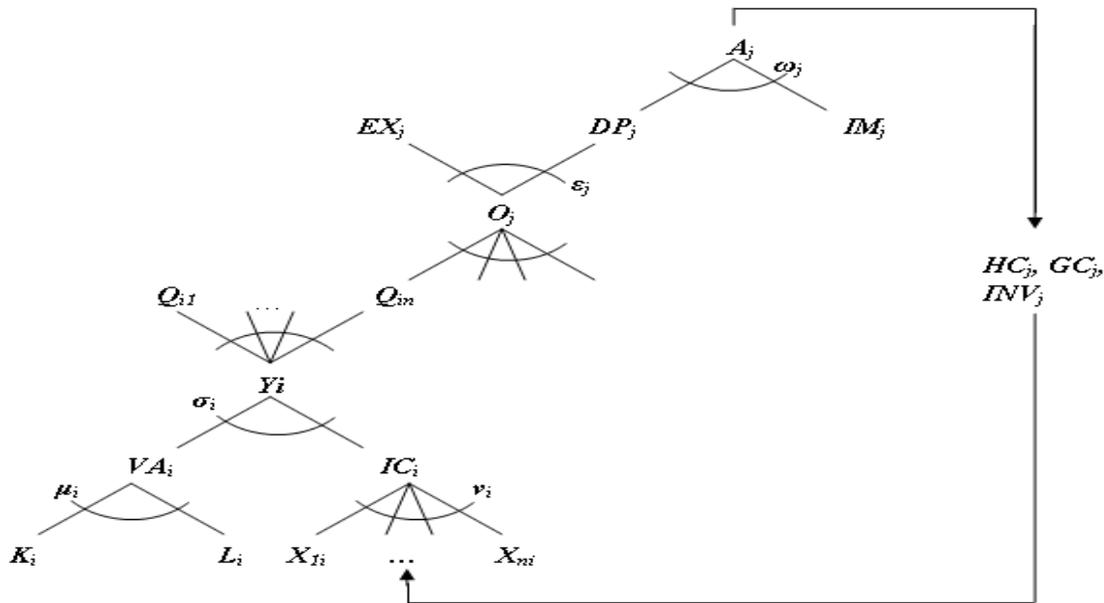
Source: Own presentation.

The block of macroeconomic equations of supply and demand equilibrium of labor and capital is supposed to behave according to Keynesian theory. For our model this means mathematically that, while a deviation from average wage in each industry remains unchanged, the shock in the economy affects the demand for labor in the particular industries. We restrict total labor supply to be the sum of employment and unemployment, which is constant during the simulated period.

All prices are compared to a numeraire, which represents the price level of household consumption. Endogenous variables are represented by non-marginal changes to their reference value.

Exogenous variables are calibrated from the SAM (e.g. shares of goods to total production), or empirically (e.g. elasticities of production factors in production[15], elasticities in Armington concept[16]).

Selected scenarios

Our scenario simulates gas supply shock in the import, which recalls the situation in the Slovak economy in January 2009. The supply shock is represented by a change of the weight of imports in the mining sector in the Armington model (equation (1)), which implies a change of total domestic supply. We simulate the drop of import share (parameter α_j), which corresponds to a two thirds reduction of annual gas supply imported to Slovakia[17], admitting a use of gas reserves as well. The drop of import share affects supply (A_j) of mineral oils (aggregated in mining sector) in the domestic market as well as in the total production (P). A change in production affects demand for labor. We suppose that the drop of import affects production negatively, therefore we expect a decline in employment. Lower employment affects the income of households, which causes multiplicatively lower consumption and investments. An overall decline appears of course in the power of economy expressed by the Gross Domestic Product macroeconomic indicator.

Following the supply shock, the model has computed a new equilibrium with particular changes in key economic indicators (Table 1).

Table 1: Impact of a supply disturbance in mining sector on key macroeconomic indicators

	GDP	P	M_Cons	M_Ent	TL	LU
	mil. Euro	mil. Euro	mil. Euro	mil. Euro	thousand of people	thousand of people
reference year 2005	49 315	110 504	30 310	7 789	2 205	428
new equilibrium	40 168	88 183	25 932	4 565	1 761	872
% change in compare to reference year	-18,50%	-20,20%	-14,40%	-41,40%	-20,20%	104,00%

Source: SR National Accounts, 2005; Model calculations

As we expected, the real Gross Domestic Product (GDP) dropped. Calculation shows that the non-marginal negative change equals to 18.5%, which corresponds with the simple calculation under the assumption of a lower economic output. This decline certifies the fact that Slovakia is strongly dependent on the import of mineral oils and their lack causes extensive depression. An even stronger decrease, by more than 20%, was observed in the total production (P). This signalizes close tie-up between production and the mineral oil resource. Due to the drop in production, unemployment (LU) rose more than twice, which correspondences to job losses of more than 440 thousand (TL). Nevertheless, average wage rose slightly (1.4%). A huge drop in labor demand caused overall drop in the total income of households (M_Cons) by more than 14%. The worst impact on consumption took place

---

[15] Elasticity of substitution between labour and capital in value added factors is low in the sector of electricity production, and services (0.2 – 0.3). In the remaining industries elasticity varies between 0.6 and 0.9.

[16] We have calibrated the elasticities in the Armington concept by the CGE model used in the National strategic reference framework (NSRR), with low elasticity in the sectors of mining, construction and services.

[17] The share estimation is based on source provided by Statistical Bureau of Slovak Republic.

in the sector of enterprises, whose total income (M_Ent) fell almost to one half due to investment decline.

Structural adjustments

Structural production by sectors points out a drop in every industry. It is highest in sectors of construction (32.8%) and heavy industry (26.9%) which includes car industry. To which the Slovak economy is strongly tied. We have to keep in mind that we calibrated CGE model using data for 2005 when 2 out of 3 major automotive producers were not yet working in Slovakia[18]. Therefore the presented figures have to be viewed as lower bound estimates for Slovakia. On the other side, expected structural changes in Slovak industry sector during last four years are much lower than during transformation period in early 90-ties.

Table 2: Impact of supply shock in mining sector on production (P), structured by industries, mil. Euro (reference year 2005)

	agriculture	mining	heavy industry	light industry	power industry	construction	services	total
benchmark production	112,1	13,4	545,0	738,2	226,8	270,7	1 422,8	3 329,0
% of total (benchmak)	*3,4%*	*0,4%*	*16,4%*	*22,2%*	*6,8%*	*8,1%*	*42,7%*	*100,0%*
production	93,5	10,4	398,2	618,7	189,4	181,9	1 164,7	2 656,6
% of total	*3,5%*	*0,4%*	*15,0%*	*23,3%*	*7,1%*	*6,8%*	*43,8%*	*100,0%*
% change(drop) compared to reference year	*-16,7%*	*-22,8%*	*-26,9%*	*-16,2%*	*-16,5%*	*-32,8%*	*-18,1%*	*-20,2%*

Source: SR National Accounts, 2005; Model calculations

Chart 1: Impact of supply shock in mining sector on production (P), structured by industries, mil. Euro (reference year 2005)
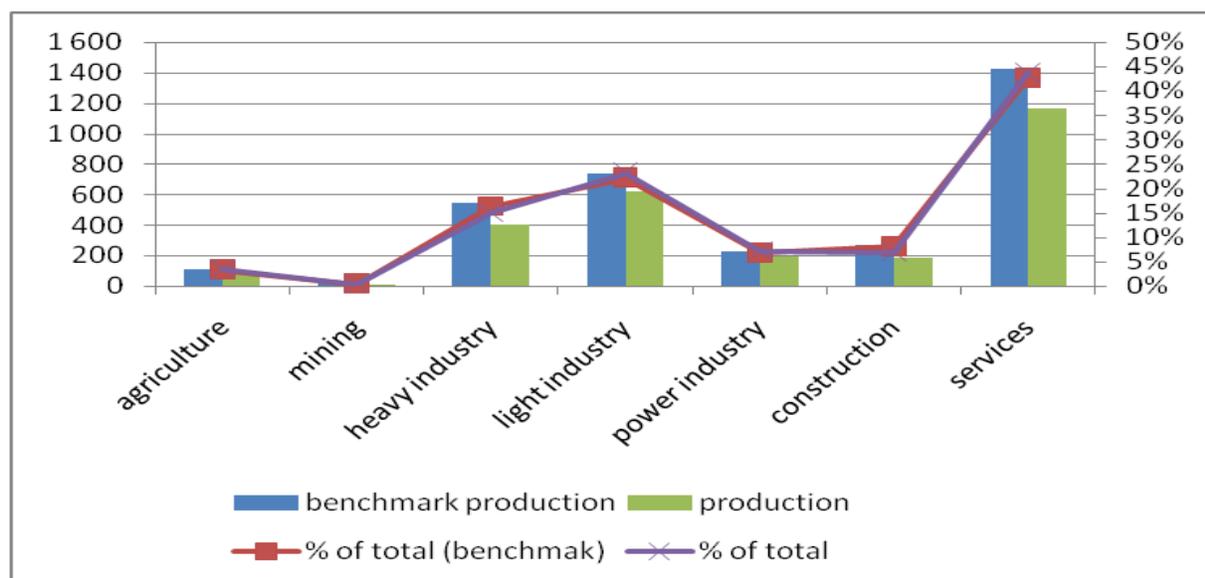
Source: SR National Accounts, 2005; Model calculations

---

[18] At present Slovak statistical bureau published supply and use tables from year 2005.

In the labor market the most remarkable structural change appears in the sector which employs the most people – the sector of services. Due to lower production, demand for employees dropped from the reference 1241 thousand to 1014 thousand (by over 200 thousand). However, the highest percentage fall (similarly to production) take place in sectors of construction (33%) and heavy industry (27%).

Table 2: Impact of supply shock in mining sector on labor (TL), structured by industries, thousand employees (reference year 2005)

	agriculture	mining	heavy industry	light industry	power industry	construction	services	total
benchmark labour	105,1	14,7	206,3	385,5	42,6	209,8	1 241,3	2 205,3
% of total (benchmark)	4,8%	0,7%	9,4%	17,5%	1,9%	9,5%	56,3%	100,0%
labour	105,0	14,1	200,1	388,3	42,6	209,9	1 238,0	2 198,0
% of total	4,8%	0,6%	9,1%	17,7%	1,9%	9,5%	56,3%	100,0%
drop	-0,1%	-3,9%	-3,0%	0,7%	0,0%	0,0%	-0,3%	-0,3%

Source: Slovak statistical bureau, 2005; Model calculations

Chart 2: Impact of supply shock in mining sector on labor (TL), structured by industries, thousand employees (reference year 2005)
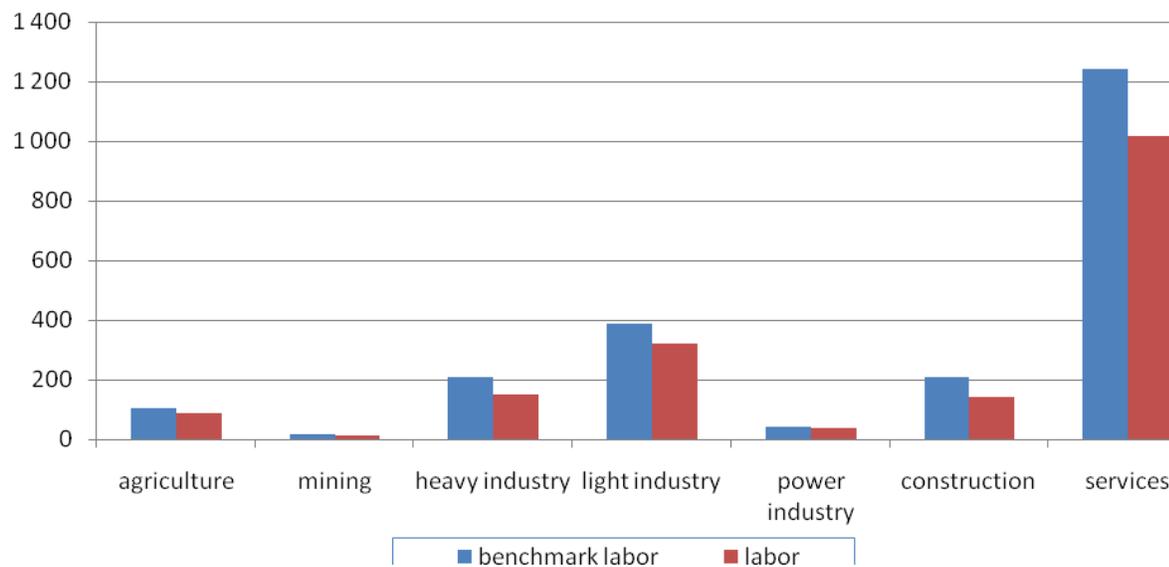
Source: SR National Accounts, 2005; Model calculations

Parameter changes

In this section we analyze the model outputs by changing imported shares (parameter α_j) in the mining sector. We focus on different gas cut-offs corresponding to 1/12 (8.5%, month), 1/3 (33%), 2/3 (66%), 3/3 (100%) drop of imported gas. Zero percent of gas import drop represents the value of import from the reference (benchmark) year 2005. Impact on key macroeconomic indicators can be seen in the following table:

Table 3: Impact of supply disturbance in mining sector on key macroeconomic indicators by changing failure of imported gas

|		Gas supply reduction, % of total year supply				
		0%	8,5%	33%	66%	100%
GDP	mil Euro	49 315	49 326	45 071	40 168	36 268
% change compared to reference year			*0,0%*	*-8,6%*	*-18,5%*	*-26,5%*
P	mil Euro	110 503	110 038	100 077	88 183	78 808
% change compared to reference year			*-0,4%*	*-9,4%*	*-20,2%*	*-28,7%*
M_Cons	mil Euro	30 310	30 321	28 290	25 932	24 043
% change compared to reference year			*0,0%*	*-6,7%*	*-14,4%*	*-20,7%*
M_Ent	mil Euro	7 789	7 807	6 287	4 565	3 201
% change compared to reference year			*0,2%*	*-19,3%*	*-41,4%*	*-58,9%*
TL	thousand of people	2 205	2 198	1 997	1 761	1 575
% change compared to reference year			*-0,3%*	*-9,4%*	*-20,2%*	*-28,6%*
LU	thousand of people	428	435	636	872	1 057
% change compared to reference year			*1,7%*	*48,7%*	*104,0%*	*147,4%*

Source: SR National Accounts, 2005; Model calculations

The lowest value 8,5% of the supply drop results in marginal changes in comparison to the reference year (column 0% of gas failure in Table 3). As expected, the production and the GDP indicators of the Slovak economy would not suffer significantly because of substitution between alternative sources[19] and the use of national reserves. Total labor drops slightly because of decline of demand in the sector of services employing most labour and the sector of heavy industry and mining. Households' income does not change significantly; on the other hand income of financial and non-financial enterprises grows slightly because of the more difficult access to capital[20].

Chart 3: Comparison of GDP decline and decline of household's income by different failure of imported gas, mil. Euro

---

[19] Alternative sources are represented by calibrated substitution between imported production and domestic production in mining sector.
[20] Model abstracts from bank sector policy (prospective problems with bad loans).
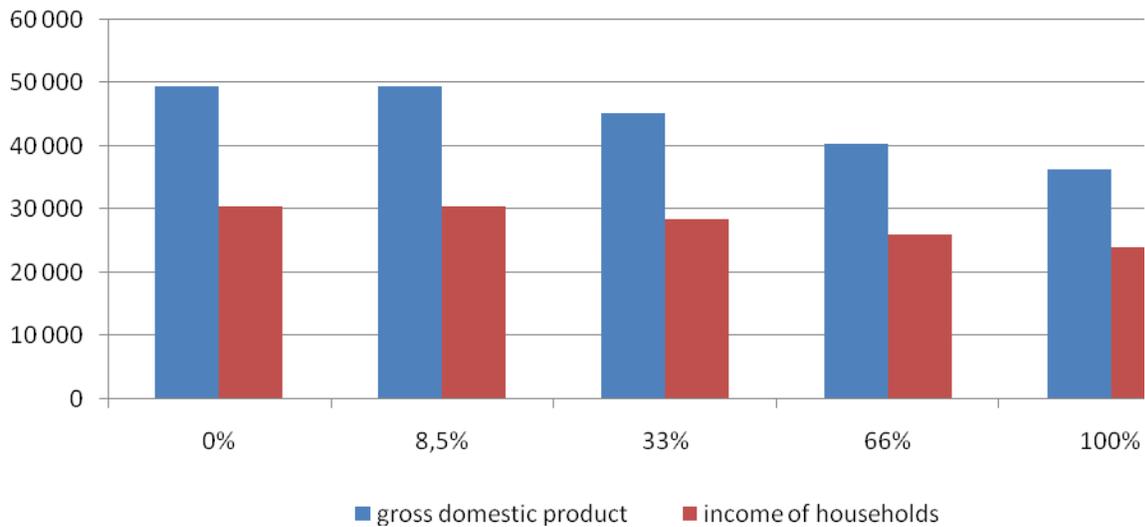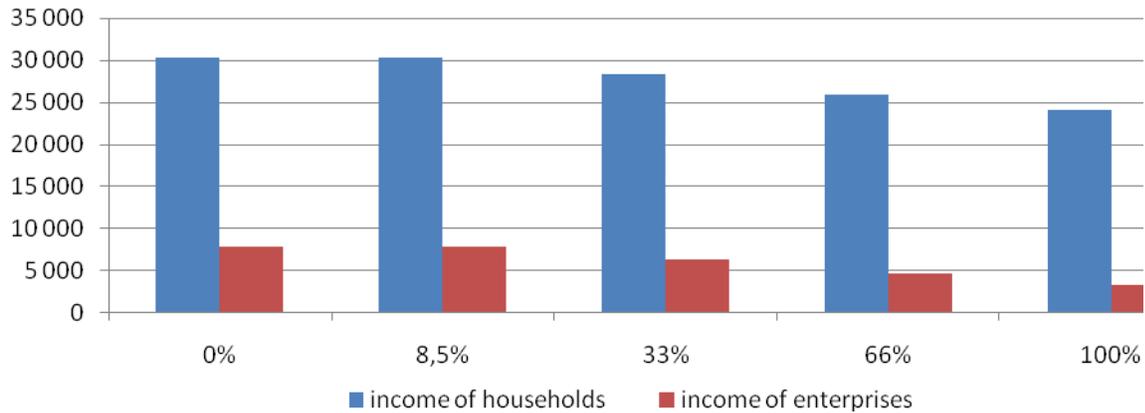
Source: SR National Accounts, 2005; Model calculations
Comment: 0% scenario represents benchmark value

The worse scenario is a result of 100% failure of gas import. As a consequence of overall decline in each industry, total production decreases by 28,7%. GDP decreases by 26,5% because of a drop in both its parts – domestic demand and foreign demand. Domestic demand is drawn by households consumption, which is cut by lower income (20,7% decrease). A comparison of the sequence of GDP and households income drops is seen in Chart 3. We can see that households' income falls slower than GDP, which is caused by the direct and indirect multiplicative effect[21] of cut import. Enterprises notice the strongest fall in their income (58,9% decrease) through decreased investment demand. In comparison with the sector of households we notice that enterprises suffer evidently from gas crisis more (Chart 4). This can be explained by higher fixed capital consumption. Situation on the labor market is critical as well, because enterprises are able to employ over 600 thousand of labor less compared to the reference year 2005 only.

Chart 4: Comparison of household's income decline and enterprises income decline by different failure of imported gas, mil. Euro

---

[21] We understand by multiplicative effect iterations in optimizing process, that calculate new equilibrium values of endogenous variables.

Source: SR National Accounts, 2005; Model calculations
Comment: 0% scenario represents benchmark value

The scenario with estimated drop by two thirds in Slovakia's gas import (column 66% of gas failure in Table 3) is approximately two times worse than for the drop by one third (column 33% of gas failure in Table 3) in every of the listed macroeconomic indicators. We can see here that a trend of overall worsening is non-linear and therefore particular results depend on exact estimation of gas supply failure.

Discussion about possible difficulties

To construct our CGE model we faced exogenous interventions. For example the parameters of elasticities in the production function for each of the sectors *i* had to be calibrated. This calibration and the choice of the proper estimation method is a matter of discussion. We can also dispute the data from the Input-Output table and their appropriate reflection of energetic difficulty in intermediate consumption among industries.

In spite of the possible discussion and open questions about exogenous parameters, the results from the simulations signalize, that our economy might fall into long depression.

Overall discussion

Our overall estimation of short term drop based on first calculations might represent a 0.6-0.7 percentage point slowdown in GDP growth compared to previous forecasts. Actual total losses were even smaller because of the influence of the economic crisis[22].

Early expectations were losses in production of GDP of about 3 bill. SKK (100 mil. Euro) per day, which means about 0,14 % of the GDP growth in the long term. The short term losses could be

---

[22] Absolute effect of global crisis on GDP of Slovakia is nearly 11 percent. Pre crisis estimation of 2009 GDP growth was around 6,4 %, current estimations are about -4,5 %.

compensated by later production increases and the expected losses were about 1/3 of the original production reductions (33-37 mil. Euro per day).

The long term effects of a permanent reduction of gas deliveries are modeled in four scenarios and are quantified up to a drop of GDP by 25%, a drop of production by 30% and very high unemployment increased to the 40% level (in the extreme way). Such a depression in Slovakia would be comparable to situation in the beginning of the 90s (during 1991 unemployment rate rose from almost zero to 12 % (almost 300 thousand)) in Slovakia or to the effects of the oil price crisis in the 70s.

Fortunately, after 13 days gas supply was started. The shortfalls in production of particular businesses could be difficult to quantify because they have different levels of gas dependences and the individual structures of their production. At the same time, it is widely known that some companies were violating the degree 8 supply restrictions and used gas in larger amounts despite the regulations. Some of the companies will have to pay penalties for violating their consumer contracts. Because of the simultaneous effect of the financial crisis and falling foreign demand for Slovak goods, the country has not felt the full impact of limited gas supplies, since most of the affected companies were not working at full capacity even before supplies were cut. The short term losses were only partially (by approximately two thirds) compensated by production increasing in further period.

This case illustrate, that if economy is working bellow potential level, real negative effects of short-term outage are really low and losses can be compensated in next period. More important is negative effects in trust and suppliers confidence. These shortages on gas supplies from Russia were reality despite valid long-term contracts about gas supply. Gas and other resources dependency can be used as advantage and instrument of negotiation by third country (in this case Ukraine). The only solution for the future is diversification of sources, establishment of strategic reserves for the case of shortage and the use of alternative routes.

Conclusions

The present paper discusses effects of gas supply failure on a small open economy. The impacts of interruption of gas transport from Russia through Ukraine into Central and Western Europe, which occurred in January of 2009, showed the necessity to quantify effects of such gas crisis on affected countries.

We demonstrate the use of CGE (Computable General Equilibrium) model on the example of Slovakia and we discuss the results based on production loss per one day of the gas crises. A disaggregated view is an advantage of the CGE models. Shortage of gas is a good example of supply shock which can serve as an example for this type of general equilibrium models. The disadvantage of CGE models is lack of dynamics in the process of transfer to the new equilibrium.

Application of CGE model on simulation of potential macroeconomic effects of permanent interruption of gas import from Russia are consistent with later developments. The results are similar to the estimates of daily GDP loses. Appropriate CGE scenarios allow estimating effective volumes of

investments into gas sources diversification and potential impacts on individual sectors of economy in a specific country. The model also shows that the effects are not equal in all sectors of the economy.

One of the key factors will be the attitude of the European Union to negotiations with Russia and Ukraine in the future. The European Union must be more involved in energetic safety of member states. The key question for energy policy will by also secure the energetic safety of small open countries without own natural resources by setting of mandatory reserves of key resources. The key factor is diversification of foreign sources and an increase of strategic reserves of natural gas and oil. Secondary, a threat for Slovakia is represented by the supply of electric energy as well, because after the decrease of the share of nuclear energy in Slovakia, more energy has to be provided via gas and oil plants. The problem of energy and natural resources strategy is not trivial, and any interruption of steady supply could result to significant losses on national economies. Additionally as real situation shows, gas strategic reserves differs from oil. If they are needed, they have to be transported to all regions, which could be problematic without adjusted infrastructure.

Literature

[1]   Ukraine Energy policy review 2006, OECD/International Energy Agency, France, 2006, ISBN: 92-64-10991-9, 379 pages

[2]   Energy, transport and environment indicators, Eurostat, 2008, ISSN 1725-456

[3]   Council directive 98/93/ES from 14 December 1998 imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/or petroleum products

[4]   Council Directive 2004/67/EC of 26 April 2004 concerning measures to safeguard security of natural gas supply

[5]   Modernization of Macroeconomic Forecasting as a Basis for Efficient Budgeting in Ukraine: Juraj Renčko, Viliam Páleník, Tomáš Domonkos, Vladimír Kvetan, Martin Mlýnek, Lucia Pániková, Marek Radvanský; ISBN number: 978-966-8274-15-2, Kiev – 2008

[6]   Theory of static and dynamic CGE models: Stanislav Sekereš; Faculty of Mathematics Physics and Informatics,   Comenius   University   in   Bratislava,   diploma   work,   2006 http://www.iam.fmph.uniba.sk/studium/efm/diplomovky/2006/sekeres/diplomovka.pdf

 [7]   World Oil and Gas Review, ENI, 2008, www.eni.com