



## Annex 3 – Macroeconomic impact of selected structural reforms

In 2010, EU presented the Europe 2020 strategy, the main objective of which is to achieve a prosperous sustainable economy. Europe 2020 has set seven targets which all Member States undertake to meet:<sup>1</sup> increase employment, gross domestic expenditure on R&D, share of tertiary education attainment, proportion of energy from renewable resources, energy efficiency, decrease the volume of greenhouse gases, school drop-out rate and the number of people at risk of poverty. Every Member State has set its own national targets which it would like to meet until 2020.

Policies promoting growth and creation of jobs also raise the issue of assessment of their impacts. It is natural that there is an effort to reflect the economic reality in mathematical equations which would explain it in the most reliable manner. In addition to common macroeconomic models, the so-called Dynamic Stochastic General Equilibrium (DSGE) models are used to simulate reforms. They are dynamic because they examine the development of economy in time. Shocks in the model may be random (stochastic) and their main principle – and at the same time difference, when compared to common models – is the fact that DSGEs are based on microeconomic bases. They use the principle of general equilibrium, while they examine individual markets and behaviour of individual agents in economy. They are mainly used to simulate shocks or for forecasting.

Structural measures respond to the need to revive economy and ensure its long-term growth. In general, it is quite demanding to quantify the impact of structural reforms on the economy. Selected reforms from NRP, connected to the variables of the model itself, form the basis for the simulation. They include structural reforms in regional education, business environment and in the labour market. Such measures have been selected which are included in NRP and which may also be reflected in the model through a shock (exogenous) variable. We simulate each reform in several scenarios, resulting in a scale of possibilities, from conservative to optimistic ones. We expect each reform to be implemented gradually in the course of 5 years (except for the scenario which includes a regional education reform). The list of simulated measures: 1) education of children from socially vulnerable environment; 2) decreasing entrance barriers for starting a business; and 3) increasing competition together with a variable in the model affected by it, is shown in the Table.

List of structural reforms matched to the variables in the Quest III model		
Measure contained in NRP	Area	Description of the variable implemented as a shock
1. Education of children from socially vulnerable environment and MRC	Regional education system	Shift of the share of low-qualified population (SL) to medium-qualified population (SM)
2. Decreasing entrance barriers for starting a business	Domestic market	Decreasing entry costs (FCA)
3. Increasing competition (final product market)	Domestic market	Decreasing the mark-up in the final product market( $\varepsilon_{ETA}$ )

The outcomes of structural reforms come delayed. However all reforms in the model are simulated as a permanent shock, i.e. a change of the steady state, as it represents the nature of structural changes better. Model outputs have the form of an IR function (Impulse response function), i.e. they present a percentage deviation from the steady state. The resulting number represents a percentage contribution of the reform itself compared to the no-policy-change scenario in the particular year. The sum of all contributions until the year would thus represent a total contribution of the reform from the current condition at constant prices. Simulations in two cases (education of children from socially vulnerable environment and increasing the competition) are supported by outcomes from two different models.

<sup>1</sup> The list of Europe 2020 objectives for Slovakia as well as for other Member States is available in NRP or on [http://ec.europa.eu/europe2020/pdf/targets\\_en.pdf](http://ec.europa.eu/europe2020/pdf/targets_en.pdf)



In line with the NRP idea as well as the Europe 2020 strategy, emphasis is mainly laid on monitoring the GDP and other decisive macroeconomic indicators dynamics change. There is also motivation to watch EU 2020 indicators (employment, expenditures on science and research) within the model variables.

### **Quest III and MUSE models**

Simulations from the DSGE model of the European Commission – Quest III – are used to estimate the impacts of the reforms and with some measures are used also simulations from the DSGE model of the National Bank of Slovakia – MUSE.

QUEST III<sup>2</sup> is an open economy model suitable to quantify the impacts of structural reforms. It includes households divided into three groups, based on the education. Companies in the intermediate product market and in the final product market are subject to monopolistic competition. The area of science and research produces new patents based on the stocks of the existing patents both at home and abroad. These represent inputs for companies in the intermediate product market. The government has fiscal instruments in the form of taxes, tax credits, subsidies and contributions. The Central Bank controls the currency policy. The domestic economy is able to trade final and intermediate products with foreign countries. The model is calibrated for all EU Member States. The version calibrated for Slovakia is used for the model purposes.

The Central Bank model – MUSE<sup>3</sup> – consists of two blocks: domestic economy (Slovakia) and foreign countries (the rest of the euro area). The model can work in two modes: one with an autonomous currency and its own monetary policy (it simulates the situation in Slovakia before joining the euro area), the second one with a common currency and a single central bank (ECB). There are households, two types of companies (final and intermediate production) and a central bank in each block of countries.

## **1. Regional education reform**

Accumulation of human capital has a significant impact on production growth. The notion of 'human capital' involves a set of competencies, knowledge, social and personality skills (including creativity) necessary for a person to produce economic value when performing his/her work. Those employees who own human capital of higher quality have a higher output. Another reason why to invest in education is to create a positive externality, in addition to increasing the quality of the human potential. It may be understood so that increasing the qualification of one person conditions increasing the qualification of others.

### **Reforms in regional education in Slovakia according to NRP**

The Slovak educational system has a tendency to auto-reproduce education – children copy the achieved level of education of their parents. In such school system children from socially weaker groups, particularly from marginalized communities, have a low chance to achieve a higher level of education. This is the reason why the "Education of marginalized groups" project has been implemented. Education towards inclusion of marginalized Roma communities is carried out as a part of the project, as well as education of pedagogues to be able to work with problematic children and innovation of old textbooks and creation of new ones. The project is mainly intended for children at primary schools (aged 6 – 15), but is partially covers also pre-primary education within the "Inclusive model of education at pre-primary level of school system". The project also involves a day-long educational system operational at primary schools with at least 20% participation of pupils from socially vulnerable environment. Pupils thus do leisure-time educational activities in the afternoon. Various forms of education and participation of children in pre-primary education in kindergartens are ensured. The number of assistant teachers who work with these pupils is increasing. An important aspect related to improving the quality

<sup>2</sup> More details about the model can be found in: Roeger W., Varga J., Veld J.: "Structural Reforms in the EU: A simulation-based analysis using the QUEST model with endogenous growth", Economic Papers 351, December 2008

<sup>3</sup> Matúš Senaj, Milan Výškrabka, Juraj Zeman: "MUSE: Monetary Union and Slovak economy model"; available on [http://www.nbs.sk/\\_img/Documents/PUBLIK/WP\\_1-2010.pdf](http://www.nbs.sk/_img/Documents/PUBLIK/WP_1-2010.pdf)



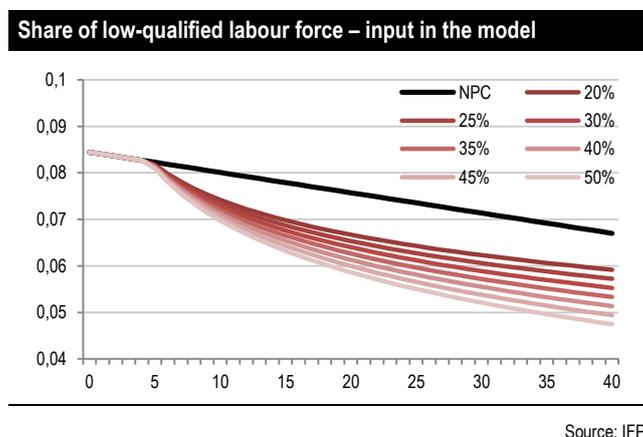
of education is increasing the wages of teachers. These measures have an ambition to achieve that a larger part of children from marginalized Roma communities is competent to proceed to a higher level of education.

### Transmission channel in the model

The model distinguishes three kinds of labour force according to the achieved level of education<sup>4</sup>: low-, medium- and high-skilled. Implementation of the measures from NRP in the regional education is simulated in the model **as a shift of a part of the share of low-skilled labour force to medium-skilled**. Participants in the labour market with low qualification are people with the achieved education at the level ISCED 0 – 2, representing education with no school-leaving-exam certificate. Implementation of the measures may help decrease the share of low-skilled labour force what will then be reflected in increasing the share of the medium-qualified. The target group of the reforms are socially vulnerable groups, marginalized Roma communities as well as such children where it is very likely that they will have the tendency to copy the weak education of their parents.

### Model approach and assumptions

Currently the share of low-skilled population in Slovakia is 8.4%<sup>5</sup>. The share of high-skilled population is 5.9%<sup>6</sup> and the rest is medium-skilled labour force at the level of 85.7%. The current school system (without any reform) decreases the share of low-qualified ones. The share of 20 – 24 year-old low-educated people is 6.7%, what we will consider to be an estimate of the share of low-educated persons in 40 years. Since the share of educational categories is constant in the steady state throughout the whole time period in the model, we will simulate this development and we will consider it to be a NPC scenario ("no policy change"). Our NPC scenario will decrease the share of the low-educated in the time period of 40 years from the current 8.4% to 6.7%. We consider a cross-section of several arbitrary scenarios according to the success of the reform from a conservative (20%) up to an optimistic (50%) one.



The reform affects children mainly at primary schools (students' age profile: 5 – 14). The forecast of the development of the Roma population (*Infostat, 2002*) and the demographic development of the whole population determines the potentially marginalized children whose education may be improved. A conservative scenario (success rate 20%) means that out of the total initial number of 83,000<sup>7</sup> of Roma children aged 5 – 14 (*Infostat, 2002*), 20% will increase their qualification within 40 years to the level of medium-educated ones thanks to the reform. Analogically, the optimistic scenario (success rate 50%) says that 50% of the equal total number of children will increase their qualification. In the conservative scenario the share of low-educated will decrease to 5.9% in 40 years (16,600 of children represent decreasing the share by 0.8% compared to NPC) up to the optimistic one where the share of the low-educated will only be 4.7% (41,500 of children represent a drop in the

<sup>4</sup> Division into categories according to the achieved education is shown in the age cohort of 24 – 64 years.

<sup>5</sup> Population educational shares set in the model are based on Eurostat data.

<sup>6</sup> Highly-qualified labour force in the model is represented by people with tertiary education who have a potential to find employment in the technical area or in natural sciences in the area of science and research.

<sup>7</sup> Infostat Forecast, the medium variant, is used for the development of the Roma population.



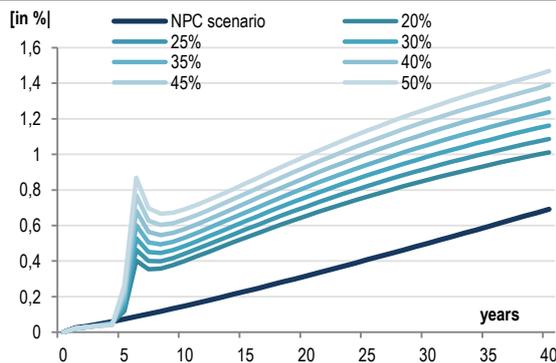
share by 2% compared to NPC). The chart above displays the development of the share of the low-educated in time for all success variants, what is at the same time an input in the model.

The reform is based on primary school students. We expect that the number of children whom the reform will affect will start changing only after a certain time. First trained people will start coming to the labour market after 5 years at the earliest. At the beginning of the school reform we expect that the share of the low-educated will be decreasing more significantly. On the contrary, the decrease will be smaller after a certain time. We therefore estimate the development by a logistic curve so that after 40 years the share of the low-educated amounts to the target value from the conservative scenario (5.9%) up to the optimistic scenario (4.7%).

### Outcomes – Quest III

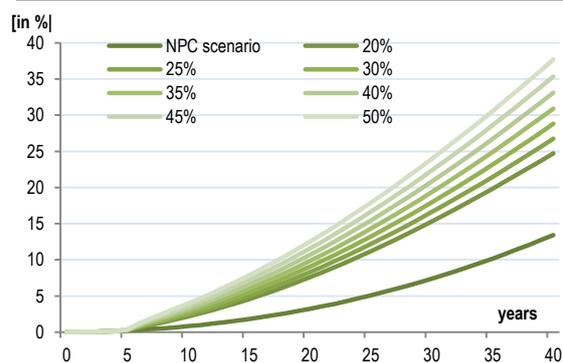
The outcomes of the education reform will be demonstrated only after 5 years since its implementation. Investments in human capital have positive impacts on all major macroeconomic indicators. Already in the fifth year since implementation of the reform, the contribution of the reform to GDP would be 0.05% in the conservative variant (20% of the children with qualification of the medium-educated) up to 0.19% in the optimistic variant (50% of the children with qualification of the medium-educated). From the long-term point of view, the effect of the reform significantly graduates and increases each year. E.g. in the 20th year after the reform, the GDP will be higher by 0.34 – 0.67% thanks to the measure. Cumulatively it is a contribution of 4.4 – 9.3%, in the 40th year even by 0.32 – 0.78% (cumulatively 11.3 – 24.3%).

Annual GDP contribution to decreasing the share of the low-skilled



Source: IFP, Quest III

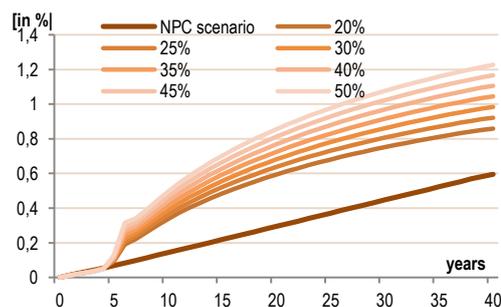
Cumulative GDP contribution in decreasing the share of the low-skilled



Source: IFP, Quest III

Neither private consumption nor investments are significantly affected in this kind of reform. The reform will bring slightly higher contributions also in employment which will be higher by 0.02 – 0.06% in the fifth year. **In the 20th year employment will be higher by 0.3 p.p. – 0.56 p.p. and in the 40th year this difference compared to the NPC scenario represented 0.26 p.p. – 0.63 p.p.**

Annual emp. contribution to decreasing the share of the low-skilled



Source: IFP, Quest III



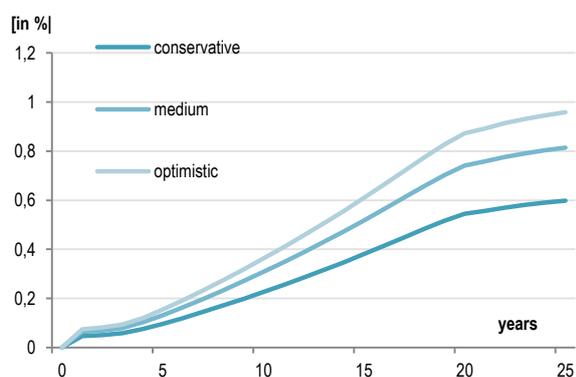
### Outcomes – MUSE

The impact on investments in regional education is simulated in the QUEST model. These investments will cause a higher migration of labour force from the low-qualified to the medium-qualified level, increasing the growth of accumulation of the human capital which will boost the potential of the growth of the economy potential in the long run.

The MUSE model counts with a homogeneous labour force and thus an equal simulation cannot be repeated. However, a similar situation may be simulated with a shock in the variable representing the technological progress (appearing in the production function equation).

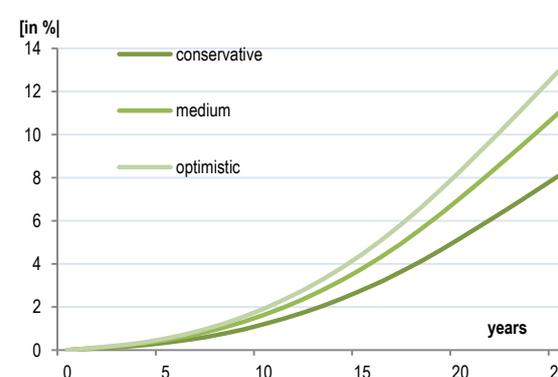
Technological progress is exposed to a series of positive shocks with an effect in the period from 0 years (when the investment starts to be manifested in the labour market) to 20 years which cause a labour productivity increase comparable to the productivity increase observed in the QUEST simulation (conservative, medium and optimistic scenario) of further education of children.

**Annual GDP contribution to increase productivity**



Source: NBS, MUSE

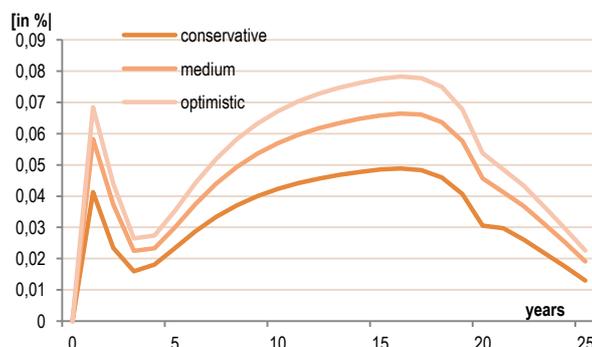
**Cumulative GDP contribution in increasing productivity**



Source: NBS, MUSE

In the tenth year, the reform contribution would be 0.23 – 0.36% (0.25 – 0.54% in Quest) and in the 20th year 0.54 – 0.87% (0.34 – 0.67%), representing a higher estimate than in the output from the Quest model. After 20 years, it cumulatively represents the contribution of 5.2 – 8.3% (4.37 – 9.29%). From the long-term point of view, the effect of this reform graduates in this model situation as well. Employment benefits are small and represent the values from 0.01 – 0.08 (in a Quest estimate the contribution of over 0.61% can be achieved in the same period in the optimistic scenario) in the period of 25 years.

**Annual employment contribution to increase productivity**



Source: NBS, MUSE



## 2. Decreasing entrance barriers

High-quality business environment has a significant impact on the stability and competitiveness of the economy, inflow of investments and establishment of new companies. In end effect, it has a positive effect on wages, employment, GDP growth and an overall prosperity of the economy.

### **Reforms decreasing the entrance barriers for companies in Slovakia according to NRP**

Barriers to starting a business may be financial (costs of starting a business) but also administrative (number of actions and the time necessary to start a business). According to a World Bank report (*Doing Business, 2014*), Slovakia is currently ranked in the 49th place in business environment evaluation and it has been going down for several consecutive years. In the "Starting a business" sub-category, we are ranked in the 108th place<sup>8</sup> out of the 189 evaluated countries in total. There is thus a considerable room to improve the business environment in Slovakia.

The government will implement measures to decrease the administrative burden mainly in relation to establishing a business company, collecting taxes and cross-border trade. The administratively difficult procedure of repayment of the monetary deposit to the registered capital before establishment of the company will be simplified and the amount of registered capital will be reassessed. The quality of the rules for registration will increase towards a more frequent use of electronic services, and measures will be adopted to use electronic payments (settlements of fees by credit cards). Measures will be implemented to increase the quality in electronic communication (Electronic Case File, Legal Code, Registry of Insolvent Entities and Register of Disqualified Persons) and cooperation among individual public administration bodies. Assessment of impacts of the new and the existing legislation will improve, regulation will loosen and awareness of companies will improve.

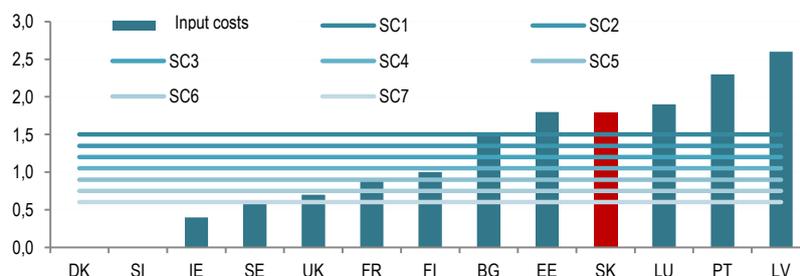
### **Transmission channel in the model**

Decrease in input costs facilitates the entrance of new companies in the market. Decreasing entrance barriers cuts the initial fixed costs of companies. The  $FC_A$  variable enters directly in the corporate profit function. Savings for companies are only one-off, therefore we do not expect a significant long-term impact on the economy in this respect. The following increase of competition brings a higher demand for innovation and increasing expenditures in science and research.

### **Model approach and assumptions**

In terms of costs of starting a business, Slovakia is the 9th best together with Estonia compared to EU27 countries. In order to estimate the impacts of this reform, we will use the benchmarking approach of catching up the countries which are ahead of us. The chart below displays the level of individual scenarios.

**Scenarios of decreasing input costs (costs as a proportion of GDP per capita, in %)**



Note: The chart displays 13 countries with the lowest costs for starting a business from among EU27. Source: *Doing business 2012*

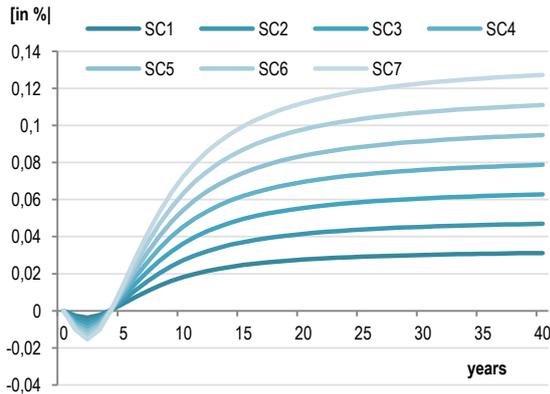
<sup>8</sup> The "Starting a business" sub-category is composed of three components: number of procedures (7), number of days (18.5) and costs as % of income per capita (1.5).



The conservative scenario (SC1) will decrease the value of input costs to the level of the country which is right ahead of us in the comparison (Bulgaria). On the other hand, the optimistic scenario expects us to get to the 5th position among the countries with the lowest input costs (the chart above). We expect a full implementation to take 5 years. In this period the value  $FC_A$  decreases gradually linearly. After the implementation period, the level of registered capital remains at a new value changed by the measure.

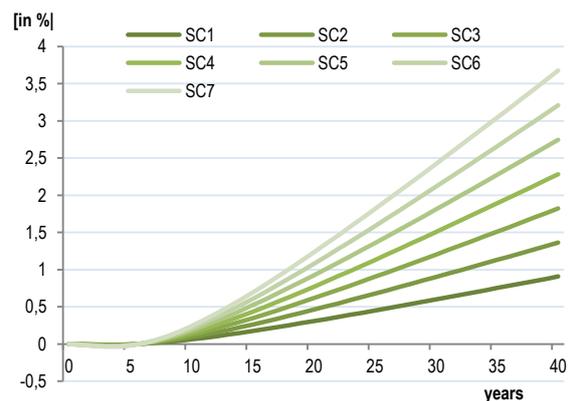
### Outcomes

Annual GDP contribution to decrease input costs



Source: IFP, Quest III

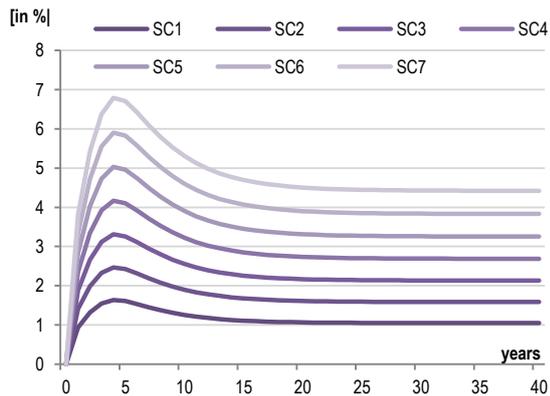
Cumulative GDP contribution in decreasing input costs



Source: IFP, Quest III

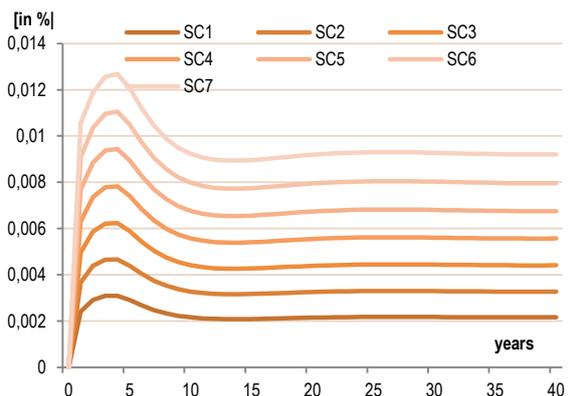
The contribution to growth and employment is smaller compared to other reforms. On the other hand, this measure has a significant positive impact on expenditures on research and development (R&D) (the chart below). These may annually increase by 1.6 – 6.7% in the first five years, compared to the scenario without the reform implemented. In the long run it is 1 – 4.4%.

Annual contribution of expenditures on R&D to decrease input costs



Source: IFP, Quest III

Annual contribution of employment to decrease input costs



Source: IFP, Quest III

### 3. Increasing competition in the final product market

Monopolies and favouritism of certain business entities distorts the competitive environment considerably. On the contrary, higher competition pushes the prices down, increases the quality of services and promotes innovative approaches in business.



### Reforms to enhance competition in Slovakia according to NRP

The Act on Energy and the Act on Regulation in Network Industries have helped increase competition mainly in the electricity and gas market. They strengthened the rights of electricity and gas consumers who may change their supplier of gas and electricity free of charge in the course of three weeks. Access of foreign companies to the gas and electricity market has also been facilitated. The act introduces complete ownership unbundling of electricity generation and supply from electricity transmission and the unbundling of gas production and supply from gas transmission using the independent transmission network operator (ITO) model. The Government will continue supporting the methods to be applied by companies in gathering, processing and publishing information on quality, fees, overall costs and unit prices. Obligatory consultations with affected entities will be introduced as well as obligatory analyses of alternative solutions, in order to achieve better regulation.

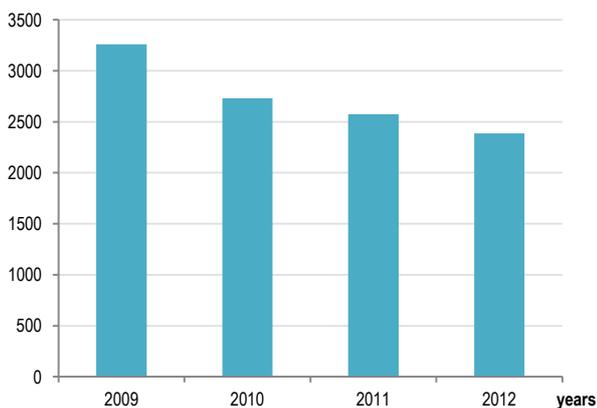
#### Transmission channel in the model

New entities in a market dominated by a monopoly lead to decreasing partial profits of the monopoly and their allocation among all participants in the market. Increased competition is commonly simulated in the model by decreasing the total mark-up in the economy.

#### Model approach and assumptions

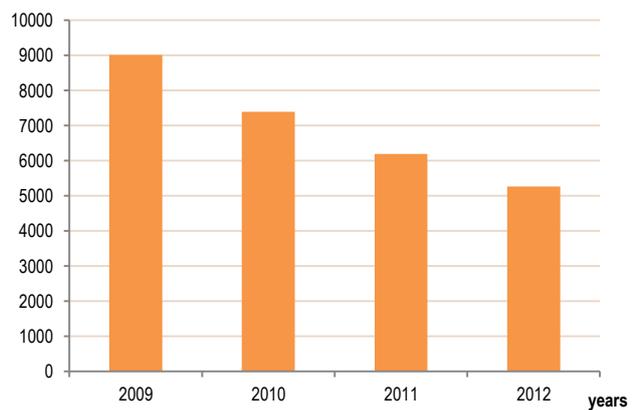
Simulated measures are related to the sale of electricity and natural gas. We may see from the Charts (below) that the concentration measured by the Herfindahl index (HHI)<sup>9</sup> in the electricity market dropped from 3,200 to 2,400 in 2009 – 2012<sup>10</sup>. It is a decrease from 9,000 to 5,000 in the gas market. In the same period the average profit mark-up dropped from approximately 13 to 8%, based on financial reports<sup>11</sup>. On the basis of the current evolution we estimate that the economic mark-up may decrease by additional 2 (conservative scenario) to 4 p.p. (optimistic scenario) in the upcoming years in relation to the adopted measures and to further strengthening of competition. We will simulate decreasing the mark-up linearly in the period of 5 years.

Concentration in the electricity sale market (HHI)



Source: IFP

Concentration in the gas sale market (HHI)



Source: IFP

For the purposes of modelling, we need to reflect the decrease of the mark-up in the energy sector in the impact of the total mark-up in the economy. As an alternative indicator of mark-up weight in the sale of gas and electricity in the total mark-up in the economy, we have used the share of the added value of this sector (approximately EUR 250 mill.) in the total added value in the economy (EUR 65 billion). The sale of electricity and gas thus

<sup>9</sup> The concentration value expresses the rate of the monopoly position in the market. 10,000 is an absolute monopoly; 0 is perfect competition

<sup>10</sup> HHI values are optically smaller for electricity as a result of existence of three regional distribution companies (contrary to one gas company). However, the concentration is significantly higher at a local level, approximately at the gas sale level.

<sup>11</sup> Based on the financial statements of companies and their market shares. The electricity – gas proportion of 1:1 is used to estimate a total mark-up.

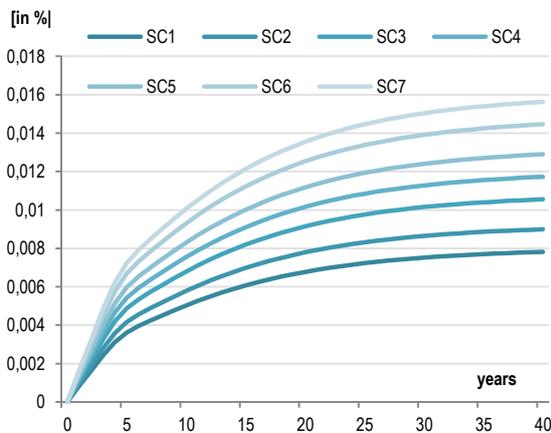


represents only 0.38% of the total added value. A decrease in the mark-up by 2 to 4 p.p. in the sector of gas and electricity sale represents a **decrease in the mark-up in the whole economy only by 0.007 – 0.015 p.p.** According to estimates (Borg, 2009), the total mark-up in the Slovak economy amounts to 28%, i.e. the simulated decrease is only marginal. These values represent a shock in the economy for marginal scenarios (conservative – optimistic).

### Outcomes – Quest III

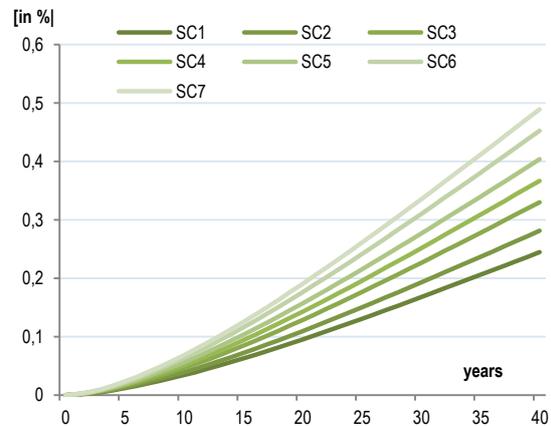
The reform annually contributes to a GDP increase only marginally. E.g. in the 20th year it is 0.007 – 0.014% and in the 40th year it is 0.008 – 0.016%. The contribution of employment in the 5th year is 0.001 – 0.003 p.p. In the following years the reform has only a slightly higher contribution, from 0.0015 – 0.0037 p.p. Low contributions are caused by a very small share in the total production of the country.

Annual GDP contribution to increasing competition



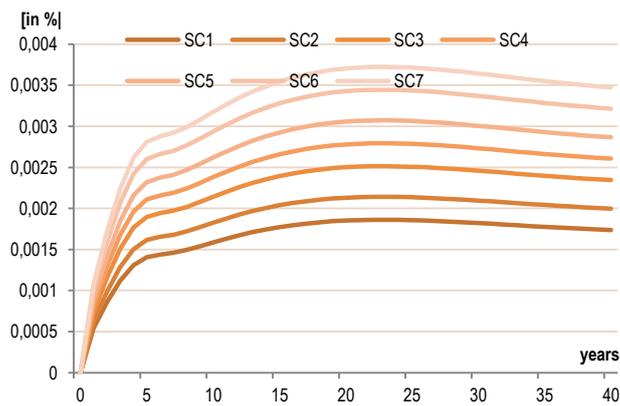
Source: IFP, Quest III

Cumulative GDP contribution in increasing competition



Source: IFP, Quest III

Annual contribution of employment to increase competition



Source: IFP, Quest III

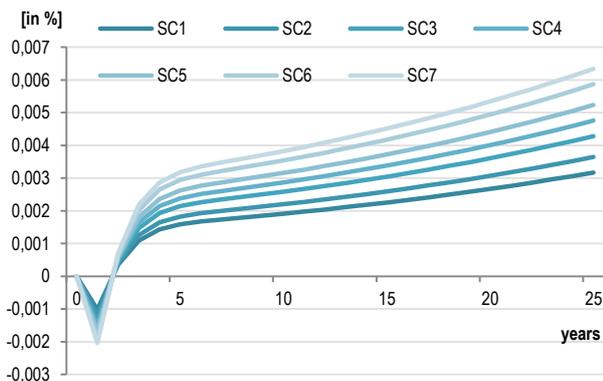
### Outcomes – MUSE

Production in the MUSE model consists of two sectors – the sector of intermediary products with a monopolistic competition and the sector of final products which is perfectly competitive. Intermediary products are a subject of trading with foreign countries; final products are consumed only in the domestic economy.



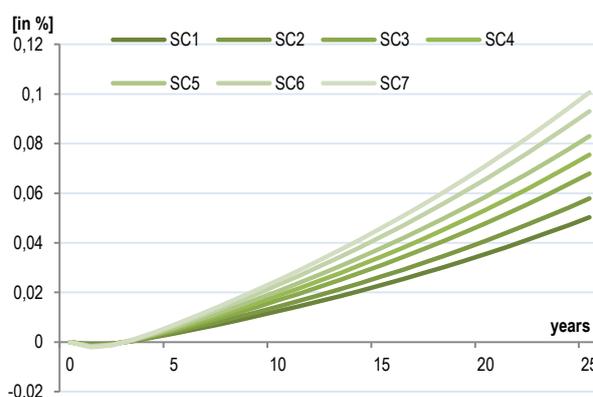
The contribution of the reform is lower in the MUSE model simulation than in the Quest III model. In the 20th year it is e.g. 0.003 – 0.005% (in Quest it is 0.007 – 0.014%) and in the 25th year it is 0.003 – 0.006 (0.007 – 0.014%). However, the differences between the models are cumulatively smaller, when the contribution for 25 years in the Quest model estimate is 0.13 – 0.26% and in the MUSE estimate it is 0.05 – 0.1%.

Annual GDP contribution to increase competition



Source: NBS, MUSE

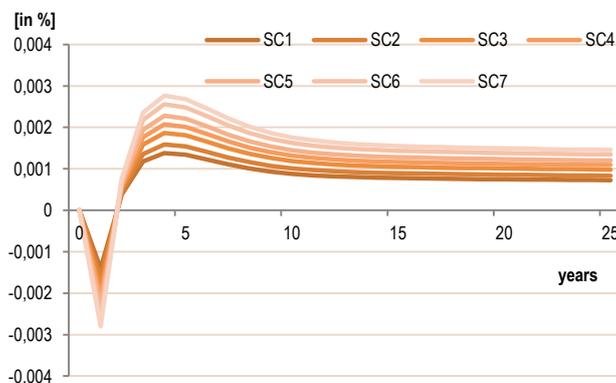
Cumulative GDP contribution in increasing competition



Source: NBS, MUSE

The contribution of employment in the 5th year is 0.001 – 0.003%. Contributions of employment in the following years are between 0.0005 – 0.0015% each year.

Annual contribution of employment to increase competition



Source: NBS, MUSE

## Conclusion

Using model approaches (Quest III and MUSE), we have estimated the impacts of measures from NRP: 1) education of children from socially disadvantaged environment; 2) decreasing entrance barriers for starting a business; and 3) increasing competition in the gas and electricity sale market. Both models were used for the measures 1) education of children from socially vulnerable environment and 3) increasing competition in the gas and electricity sale market.

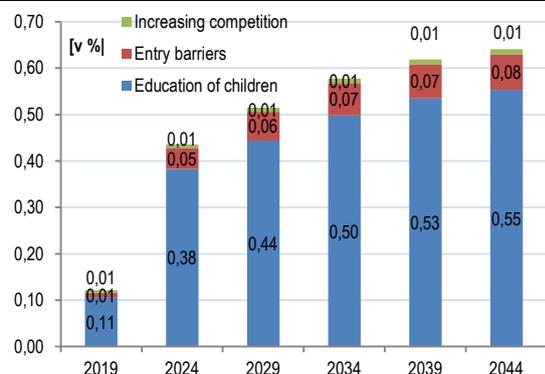
Estimates of the impact on GDP are comparable for both models. MUSE estimates a higher impact of the educational reform in the long run, while Quest III has higher contributions in the short run. Quest estimates a more significant impact in case of competition increase. Estimates of impacts on employment are very different for the educational reform. Contrary to a relatively high contribution to GDP in both models, the impact on



employment is low in the MUSE model. This is a result of different qualities of the employment variable in both models. It is good to emphasize that the educational reform is simulated through different channels in the models; therefore a mutual comparison should be only indicative.

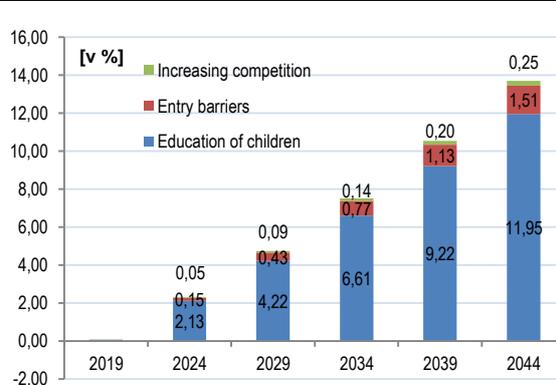
It results from the outcomes of both models that all simulated reforms have a positive impact on GDP from the medium-term and long-term perspective. We expect the most significant impact on GDP and employment in education of children – its contribution is increasing considerably from the long-term point of view. In 2019, it represents a contribution of 0.1%, in 2024 it is 0.38%, and it is increasing every year. By 2040, the cumulative contribution to GDP should be approximately 10%. The largest part of the contribution (9.2%) is represented by the reform of children education. A decrease of barriers for new businesses has a smaller impact on growth, with a cumulative contribution of 1.1% by 2040. Increasing the competition in the sale of energies has the relatively smallest contribution according to the estimates; it is caused by the focus of the measure on a narrow sector of the economy.

Annual contributions of individual reforms to GDP (medium scenario variant)



Source: Quest III simulations

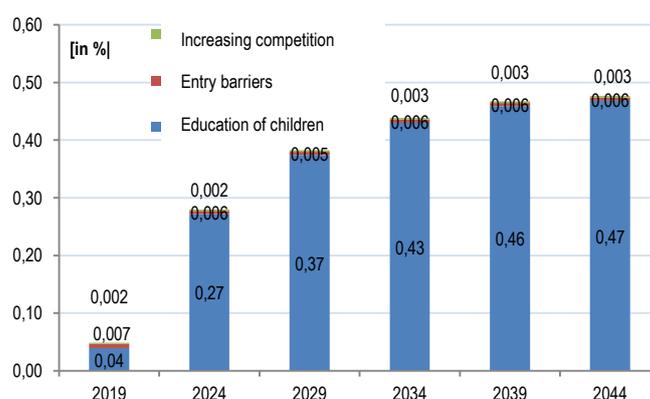
Cumulative contributions of individual reforms to GDP (medium scenario variant)



Source: Quest III simulations

The common contribution to employment in 2019 is 0.05%, with the reform of education having largest share. In 2024, the total contribution would be 0.28% (education contributing by 0.27%) and in 2034 – 2044 it would amount to 0.44 – 0.48%; out of that the school reform amounts to 0.43 – 0.47%. Increasing the competition and decreasing entrance barriers contribute significantly less in the same period, amounting to 0.003 and 0.006%.

Contributions of the reforms to employment (medium scenario variant)



Source: Quest III simulations