inštitút finančnej politiky

Ministerstvo financií SR / www.finance.gov.sk/ifp

Macroeconomic Effects of Employing Socially Excluded Communities in Slovakia

January 2023

Abstract

In this paper, we construct a computable general equilibrium model of the Slovak economy to evaluate a potential impact of different types of active labour market policies on an economic performance, with a focus on the activation works and the inclusive programmes. We then apply individual microeconomic data to identify socially excluded communities and place them either in the activation works or the inclusive programmes in each simulation period. Calibration of the model is based on a social accounting matrix and individual microeconomic data that are applied for the disaggregation of households and producers and the dynamization of active labour market policies. Our results show that both types of active labour market policies help to reduce structural unemployment and improve potential production in the Slovak economy. However, we find out that the inclusive programmes provide much better results than the activation works in a medium horizon.

Acknowledgement

The author would like to thank Daniel Dujava (IFP) and Viliam Páleník (SAV) for their helpful advices and comments.

Authors:
Richard Priesol richard.priesol@mfsr.sk

Table of contents

1 Introduction

Social exclusion of minorities presents a serious problem for world economies from both social and economic point of view. Structural differences in living standards and social relations with a respect to the major population could lead to a formation of generational poverty and a direct or latent discrimination of the excluded communities. Furthermore, an absence of necessary education and working habits results in a formation of structural unemployment with a negative impact on potential production. Finally, poor living standards and generational poverty of the excluded communities create an additional pressure on a public sector in a form of extensive expenditures on social transfers.

There is a number of examples across the world about negative implications of social exclusion of minorities. In this paper, we analyse the case of the Slovak Republic that is characterized by a structural segregation of a part of the Roma community. We reason that this segregation has resulted in a high degree of poverty within the community that is observable across generations, catastrophic living standards in particular country areas, a high degree of dependence on social transfers and a formation of structural unemployment that is driven by an absence of necessary education and working habits. The unfortunate combination of these factors then makes it extremely difficult to break the loop of social exclusion and thus improve the current situation of the Roma community. Furthermore, the problem is enhanced by a discrimination of the community from the major population and a crowding out of the community from the labour market that materializes in excessive unemployment and inactivity rates.

On the other hand, an integration of the Roma community to the labour market could have a positive impact on the Slovak economy and help to (i) improve working habits of the community with positive implications for structural unemployment and potential production, (ii) improve poor living standards and reduce generational poverty without extensive social transfers from a public sector and (iii) limit a discrimination on the labour market with a positive impact on social interactions with the major population. While there is a number of active labour market policies that support an integration of excluded communities, it is important to compare them in both absolute and relative terms and evaluate their potential impact on an economic performance.

In this paper, we focus on two measures that were adopted by the Slovak Republic to reduce the social exclusion of the Roma community and improve its integration to the domestic labour market, the activation works and the inclusive programmes. While the activation works are based on a form of social transfers for participants in exchange of small manual jobs for regions or municipalities, the inclusive programmes are based on a form of wage subsidies for employers in exchange of offering work positions to excluded communities.

Even though the activation works help to reduce disposable unemployment in a short horizon, the positive effect in a medium horizon is limited by an unqualified character of the underlying work. On the other hand, the inclusive programmes propose one of the most promising methods to limit social exclusion and reduce structural unemployment, since a positive experience with the labour market could have a significant impact on social interactions and working habits of the excluded communities and thus improve their labour market prospects in both short and medium horizons, as discussed by Páleník et al. (2013). Furthermore, an additional income could help to improve living standards and reduce generational poverty of socially excluded communities, while their integration to the labour market could help to reduce direct and latent discrimination from the major population.

Next, to compare these policies and evaluate their potential impact on the Slovak economy, we construct a computable general equilibrium model of a small open economy with two types of producers and two types of households. First, we need to distinguish between standard and inclusive producers to incorporate a structure of the domestic labour market with two types of employees. Second, we need to distinguish between standard and excluded households to

incorporate an income from active labour market policies and its impact on a behaviour of households. This approach thus allows us to incorporate the inclusive programmes that are supported by both private and public sectors and the activation works that are driven by social transfers and evaluate their economic implications.

We need to mention that the decomposition of producers and households is based on individual microeconomic data, in contrast to standard general equilibrium models. However, the novelty of this approach to active labour market policies and the uniqueness of social exclusion of the Roma community for the Slovak Republic make it impossible to calibrate the model from available literature. Therefore, to avoid arbitrary assumptions about the structure of excluded communities, inclusive producers and active labour market policies, we tend to apply the microeconomic data to identify different types of producers and households and dynamic effects of active labour market policies.

Computable general equilibrium models are regularly applied for evaluation of different tax policies, environmental regulations and trade strategies, due to their simple but rich structure, consistency with a macroeconomic theory and an ability to capture sectoral linkages within world economies.[1] Furthermore, these models could be applied also for an evaluation of potential benefits from the inclusive employment, see for example Kabir and Dudu (2020). On the other hand, to our best knowledge, we propose a novel approach to the evaluation of active labour market policies in line with a general equilibrium theory. It is important to note that there is a number of advantages of this approach over partial equilibrium methods, since we are able to capture (i) structural relationships in the Slovak economy, (ii) a different labour productivity of standard and inclusive employees, (iii) a different model structure of standard and inclusive producers, (iv) different consumption habits of standard and excluded households and (v) dynamic effects of active labour market policies on domestic producers and households.

Our paper further contributes to the existing literature on active labour market policies by a novel approach to their evaluation with a computable general equilibrium model. While the other studies focus on labour market outcomes and cost benefit analyses of active labour market policies, we are able to evaluate macroeconomic effects of the activation works and the inclusive programmes and thus estimate their impact on (i) potential production, (ii) private consumption, (iii) domestic investment, (iv) public sector deficit and (v) public sector debt.

The paper is structured as follows. First, we provide a literature review of the most recent studies about generational poverty, inclusive growth, structural unemployment and active labour market policies. Second, we propose a recursive dynamic computable general equilibrium model of a small open economy with two types of producers and two types of households. Third, we present an underlying model dataset and describe the construction of a social accounting matrix. Fourth, we evaluate a potential impact of different types of active labour market policies on the Slovak economy with a respect to structural unemployment and potential production. Finally, we discuss the results in the context of related literature.

[1] For an introduction to computable general equilibrium models and their possible applications see Dixon and Jorgenson (2012) or Burfisher (2017).

2 Related literature

There is a number of social and economic issues that result from the social exclusion of minorities. One of the most negative consequences of social exclusion is without a doubt a formation of generational poverty. The theory of poverty traps stands in contrast to the assumption that a lack of disposable income could be overcome by hard work and a reduction in consumption. Contrary to this, an economic system requires a lot of physical and human capital to escape the poverty trap what leads to a self-reinforcing cycle of poverty. Azariadis and Stachurski (2004) further state that an acquisition of capital could be limited by market or institutional failures what limits an individual responsibility for poverty. However, the detection of poverty traps could be quite problematic due to short data samples and measurement errors as pointed out by Antman and McKenzie (2007).

The existence of poverty traps has further inspired economic researchers to introduce alternative measures for economic growth that can incorporate a degree of poverty reduction and inequality improvement over time. We mention the growth incidence curve of Ravallion and Chen (1999), the poverty bias of growth of McCulloch and Baulch (2000), the pro-poor growth index of Kakwani and Pernia (2000) and the poverty equivalent growth rate of Kakwani and Son (2008).[2] However, we should be interested not only in the reduction of poverty but in both pace and pattern of economic growth with a focus on sustainability and inclusiveness, or in other words, in the inclusive growth. Ianchovichina and Lundstrom (2009) then assume that the most important constraints to the inclusive growth are determined by an access to domestic and international markets, a distribution of information and education and an effectiveness of government.[3]

Therefore, we need to question, whether the economic growth in the Slovak Republic was able to reduce income inequalities between the excluded communities and the major population and thus limit the formation of generational poverty. However, since Domonkos et al. (2013) observe a negative relationship between an increase in economic growth and a decline in income inequalities in the Slovak Republic, we could assume that the economic growth in the Slovak Republic was not oriented on the excluded communities. An important objective should be then the evaluation of different types of labour market policies and their impact on an economic performance and a degree of social exclusion, as discussed by Páleník et al. (2015).

Another negative consequence of social exclusion is a formation of structural unemployment with further negative implications for potential production. This is a very relevant issue for the Slovak economy that operates with excessive levels of structural unemployment with a regional concentration and an accumulation of social exclusion, as was pointed out by Páleník (2015). The reduction of structural unemployment could be achieved by boosting a labour demand with new work positions and wage subsidies for employers or by supporting human capital with education and training of excluded communities, as was pointed out by Jusko (2015). We need to mention that we focus on the demand types of inclusive programmes. An evaluation of the supply types of inclusive programmes is beyond the scope of this paper.

Furnham (1982) then provides three basic explanations of unemployment: individualistic, social and fatalistic. The individualistic reasons explain the unemployment with a personal disposition like a lack of ability or effort. On the other hand, the social reasons explain the unemployment with a public disposition like a failure to pursue effective labour market policies. Finally, the fatality reasons explain the unemployment with a set of uncontrollable parameters like a lack of chances or luck. Even though the excessive unemployment of the Roma community could be viewed as a combination of these factors, we focus on the social factor as the most important explanation of this phenomenon. We thus assume that active labour market policies could provide an effective method to reduce the structural unemployment of the Roma community.

[2] For further information see Jmurova (2017).

[3] For an evaluation of the inclusive growth in the European Union see Domonkos et al. (2015).

We continue with a summary of active labour market policies in the OECD countries that is provided by Meager and Evans (1998). The authors summarize results from a number of evaluation studies within the OECD countries and advantages and drawbacks of main evaluation methods. The authors favour evaluation methods that are oriented on targets rather than programmes and suggest that labour market policies that include both public and private sectors propose the best results with a respect to structural unemployment. On the other hand, a summary of Martin and Grubb (2001) stands that the evaluation findings are not very encouraging at the first sight but there are some successful stories, for example job search assistance and training programmes. The authors further assume that wage subsidies could help their participants but may suffer from dead-weight and substitution effects.

More recent studies provide mixed results of active labour market policies. On the one hand, Crepon and Van den Berg (2016) declare that evaluations have not shown these policies to be particularly effective and McKenzie (2017) states that these policies are much less effective than policymakers usually assume. On the other hand, Escudero (2018) states that active labour market policies reduce unemployment rates and increase participation rates and the positive effects seem to be particularly beneficial for low-skilled participants. Furthermore, Card et al. (2018) declare that average impacts of these policies are close to zero in a short horizon but become more positive in a medium horizon. The authors then favour programmes that emphasize an accumulation of human capital.

The structure of active labour market policies is also very important, as was pointed out by a number of studies. For example, a meta-analysis of Kluve (2010) declares that while direct employment in a public sector frequently appears detrimental, wage subsidies in a private sector can be effective in improving labour market outcomes. These results are further consistent with a meta-analysis of Card et al. (2010). The authors also state that job search assistance is more effective in a short horizon and training programmes are more effective in a long horizon. Finally, a meta-analysis of Vooren et al. (2018) declares that public employment and wage subsidies have negative impacts in a short run but gradually improve and turn positive in a long run. On the other hand, job search assistance and training programmes stay positive on an entire horizon. The job search assistance then shows the best results in a short run and the wage subsidies provide the best results in a long run.

It is also important to note that active labour market policies may be influenced by a number of external factors, for example a cyclical position of an economy. Brown and Koettl (2015) declare that measures to retain work positions should be used only for short periods of time in economic recessions, while measures to create work positions are very effective during economic recoveries. Furthermore, the authors state that activation works are not very effective in terms of labour market outcomes but may be beneficial for a reduction of poverty and inequalities. Finally, the authors declare that training programmes are more effective over time and when targeting excluded communities.

Harvan (2011) then analyses active labour market policies in the Slovak Republic with a focus on graduate practices and activation works. The author suggests that while the graduate practises lead to a better outcome of the participants on the labour market, the activation works may have an opposite effect. Other evaluation studies from the Slovak Republic are not very encouraging. Štefánik (2014) does not estimate a positive impact of training programmes on labour market outcomes and Karasová et al. (2019) declare that a current composition of active labour market policies has a limited impact on the Roma community. On the other hand, Páleník et al. (2013) propose that the inclusive programmes could provide more positive results in terms of labour market outcomes and their impact on an economic performance.

3 Model specification

To compare different types of active labour market policies and evaluate their potential impact on an economic performance we construct a recursive dynamic computable general equilibrium model of a small open economy with two types of producers and two types of households. Specifically, we decompose the sector of households into standard and excluded components and the sector of producers into standard and inclusive components. First, we identify the excluded households from a database of excluded communities of the Institute for Financial Policy (IFP). This database is based on individual microeconomic data and a set of social and economic characteristics. Second, we identify the inclusive producers from a database of domestic firms as the employers that offer work positions to the excluded communities. A total amount of the inclusive commodities is then equal to the production of the inclusive producers in the economy. We further define a three-level production function that incorporates both standard and inclusive employees into the production chain of value added and intermediate consumption. The number of inclusive employees is set by the government under a transformation function for employment subventions. On the other hand, the number of standard employees is implied by an optimal allocation of production factors.

Furthermore, we extend the model for a basic structure of the domestic labour market with a definition of the labour demand and a definition of the labour supply. We are thus able to estimate dynamic effects of active labour market policies on unemployment and participation rates. Finally, we provide a dynamization of the model with an accumulation function of a capital stock and a mobility function of activation workers and inclusive employees. It is important to note that while the inclusive programmes enter the production function as wage subsidies for employers and thus contribute to the domestic production, the activation works are not a part of the production chain and enter the model as social transfers of households. These assumptions are consistent with the development of national accounts.

3.1 Domestic employment

We apply a three-level production function for the inclusive producers to differentiate between standard and inclusive employees. In the first step, we aggregate both types of employees ($\mathbf{LE_t}$) into a labour production factor of inclusive producers ($\mathbf{LT_{i,t}}$) under an assumption that these producers aim to maximize their profits from both labour inputs based on their productivity and labour costs.[4] We thus assume that a fixed number of standard employees could be substituted for a fixed number of inclusive employees and aggregate them as perfect substitutes under a linear functional form (Eq.1). While the labour costs of standard employees are paid only by the producers and are thus subject to the optimization process, the labour costs of inclusive employees are partially paid by the subsidies from government and thus only a part of them is set by the optimal allocation of production factors. We label the standard employees by *s*, the inclusive employees by *i* and time periods by *t*.

$$\mathbf{LT_{i,t}} = \boldsymbol{\kappa_s} * \mathbf{LE_{s,t}} + \boldsymbol{\kappa_i} * \mathbf{LE_{i,t}} \tag{1}$$

To close the model, we need to impose two additional restrictions on the distribution of standard and inclusive employees on the domestic labour market. First, we assume that the government controls for the number of inclusive employees ($\mathbf{LE_{i,t}}$) that are set exogenous to the model ($\mathbf{IN_t}$) and thus need to write $\mathbf{LE_{i,t}} = \mathbf{IN_t}$. Second, we assume a perfect mobility of labour of standard employees, in line with the model of Corong et al. (2017), and thus need to write $\mathbf{PE_{s,t}} = \mathbf{PL_{s,t}}$ for the labour costs of standard employees ($\mathbf{PE_{s,t}}$) and the price of labour of standard producers ($\mathbf{PL_{s,t}}$).[5] The labour production factor of standard producers ($\mathbf{LT_{s,t}}$) is then equal to

[4] The inclusive producers in the model thus operate on a basis of inclusive employers. For a comparison of different types of inclusive producers and their impact on an economic performance see Priesol (2021).

[5] The labour costs of standard employees are thus equal in both production sectors.

a simple difference (Eq.2) between domestic employment ($\mathbf{DE_t}$) and the number of standard employees ($\mathbf{LE_{s,t}}$) that is implied by the inclusive producers. The domestic employment in the model consists only of the standard employees and not the inclusive employees to estimate a potential impact of active labour market policies on the domestic labour market.

$$\mathbf{LT_{s,t} = DE_t - LE_{s,t}} \tag{2}$$

3.2 Domestic production

In the second step, we incorporate a labour factor ($\mathbf{LT_t}$) and a capital factor ($\mathbf{KT_t}$) to explain value added in both production sectors ($\mathbf{VA_t}$) under a Cobb-Douglas functional form (Eq.3). We thus assume a unit elasticity of substitution between labour and capital production factors, in line with the estimation results of Lichner and Miklošovič (2011). Even though the authors state that the estimates of substitution elasticities are significantly different from unity on the level of individual industries, the average substitution elasticity in the Slovak economy is estimated close to unity and thus does not reject the Cobb-Douglas function. We further label the production sectors by *c* and time periods by *t*.

$$\mathbf{VA_{c,t} = \psi_c * LT_{c,t}^{\varphi_c} * KT_{c,t}^{1-\varphi_c}} \tag{3}$$

On the other hand, we aggregate intermediate inputs of standard ($\mathbf{IC_{s,t}}$) and inclusive ($\mathbf{IC_{i,t}}$) commodities under a Leontief functional form (Eq.4) to obtain intermediate consumption in both production sectors ($\mathbf{IC_t}$). The Leontief function is regularly applied for the aggregation of sectoral commodities under an assumption that different production sectors, for example agriculture and construction, produce complemental products that could not be replaced by each other in a production chain. This functional form would be thus accurate if the standard producers and the inclusive producers operate in different production sectors. We could then see from microeconomic data that the inclusive producers are significantly biased towards the sector of manufacturing, and are thus relatively complemental to the standard producers. We further label the production sectors by *c*, the standard commodities by *s*, the inclusive commodities by *i* and time periods by *t*.

$$\mathbf{IC_{c,t} = 1/\omega_s * IC_{c,s,t} = 1/\omega_i * IC_{c,i,t}} \tag{4}$$

In the last step, we model total production in both production sectors ($\mathbf{YT_t}$) as a function of sectoral value added ($\mathbf{VA_t}$) and intermediate consumption ($\mathbf{IC_t}$), in line with the model of Shen and Whalley (2013). We assume that the degree of substitution between these production factors could be different from unity and thus need to merge them under a Constant elasticity of substitution function (Eq.5). Furthermore, we link the parameter of substitution $\boldsymbol{\theta_p}$ to the elasticity of substitution $\boldsymbol{\sigma_p}$ with a transformation function $\boldsymbol{\theta_p = 1 - 1/\sigma_p}$ to simplify the model notation.[6] Corresponding prices of the production factors are pinned down by the first order conditions, in line with a zero-profit assumption.[7]

$$\mathbf{YT_{c,t}^{\theta_p} = \alpha_c^{\theta_p} * \beta_c * VA_{c,t}^{\theta_p} + \alpha_c^{\theta_p} * (1 - \beta_c) * IC_{c,t}^{\theta_p}} \tag{5}$$

Estimation of the elasticity of substitution $\boldsymbol{\sigma_p}$ is based on a theory of profit maximization and corresponding first order conditions, in line with Okagawa and Ban (2008). This approach is thus in contrast to the direct estimation of the production function. While the direct approach requires an application of differential equations and constant growth rates to incorporate the Hicks neutral component $\boldsymbol{\alpha_c}$ that increases over time, the estimation based on the first order conditions abstract from this parameter, in line with the first derivation of the production function, and thus provides much simpler and less biased estimation.

[6] We modify the standard definition of the CES function with a negative exponent.

[7] It is important to note that the zero profit of domestic producers does not imply the zero profit of domestic firms, since we incorporate a net operating surplus into the price of capital.

3.3 International trade

Export and import of standard and inclusive commodities is captured by the Armington model of international trade. We thus assume that total production of both types of commodities ($\mathbf{YT_t}$) distributes between domestic sales ($\mathbf{DT_t}$) and domestic export ($\mathbf{XT_t}$) under a Constant elasticity of transformation function (Eq.6). Furthermore, we link the parameter of transformation $\boldsymbol{\theta_x}$ to the elasticity of transformation $\boldsymbol{\sigma_x}$ with a transformation function $\boldsymbol{\theta_x = 1 + 1/\sigma_x}$. The export prices are then implied by external world prices and a nominal exchange rate that are set exogenous to the model. This is driven by a model assumption that a small open economy of the Slovak Republic has no impact on the development of external world prices. The absence of an independent monetary policy further implies a constant value of a nominal exchange rate within the monetary union of the euro area.

$$\mathbf{YT_{c,t}^{\theta_x} = \upsilon_c^{\theta_x} * \xi_c * XT_{c,t}^{\theta_x} + \upsilon_c^{\theta_x} * (1 - \xi_c) * DT_{c,t}^{\theta_x}} \quad (6)$$

On the other hand, we assume that total consumption of both types of commodities ($\mathbf{QT_t}$) consists of domestic sales ($\mathbf{DT_t}$) and domestic import ($\mathbf{MT_t}$) under a Constant elasticity of substitution function (Eq.7). It is important to note that the import of inclusive commodities is set to zero, since the total amount of inclusive commodities needs to be equal to the production of inclusive producers. Furthermore, we link the parameter of substitution $\boldsymbol{\theta_m}$ to the elasticity of substitution $\boldsymbol{\sigma_m}$ with a transformation function $\boldsymbol{\theta_m = 1 - 1/\sigma_m}$**.** The import prices are then implied by external world prices and a nominal exchange rate that are set exogenous to the model.

$$\mathbf{QT_{c,t}^{\theta_m} = \nu_c^{\theta_m} * \zeta_c * MT_{c,t}^{\theta_m} + \nu_c^{\theta_m} * (1 - \zeta_c) * DT_{c,t}^{\theta_m}} \quad (7)$$

Estimation of the trade elasticities is based on the first order conditions, in line with the method of Gallaway et al. (2003). Specifically, we perform a logarithmic transformation of the first order conditions and estimate them from historical time series of real and price variables. The estimates of both trade elasticities are significantly higher than unity and thus impose a high degree of substitution and transformation between domestic and external markets. The estimation results are in line with related literature, see for example Hillberry and Hummels (2012).

3.4 Domestic households

Consumption of commodities by standard and excluded households is based on a theory of utility maximization. Specifically, we assume that both types of households maximize their utility from standard and inclusive commodities under a Stone-Geary functional form (Eq.8) that is suitable for different types of households with different living standards and poverty levels. The Stone-Geary function is able to distinguish between necessary and additional consumption where the first one captures a subsistence minimum of particular households and the latter one captures a marginal utility from additional consumption of particular commodities. It further implies that the total consumption ($\mathbf{CT_t}$) of the commodity *c* by the household *h* can be decomposed into the necessary consumption ($\mathbf{NC_t}$) of the commodity c by the household *h* and a share of the commodity *c* on the additional consumption of the household *h*. The additional consumption ($\mathbf{AC_t}$) of the household *h* is then equal to a disposable income ($\mathbf{DI_t}$) of the household *h* minus the necessary consumption ($\mathbf{NC_t}$) of both types of commodities. Finally, we need to adjust the equation for prices of particular commodities ($\mathbf{PQ_t}$).

$$\mathbf{CT_{h,c,t} = NC_{h,c,t} + \gamma_c * \frac{DI_{h,t} - \sum_c NC_{h,c,t} * PQ_{c,t}}{PQ_{c,t}}} \quad (8)$$

Next, we determine a disposable income of both types of households from budgetary restrictions and constant savings rates. It is important to note that the savings of excluded households are set to zero under an assumption that the excluded communities consume their entire income. However, even though the standard households save a part of their income, they still consume more per person than the excluded households. Calibration of the subsistence minimum is then

based on the Frisch parameter of substitution that is set to 1.05, in line with related literature.[8] Even though the Frisch parameter does not directly enter the Stone-Geary function, the calibration of the subsistence minimum is essentially based on this parameter, as pointed out by Gharibnavaz and Verikios (2018). We further assume that the subsistence minimum per person is equal across different types of households and varies only for different types of commodities and thus calibrate the necessary consumption of standard and excluded households from the subsistence minimum per person and the number of persons within both population groups.

3.5 Budgetary restrictions

A budget of households is implied by labour and capital factors and social and activation transfers that are further distributed between private consumption, public labour taxes and savings of households. On the other hand, a budget of firms is implied by an operating surplus that is further distributed between total capital taxes and savings of firms. Public revenues then consist of public labour taxes, total capital taxes, consumption taxes, production taxes and total import taxes under constant tax rates. The public labour taxes are paid by both types of employees and the total capital taxes are paid by the domestic firms. On the other hand, the consumption taxes are paid from both types of commodities and the production taxes are paid by both types of producers. Public expenditures then consist of public consumption, total social transfers, wage subsidies and activation transfers. A current account is further implied by a trade balance of standard and inclusive commodities and savings of government define a public sector deficit and a public sector debt. Finally, the budgetary restrictions are extended for intersectoral transfers that are set exogenous to the model.

3.6 The labour market

Next, we extend the model for a basic structure of the domestic labour market with a definition of the labour demand and the labour supply. First, we exogenize domestic employment in each simulation period with a mobility function of activation workers and inclusive employees. It is important to note that the domestic employment in the model consists only of the standard employees and not the inclusive employees. Second, we define national employment as a sum of domestic employment and a migration balance that is set exogenous to the model. We further exogenize an amount of unemployment and inactivity in the standard population and distribute the excluded population between unemployment and inactivity in fixed shares that are set from a benchmark period. Finally, we define a national labour force as a sum of national employment and unemployment and a national population as a sum of national labour force and inactivity. The rate of unemployment is then equal to a ratio between national unemployment and labour force and the rate of participation is equal to a ratio between national labour force and population.

We further assume that government controls for the number of activation workers and inclusive employees in each simulation period by subventions on active labour market policies. While the activation subventions are paid to households in the form of social transfers, the inclusive subventions enter the production function as wage subsidies for employers. Finally, we assume that the activation workers obtain a fixed activation transfer and the inclusive employees obtain a fixed labour income in each simulation period. These assumptions are very important for alternative scenarios where we derive a degree of participation of excluded communities from the subventions per person.

In a baseline scenario, we calibrate the subventions per person from a benchmark period and fix them as constant on a simulation horizon. It is important to note that the alternative policies are not budgetary neutral, since the inclusive programmes are based on wage subsidies for employers that are further adjusted for taxes and contributions, in contrast to the activation

[8] For further references see Miklošovič (2014).

works that materialize in social transfers of households. Furthermore, the inclusive programmes result in a higher productivity than the activation works, due to a more qualified character of the underlying work. The subventions for the inclusive programmes are thus significantly higher than the subventions for the activation works but most of them are paid off by themselves. Finally, we assume that both producers and households adapt their decisions in line with the subventions from government in each simulation period.

3.7 The capital market

Allocation of investment between standard and inclusive sectors is based on the method of Lemelin (2007) that builds on the work of Jung and Thorbecke (2001). Specifically, we assume that a production sector with a stronger return to capital attracts more investment in each simulation period. First, we define a rate of return ($\mathbf{RK_t}$) as a ratio between a price of capital ($\mathbf{PK_t}$) and user costs ($\mathbf{UK_t}$) to approximate the Tobin's Q in both production sectors (Eq.9). We label the production sectors by *c* and time periods by *t*.

$$\mathbf{RK_{c,t}} = \mathbf{PK_{c,t}}/\mathbf{UK_{c,t}} \tag{9}$$

The price of capital ($\mathbf{PK_t}$) is then pinned down by an optimal allocation of production factors by standard and inclusive producers. This definition of the return to capital is set in line with Křístková (2010) and thus differs from the original specification with a net operating surplus. On the other hand, the user costs ($\mathbf{UK_t}$) consist of a capital depreciation rate $\boldsymbol{\delta_c}$ to capture a real cost of the capital usage and a real interest rate $\boldsymbol{\iota_c}$ to capture an opportunity cost of the capital investment (Eq.10). The user costs are further adjusted by an investment price index ($\mathbf{IP_t}$) that captures an average price of investment in the economy.

$$\mathbf{UK_{c,t}} = \boldsymbol{\delta_c} * \mathbf{IP_t} + \boldsymbol{\iota_c} * \mathbf{IP_t} \tag{10}$$

The allocation of investment ($\mathbf{ID_t}$) into standard and inclusive sectors relative to a sectoral capital stock ($\mathbf{KT_t}$) is then a function of the rate of return ($\mathbf{RK_t}$), in line with a macroeconomic theory of the Tobin's Q (Eq.11). The rate of return above one then means that the production sector will attract new investment, since a future profit from a unit of capital exceeds its user costs. The elasticity of substitution $\boldsymbol{\sigma_k}$ is set to 2.50, in line with the model of Křístková (2010). Finally, since the total amount of investment is pinned down by the savings to investment identity, we need to recalibrate the allocation of investment to achieve a balance between the demand for investment and the supply of investment.

$$\mathbf{ID_{c,t}} = \boldsymbol{\varepsilon_c} * \mathbf{KT_{c,t}} * \mathbf{RK_{c,t}^{\sigma_k}} \tag{11}$$

3.8 Clearing of markets

Model closure is based on a constant depreciation rate for both production sectors and a constant savings rate for both types of households. We thus assume that the agents in the economy maintain their preferences over time. External world prices and a nominal exchange rate are set exogenous to the model what comes as natural in a small open economy of the Slovak Republic. Savings of firms are then implied by budgetary restrictions of firms and a current account is pinned down by budgetary restrictions of the external world. On the other hand, we need to exogenize public consumption ($\mathbf{GT_t}$) to estimate dynamic effects of active labour market policies on fiscal variables. Savings of government are then implied by budgetary restrictions of government and further define a public sector deficit and a public sector debt. Finally, we exogenize domestic inventories ($\mathbf{VT_t}$) and thus obtain domestic investment ($\mathbf{IT_t}$) from total savings in the economy, in line with the Walras's law. Distribution of the domestic investment between standard and inclusive commodities is then based on a Leontief functional form (Eq.12) and is thus fixed in constant proportions. We label the standard commodities by *s*, the inclusive commodities by *i* and time periods by *t*.

$$\mathbf{IT_t} = \mathbf{1/\mu_s} * \mathbf{IT_{s,t}} = \mathbf{1/\mu_i} * \mathbf{IT_{i,t}} \quad (12)$$

Next, we need to close the commodity market by a market clearing condition for standard and inclusive commodities (Eq.13) that decomposes the consumption of commodities ($\mathbf{QT_t}$) between producers ($\mathbf{IC_t}$), households ($\mathbf{CT_t}$), government ($\mathbf{GT_t}$), investment ($\mathbf{IT_t}$) and inventories ($\mathbf{VT_t}$). We label the sectoral commodities by *c*, the standard producers by *s*, the inclusive producers by *i*, the standard households by *s*, the excluded households by *e* and time periods by *t*.

$$\mathbf{QT_{c,t}} = \mathbf{IC_{s,c,t}} + \mathbf{IC_{i,c,t}} + \mathbf{CT_{s,c,t}} + \mathbf{CT_{e,c,t}} + \mathbf{GT_{c,t}} + \mathbf{IT_{c,t}} + \mathbf{VT_{c,t}} \quad (13)$$

Furthermore, we exogenize the number of standard and inclusive employees in each simulation period and thus close the labour market. Distribution of the standard employees between both production sectors is implied by a perfect mobility of labour, while a total amount of the inclusive employees is pinned down by the government. Finally, we exogenize a capital stock in both production sectors in each simulation period and thus close the capital market.

3.9 Definition of prices

We distinguish between different types of prices in the model specification. We start with the labour costs of employees ($\mathbf{PE_t}$) that are pinned down by the first order conditions of inclusive producers (Eq.1) and a perfect mobility of labour of standard employees. The price of labour ($\mathbf{PL_t}$) and the price of capital ($\mathbf{PK_t}$) are then implied by the first order conditions of the Cobb-Douglas function (Eq.3). Furthermore, we obtain the price components of value added ($\mathbf{PA_t}$) and intermediate consumption ($\mathbf{PC_t}$) from the zero-profit assumptions of the Leontief function (Eq.4) and the Constant elasticity of substitution function (Eq.5) in the production chain.

On the other hand, the price components of domestic production ($\mathbf{PY_t}$) and domestic sales ($\mathbf{PD_t}$) are pinned down by the zero-profit assumptions of the Armington functions of transformation (Eq.6) and substitution (Eq.7). The export prices ($\mathbf{PX_t}$) and the import prices ($\mathbf{PM_t}$) are then implied by external world prices ($\mathbf{PW_t}$) and a nominal exchange rate ($\mathbf{ER_t}$) that are set exogenous to the model. We conclude with the prices of particular commodities ($\mathbf{PQ_t}$) that are pinned down by the first order conditions of the Stone-Geary function (Eq.8) and our choice of the model numeraire. Specifically, we tend to choose a consumer price index ($\mathbf{CP_t}$) as the model numeraire and thus pin down an average price of commodities in the domestic economy.[9] The model prices are set to unity in a benchmark period and further evaluated with a respect to the model numeraire on a simulation horizon.

3.10 Constant subventions

We assume that the government controls for the number of activation workers and inclusive employees in each simulation period by subventions on active labour market policies. Therefore, we could calibrate the subventions per person from a benchmark period, fix them as constant on a simulation horizon and thus determine the number of activation workers and inclusive employees in each simulation period. However, we could argue that an inelastic relationship between the number of participants and the subventions per person is questionable, since an incentive of both producers and households to participate in active labour market policies could decline with a degree of social exclusion and thus with the number of participants.[10] We then need to incorporate a negative relationship between the number of participants in each simulation period and their incentive to participate in active labour market policies.

[9] Common price indices are regularly chosen as model numeraires to avoid issues with microeconomic closures. For further information about alternative choices of model numeraires see Ezaki (2006).

[10] We assume that an increase in the number of participants in active labour market policies should result in an increase in a degree of social exclusion of the last participant. In other words, the least excluded persons should be the first ones to participate in active labour market policies and the opposite should hold for the most excluded persons. We thus apply a marginal approach to identify a degree of social exclusion of the participants in active labour market policies.

3.11 Subvention functions

The labour income per person ($\mathbf{\Lambda_t}$) should be then defined as an increasing function of the number of inclusive employees ($\mathbf{IN_t}$) to motivate more excluded persons to participate in the inclusive programmes (Eq.14). We choose a linear functional form for convenience and a lack of additional information but the application of other increasing functional forms is also possible. Calibration of the parameters is based on the number of inclusive employees in a benchmark period and an additional assumption about a minimal labour income implied by the subventions per person. Specifically, we set the number of inclusive employees to zero if the labour income per person is less than an official minimum wage.

$$\mathbf{\Lambda_t = \eta_1 + \eta_2 * IN_t} \tag{14}$$

On the other hand, the activation transfer per person ($\mathbf{\Upsilon_t}$) should be defined as an increasing function of the number of activation workers ($\mathbf{AN_t}$) to motivate more excluded persons to participate in the activation works (Eq.15). Again, we choose a linear functional form for convenience and a lack of additional information. Calibration of the parameters is based on the number of activation workers in a benchmark period and an additional assumption about a maximal activation transfer implied by the subventions per person. Specifically, we set the number of activation workers to maximum if the activation transfer per person is more than an official subsistence minimum.

$$\mathbf{\Upsilon_t = \tau_1 + \tau_2 * AN_t} \tag{15}$$

3.12 Labour dynamization

Dynamization of the model is implied by additional equations for labour and capital production factors. Specifically, we exogenize these variables in each simulation period by corresponding dynamic equations and thus provide a microeconomic closure to the model. First, we determine the domestic employment ($\mathbf{DE_t}$) by a mobility function of activation workers and inclusive employees (Eq.16). We thus assume that an actual value of the domestic employment is equal to a previous value of the domestic employment and a share of activation workers ($\mathbf{AN_t}$) and inclusive employees ($\mathbf{IN_t}$) from a previous simulation period that are able to find a work position in an actual simulation period. On the other hand, we assume that once the activation workers or the inclusive employees find a work position, they become the standard employees and do not return to the activation works nor the inclusive programmes. We thus do not define a mobility function of standard employees.

$$\mathbf{DE_{t+1} = DE_t + \Sigma_t * AN_t + \Gamma_t * IN_t} \tag{16}$$

Next, we calibrate the mobility of activation workers ($\mathbf{\Sigma_t}$) and inclusive employees ($\mathbf{\Gamma_t}$) from historical data and fix it as constant on a simulation horizon.[11] While the activation works provide a small improvement (2%) over the control group that does not participate in active labour market policies, the inclusive programmes provide much better prospects (12%) for the participants to find a work position in a next simulation period. While we could satisfy with the partial equilibrium results that are implied by the calibration of the mobility function and its impact on the domestic labour market, we propose a more complex approach to its evaluation that is consistent with a theory of general equilibrium and thus incorporate (i) structural relationships in the Slovak economy, (ii) a different labour productivity of standard and inclusive employees, (iii) a different model structure of standard and inclusive producers, (iv) different consumption habits of standard and excluded households and (v) dynamic effects of active labour market policies on domestic producers and households.

[11] The historical mobility of activation workers and inclusive employees is obtained from the individual microeconomic data of the Institute for Financial Policy (IFP).

3.13 Capital dynamization

Next, we determine the capital stock in the standard sector ($\mathbf{SK_t}$) by an accumulation function of standard capital (Eq.17). An actual value of the capital stock is thus equal to a previous value of the capital stock that is adjusted for a capital depreciation rate $\boldsymbol{\delta_s}$ and a share of domestic investment ($\mathbf{IT_t}$) from a previous simulation period. The share of investment ($\boldsymbol{\Omega_{s,t}}$) is then equal to a ratio between the allocation of investment in the standard sector and a sum of investment allocations in both production sectors. To unify the model notation, we need to write $\mathbf{KT_{s,t}} = \mathbf{SK_t}$ for the capital factor of standard producers ($\mathbf{KT_{s,t}}$).

$$\mathbf{SK_{t+1}} = (\mathbf{1} - \boldsymbol{\delta_s}) * \mathbf{SK_t} + \boldsymbol{\Omega_{s,t}} * \mathbf{IT_t} \tag{17}$$

Finally, we determine the capital stock in the inclusive sector ($\mathbf{IK_t}$) by an accumulation function of inclusive capital (Eq.18). An actual value of the capital stock is thus equal to a previous value of the capital stock that is adjusted for a capital depreciation rate $\boldsymbol{\delta_i}$ and a share of domestic investment ($\mathbf{IT_t}$) from a previous simulation period. The share of investment ($\boldsymbol{\Omega_{i,t}}$) is then equal to a ratio between the allocation of investment in the inclusive sector and a sum of investment allocations in both production sectors. To unify the model notation, we need to write $\mathbf{KT_{i,t}} = \mathbf{IK_t}$ for the capital factor of inclusive producers ($\mathbf{KT_{i,t}}$).

$$\mathbf{IK_{t+1}} = (\mathbf{1} - \boldsymbol{\delta_i}) * \mathbf{IK_t} + \boldsymbol{\Omega_{i,t}} * \mathbf{IT_t} \tag{18}$$

4 Data and calibration

Calibration of the model parameters is based on a social accounting matrix (SAM) that incorporates structural relationships between macroeconomic variables in a benchmark time period (2016). Specifically, the matrix captures nominal flows in the economy to describe production and consumption of commodities and intersectoral transfers between households, firms, government and external world. Furthermore, we disaggregate the matrix for standard and inclusive commodities, standard and inclusive producers and standard and excluded households to estimate a potential impact of active labour market policies on an economic performance of the Slovak Republic.

Construction of the matrix is based on two basic assumptions. First, the principle of input-output tables states that expenditures of one economic subject are compensated as revenues of another economic subject. Second, the principle of national accounts states that total incomes and total expenditures of an economic subject are equal to each other. Social accounting matrix is thus a square matrix with a sum of rows equal to a sum of columns, where the matrix rows correspond to the incomes of an economic subject and the matrix columns correspond to the expenditures of an economic subject. Furthermore, the matrix distinguishes between blocks of commodities (standard and inclusive), activities (standard and inclusive), factors (labour and capital), taxation (domestic and import), households (standard and excluded), institutions (firms and government), subventions (activation and inclusive), savings (investment and inventories) and the external world.

4.1 Macroeconomic data

Calibration of the social accounting matrix is based on national and sectoral accounts of the Statistical Office of the Slovak Republic (Table 1). The national accounts provide information about production and consumption of commodities. On the other hand, the sectoral accounts describe nominal flows between households, firms, government and external world. We then observe that the labour factor accounts for 50.4% and the capital factor accounts for 49.5% of a gross value added in a benchmark period. The gross value added further accounts for 38.1% and intermediate inputs account for 61.9% of domestic production. On the other hand, private consumption explains 54.6% and public consumption explains 19.4% of a gross domestic product in a benchmark period. A share of investment on output is then equal to 21.3% and a share of inventories on output is equal to 1.7%. Furthermore, a trade to output ratio is equal to 3.0% in a benchmark period.

Calibration of the labour market and the capital market is further based on the national accounts of the Statistical Office of the Slovak Republic (Table 1). We thus observe that an unemployment rate is equal to 9.6% and a participation rate is equal to 60.0% in a benchmark period. On the other hand, calibration of the fiscal variables is based on government finance statistics of the Eurostat (Table 1). A deficit to output ratio is thus equal to 2.9% and a debt to output ratio is equal to 51.8% in a benchmark period.

4.2 Types of households

Decomposition of a national population into standard and excluded households is implied by a database of excluded communities that is obtained from the Institute for Financial Policy (IFP). The database is based on individual microeconomic data and a set of social and economic characteristics from the Atlas of Roma communities (2013), for further information see Hidas et al. (2018). We are thus able to identify the excluded communities on an individual level and further link them with other administrative data to approximate a structure of the domestic labour market, calibrate subventions on active labour market policies and identify components of budgetary restrictions of households.

We then distinguish between different types of active labour market policies with a focus on the activation works and the inclusive programmes. Specifically, we include activation transfers for activation and voluntary services, to capture subventions for households in exchange of small manual jobs for regions or municipalities, and wage subsidies on private and regional employment, to capture subventions for employers in exchange of offering work positions to socially excluded communities.[12] We then merge the database of active labour market policies with the database of excluded communities to identify the number of activation workers and the number of inclusive employees in a benchmark period (Table 3). We observe that 14.5% of the excluded population participates in the activation works and that 5.7% of the excluded population participates in the inclusive programmes. Furthermore, we identify subventions for the activation works and the inclusive programmes in a benchmark period (Table 3).

Next, we merge the database of excluded communities with the database of labour market participants to identify a share of activation workers and inclusive employees that are able to find a work position in a next simulation period (Table 3). We then observe that the activation works improve the prospects of the participants by 2.3% and that the inclusive programmes improve the prospects of the participants by 11.7%. Furthermore, we can see that 29.9% of the non-participants are searching for a job on the labour market and that 70.1% of the non-participants are set outside the labour market. Finally, we merge the database of excluded communities with the database of social benefits to identify social transfers of both types of households. Furthermore, since we assume that the capital factors and the other transfers are relevant only for the standard households and not for the excluded households, we are able to identify a disposable income of both types of households in a benchmark period (Table 2). The budgetary restrictions then imply a decomposition of private consumption between both types of households.[13]

4.3 Types of producers

Decomposition of total production between standard and inclusive producers is based on a database of domestic firms from the Institute for Financial Policy (IFP). Specifically, we merge the database of domestic firms with the database of active labour market policies and thus identify the domestic producers that participate in the inclusive programmes. We are then able to determine the production chain of both types of producers and thus decompose the domestic production between both production sectors (Table 2). We further assume that the production taxes are distributed in fixed proportions between both types of producers.

Next, we extract labour costs of standard and inclusive employees to approximate a labour productivity of both types of employment (Table 2). Furthermore, we can see that 39.4% of the inclusive programmes are paid by government in a form of wage subsidies for employers and 60.6% of the inclusive programmes are paid by producers in a form of labour costs of employees. We further assume that the labour income taxes are distributed in fixed proportions between both types of employees. Finally, since we assume that the total mixed surplus is relevant only for the standard producers and not for the inclusive producers, we can determine the operating surplus of both types of producers. The heterogeneity of standard and inclusive producers is consistent with the findings of Bredgaard and Halkjaer (2016) that the firms participating in active labour market policies are characterized by a high number of unskilled workers, a strong coverage of collective agreements, a deteriorating economic situation and a domestic ownership structure.

[12] We include the activation works with a respect to the paragraph §52 and the inclusive programmes with a respect to the paragraphs §50 and §54 of the Act on Employment Services. A brief definition of these paragraphs is provided in the Appendix. For the original version of the Act on Employment Services see https://ec.europa.eu/migrant-integration/library-document/act-no-52004-employment-services_en. For the current version of the Act on Employment Services see https://www.slov-lex.sk/static/pdf/2004/5/ZZ_2004_5_20220401.pdf.

[13] The activation transfers for the excluded communities are a part of the social transfers of the excluded households. On the other hand, the wage subsidies for the excluded communities are a part of the subsidies on production of the inclusive producers.

4.4 Types of commodities

Distribution of standard and inclusive commodities between intermediate inputs, private consumption, public consumption, domestic investment, domestic inventories and export of commodities is based on a sectoral decomposition of standard and inclusive producers. Specifically, we decompose the total production in both production sectors into subsectors of agriculture, industries, construction and services and then distribute the production in the subsectors between the consumption components in fixed shares that are obtained from an input-output table (2015). For example, since the inclusive producers are significantly biased towards the sector of manufacturing, the distribution of the inclusive commodities should be positively biased towards export of commodities and negatively biased towards private and public consumption. We further assume that the consumption taxes are distributed in fixed proportions between both types of commodities.

4.5 Data decomposition

The model disaggregation is based on a decomposition of (i) the block of commodities into standard and inclusive commodities, (ii) the block of activities into standard and inclusive producers and (iii) the block of households into standard and excluded households under a set of model assumptions. First, we assume that the inclusive producers obtain subventions from the government in exchange of offering work positions to excluded communities and thus need to incorporate both standard and inclusive employees. On the other hand, the standard producers incorporate only the standard employees. Second, we assume that the inclusive commodities result from the inclusive producers and that the standard commodities result from the standard producers and import of commodities.

Third, we assume that the excluded households consume their entire income and that only the standard households contribute to total savings in the economy and thus to domestic investment. We further assume that the excluded households do not borrow from the standard households on financial markets and thus set their consumption equal to their income. Fourth, we assume that the revenues of the excluded households consist of labour factors and social transfers and that the revenues of the standard households consist of labour and capital factors and social and other transfers.[14] Fifth, we assume that only a part of the excluded communities participates in the activation works and the inclusive programmes. The activation workers and the inclusive employees then obtain the same social transfers and share the same spending habits as the rest of the excluded communities. Furthermore, the activation workers obtain an additional activation transfer and the inclusive employees obtain an additional labour income. Finally, we assume that the activation transfers for the excluded communities are a part of the social transfers of the excluded households and that the wage subsidies for the excluded communities are a part of the subsidies on production of the inclusive producers.

4.6 Output elasticities

Estimation of the elasticity of substitution $\boldsymbol{\sigma_p}$ is based on a theory of profit maximization and corresponding first order conditions, in line with Okagawa and Ban (2008). We thus identify real and price components of value added and intermediate consumption and then estimate a logarithmic ratio of their first order conditions (Eq.19). We assume that a ratio between the price components of value added ($\mathbf{PA_t}$) and intermediate consumption ($\mathbf{PC_t}$) is a function of a ratio between the real components of value added ($\mathbf{VA_t}$) and intermediate consumption ($\mathbf{IC_t}$) that depends on the elasticity of substitution $\boldsymbol{\sigma_p}$ and the mean factor effectivity $\boldsymbol{\beta_e}$ in the Slovak

[14] The other transfers further consist of the transfers of households from the domestic firms and the balance of households with the external world that are relevant only for the standard households and not for the excluded households.

economy. We further link the constant parameter in the equation $\boldsymbol{\Delta_p}$ to the mean factor effectivity $\boldsymbol{\beta_e}$ with a transformation function $\boldsymbol{\Delta_p = \log(\beta_e) - \log(1 - \beta_e)}$. It is important to note that the price components of the production factors are identified as ratios between corresponding variables in current prices and chain linked volumes and thus as price deflators. The real components of the production factors are obtained in chain linked volumes.

$$\boldsymbol{\log\left(PA_t/PC_t\right) = \Delta_p + 1/\sigma_p * \log\left(IC_t/VA_t\right)} \quad (19)$$

The estimation is based on the Ordinary Least Squares (OLS) and performed on quarterly data from the first quarter of 1995 to the last quarter of 2016. The estimated value of the elasticity of substitution $\boldsymbol{\sigma_p}$ is equal to 2.75, thus rejecting the unit elasticity of substitution between value added and intermediate consumption in the Slovak economy. These results are consistent with related literature, see for example McDonald et al. (2005).

4.7 Trade elasticities

Estimation of the elasticity of substitution $\boldsymbol{\sigma_m}$ and the elasticity of transformation $\boldsymbol{\sigma_x}$ is based on a system of linear equations that are derived from first order conditions, in line with Gallaway et al. (2003). First, we estimate a logarithmic ratio of first order conditions for domestic sales and export of commodities (Eq.20). We thus assume that a ratio between the price components of domestic exports ($\boldsymbol{PX_t}$) and domestic sales ($\boldsymbol{PD_t}$) is a function of a ratio between the real components of domestic exports ($\boldsymbol{XT_t}$) and domestic sales ($\boldsymbol{DT_t}$) that relies on the elasticity of transformation $\boldsymbol{\sigma_x}$ and the mean export effectivity $\boldsymbol{\xi_e}$ in the Slovak economy. We further link the constant parameter in the equation $\boldsymbol{\Delta_x}$ to the mean export effectivity $\boldsymbol{\xi_e}$ with a transformation function $\boldsymbol{\Delta_x = \log(\xi_e) - \log(1 - \xi_e)}$. The estimation is based on the Ordinary Least Squares (OLS) and performed on quarterly data from the first quarter of 1995 to the last quarter of 2016.

$$\boldsymbol{\log\left(PX_t/PD_t\right) = \Delta_x + 1/\sigma_x * \log\left(DT_t/XT_t\right)} \quad (20)$$

Second, we estimate a logarithmic ratio of first order conditions for domestic sales and import of commodities (Eq.21). We thus assume that a ratio between the price components of domestic imports ($\boldsymbol{PM_t}$) and domestic sales ($\boldsymbol{PD_t}$) is a function of a ratio between the real components of domestic imports ($\boldsymbol{MT_t}$) and domestic sales ($\boldsymbol{DT_t}$) that relies on the elasticity of substitution $\boldsymbol{\sigma_m}$ and the mean import effectivity $\boldsymbol{\zeta_e}$ in the Slovak economy. We further link the constant parameter in the equation $\boldsymbol{\Delta_m}$ to the mean import effectivity $\boldsymbol{\zeta_e}$ with a transformation function $\boldsymbol{\Delta_m = \log(\zeta_e) - \log(1 - \zeta_e)}$. The estimation is based on the Ordinary Least Squares (OLS) and performed on quarterly data from the first quarter of 1995 to the last quarter of 2016.

$$\boldsymbol{\log\left(PM_t/PD_t\right) = \Delta_m + 1/\sigma_m * \log\left(DT_t/MT_t\right)} \quad (21)$$

The estimation results are in line with related literature, with the elasticity of substitution $\boldsymbol{\sigma_m}$ equal to 3.89 and the elasticity of transformation $\boldsymbol{\sigma_x}$ equal to 3.98. According to the results of Hertel et al. (2007), the substitution elasticities between different external sources range from 1.80 to 34.40. The application of a standard rule of thumb then implies that the substitution elasticities between domestic and external sources range from 0.90 to 17.20. On the other hand, the results of Gallaway et al. (2003) imply that the substitution elasticities between domestic and external sources should range from 1.00 to 5.00. Finally, the transformation elasticities between domestic and external sources should range from 3.00 to 7.00, as results from the summary of Hillberry and Hummels (2012). The estimation results for the Slovak Republic are thus well within a standard estimation range, implying a high substitutability and a high transformability between domestic and external sources. To check for the robustness of the model, we estimate the trade elasticities also from annual data and compare the estimation results with the quarterly estimates. Both elasticities are in line with the original estimates what enhances the robustness of the model.

Finally, we compare the estimation results with an empirical paper of Imbs and Mejean (2010) that estimates the trade elasticities across different countries with the popular method of Feenstra (1994). The estimated values of the import elasticity of substitution for the Slovak Republic range from 1.98 to 3.19. On the other hand, the estimated values of the export elasticity of transformation for the Slovak Republic range from 0.91 to 3.80. Even though we estimate slightly higher elasticities, we argue that the results of Imbs and Mejean (2010) could be biased downwards due to historical estimation weights that may not be actual in the recent years. Furthermore, the trade elasticities for the Slovak Republic are estimated on a lower threshold of the estimation range of Imbs and Mejean (2010).

4.8 Estimation dataset

The price components of domestic export ($\mathbf{PX_t}$) and domestic import ($\mathbf{PM_t}$) are identified as ratios between corresponding variables in current prices and chain linked volumes and thus as export and import deflators. The import prices are further adjusted for taxes on import to identify financial costs of domestic consumers. On the other hand, the domestic prices ($\mathbf{PD_t}$) are identified by the producer price index, due to a lack of available information in the national accounts. Domestic sales ($\mathbf{DT_t}$) are then equal to a difference between domestic production ($\mathbf{YT_t}$) and export of commodities ($\mathbf{XT_t}$) that is further equal to a difference between domestic consumption ($\mathbf{QT_t}$) and import of commodities ($\mathbf{MT_t}$) adjusted for taxes and subsidies.

5 Discussion of results

To evaluate the potential impact of active labour market policies on the Slovak economy, we assume that the government provides the full support for either the activation works or the inclusive programmes to achieve the maximal participation of excluded communities in each simulation period. In other words, we set the number of excluded persons that do not participate in active labour market policies to zero and then distribute them either to the activation works or the inclusive programmes. The baseline scenario is set under an absence of active labour market policies and since we leave other parameters of the model unchanged, we can evaluate a potential impact of the alternative policies on an economic performance. The model closure then implies that a public sector deficit and a public sector debt in the baseline scenario should be milder than in a benchmark period.

The first set of scenarios evaluate a potential impact of the activation works on the Slovak economy under constant and linear relationships between the number of activation workers and the activation transfer per person. The second set of scenarios then evaluate a potential impact of the inclusive programmes on the Slovak economy under constant and linear relationships between the number of inclusive employees and the labour income per person. The simulation results for a gross domestic product and domestic employment are presented in the Figure 1. The contributions of particular components to a gross domestic product are presented in the Figure 2. Furthermore, we simulate an alternative scenario where we place the activation workers from a benchmark period to the inclusive programmes by cutting the activation transfers to zero and then supporting the inclusive programmes in each simulation period. We thus evaluate an empirical impact of a policy shift from the activation works to the inclusive programmes on macroeconomic and fiscal variables.

The evaluation of the alternative scenarios is then based on a 10-years simulation horizon. We further present a cumulative impact of the alternative scenarios on gross domestic product, private consumption, domestic investment, trade balance, domestic employment, excluded population, households income, rate of unemployment, rate of participation, public sector deficit and public sector debt. Since we abstract from loans between standard and excluded households, we observe that the private consumption evolves in a similar manner as the households income. The results are presented with a respect to the baseline scenario under an absence of active labour market policies.[15]

Furthermore, we need to mention that we abstract from a number of positive effects that result from the employment of socially excluded communities, for example the reduction of generational poverty, the improvement of living standards or the provision of better education. We partially incorporate their higher qualification on the labour market by a higher productivity of the standard employees over the inclusive employees. Active labour market policies could be thus viewed as a form of social investment rather than a form of social transfer. Finally, since these factors could lead to additional gains for the economy, the simulation results should be viewed as the minimal profit from the employment of socially excluded communities.

5.1 Activation works

Full support for the activation works leads only to a marginal improvement of the economic performance (Table 4). The gross domestic product and the private consumption increase by 0.3% and the domestic employment raises by 0.6%. Furthermore, the unemployment rate and the participation rate improve by 0.2 p.p. at the end of the simulation horizon. Even though it may seem a little counterintuitive that the employment improves more than the unemployment, this is driven by the fact that only a part of the excluded population searches

[15] The model simulations are performed in the Matlab software.

for a job on the labour market. Finally, the number of excluded persons declines by more than 20% at the end of the simulation horizon. Even though these results indicate a small improvement over the baseline scenario, they stay in contrast to the conclusions of Harvan (2011) that the activation works create an inferior situation on the labour market with negative implications for future prospects of their participants.

If we consider a linear relationship between the number of participants and the subventions per person, the gross domestic product improves by less than 0.2% and the private consumption raises by more than 0.4% (Table 5). It is important to note that these differences (Figure 2) are driven by more expensive subventions on the activation works with a positive impact on the private consumption and a negative impact on the domestic investment The simulation results are further consistent with the findings of Brown and Koettl (2015) that even though the activation works are not very effective in terms of labour market outcomes, they can be beneficial for a reduction of poverty and inequalities.

5.2 Inclusive programmes

Full support for the inclusive programmes leads to more favourable results in terms of structural unemployment and potential production (Table 6). The gross domestic product improves by 1.5%, the private consumption raises by 1.2% and the domestic investment increases by 3.6% at the end of the simulation horizon. We thus observe a strong contribution of the domestic investment to the gross domestic product what is driven by the fact that the elimination of social exclusion creates new opportunities for savings of households and improves the access to mortgage loans. Furthermore, the stronger domestic demand raises corporate profits and improves fiscal variables. On the other hand, we observe only a marginal impact of the inclusive programmes on the trade balance at the end of the simulation horizon (Figure 2). The domestic employment improves by 2.0% and the number of excluded persons declines by more than 70%. Finally, the rate of unemployment declines by 0.6 p.p. and the rate of participation raises by 0.7 p.p. at the end of the simulation horizon.

If we consider a linear relationship between the number of participants and the subventions per person, the gross domestic product improves by 1.3%, the private consumption raises by 1.1% and the domestic investment increases by 3.0% (Table 7). The contribution of the domestic investment is limited by more expensive subventions on the inclusive programmes and thus lower savings in the economy. On the other hand, the contribution of the private consumption is boosted by a disposable income of households. The simulation results thus support the conclusions of Páleník et al. (2013) that the inclusive programmes could reduce structural unemployment and thus improve potential production in the Slovak economy. The positive impact of the inclusive programmes on the excluded communities is further consistent with the findings of Escudero (2018) that the inclusive programmes could improve labour market prospects of low-skilled participants.

5.3 Subvention transfers

After the evaluation of the potential effects of the alternative policies, we could ask how profitable it would be to transfer the subventions from the activation works to the inclusive programmes. We thus simulate an alternative scenario where we place the activation workers from a benchmark period to the inclusive programmes by cutting the activation transfers to zero and then supporting the inclusive programmes in each simulation period. For simplicity, we assume a constant relationship between the number of activation workers and the activation transfer per person and a constant relationship between the number of inclusive employees and the labour income per person (Table 8). However, the linear relationship between the number of participants and the subventions per person does not significantly change the simulation results (Table 9).

This policy shift then improves the gross domestic product by 0.3% and raises the private consumption by 0.2%. Furthermore, the domestic employment raises by 0.4% and the number of excluded persons declines by more than 15%. Finally, the unemployment rate and the participation rate improve by more than 0.1 p.p. at the end of the simulation horizon. It is further important to note that even though the subventions for the inclusive programmes are more expensive than the subventions for the activation works, we observe a positive impact of this policy shift on fiscal variables. The deficit to output ratio improves by 0.1 p.p. and the debt to output ratio declines by 0.7 p.p. at the end of the simulation horizon. The inclusive programmes are thus more efficient than the activation works not only from a macroeconomic perspective but also from a cost-benefit point of view.

5.4 Evaluation methods

Finally, we could be interested in quantitative differences between partial and general equilibrium evaluation methods. While an evolution of the labour factor is driven by a mobility function of activation workers and inclusive employees and could be thus evaluated by the partial equilibrium methods, an evolution of the capital factor is driven by an accumulation function of a capital stock that results from the general equilibrium methods. On the other hand, while an evolution of private consumption is implied by budgetary restrictions of households and could be thus approximated by the partial equilibrium methods, an evolution of domestic investment is implied by market clearing conditions that result from the general equilibrium methods. As we can see, the quantitative differences between these approaches could be thus relatively small for the activation works but rather significant for the inclusive programmes (Figure 2).

6 Concluding remarks

In this paper, we outlined negative implications of social exclusion on a formation of generational poverty and structural unemployment and proposed a potential solution in the form of active labour market policies. Next, we identified the communities that suffer from social exclusion and structural unemployment and described different types of active labour market policies that support their integration to the labour market, with a focus on the activation works and the inclusive programmes. We then proposed a computable general equilibrium model of a small open economy with two types of producers and two types of households to compare the alternative policies and evaluate their potential impact on the economic performance. Finally, we provided dynamization of the model by an accumulation function of a capital stock and a mobility function of activation workers and inclusive employees.

The simulation results show that the inclusive programmes provide much better results than the activation works in terms of structural unemployment and potential production. These results are in line with a historical mobility of activation workers and inclusive employees that is obtained from individual microeconomic data, but provide a more complex view of the economic implications of the alternative policies. In contrast to the activation works, the inclusive programmes have a positive impact not only on a disposable income of households but also on a capital formation in the economy.

These results are robust to an alternative specification of the mobility function that is based on a linear relationship between the number of participants and the subventions per person to motivate more excluded persons to participate in active labour market policies. Furthermore, we suggest that a policy shift from the activation works to the inclusive programmes not only reduces structural unemployment and improves potential production in the domestic economy but also results in more sustainable fiscal variables. This is driven by a fact that additional tax revenues more than compensate more expensive subventions.

Data and materials

The macroeconomic data that were analysed during the current study are available in the repository of the Statistical Office of the Slovak Republic. The data are subject to revision: http://datacube.statistics.sk/#!/view/en/VBD_SK_WIN/nu1028rs/v_nu1028rs_00_00_00_en

The labour market data that were analysed during the current study are available in the repository of the Statistical Office of the Slovak Republic. The data are subject to revision: http://datacube.statistics.sk/#!/view/en/VBD_SK_WIN/nu1024rs/v_nu1024rs_00_00_00_en

The capital market data that were analysed during the current study are available in the repository of the Statistical Office of the Slovak Republic. The data are subject to revision: http://datacube.statistics.sk/#!/view/en/VBD_SLOVSTAT/nu2061rs/v_nu2061rs_00_00_00_en

The fiscal sector data that were analysed during the current study are available in the repository of the Eurostat of the European Commission. The data are subject to revision: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10dd_edpt1&lang=en

The microeconomic data that were analysed during the current study are available from the Institute for Financial Policy but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. However, these data are available upon a reasonable request and with a permission of the Institute for Financial Policy.

Paragraph definition

§52: Contribution for Activation Activity

For the purposes of this Act, activation activity is defined as the support of maintaining the working habits of the job seeker. Activation activity shall be executed in the duration of at least 10 hours per week and 40 hours per month, except for the month in which the activation activity began. Activation activity may be performed in the form of minor communal services performed for a municipality and organised by the latter, or of voluntary works organised by a legal person or by a natural person.

§50: Contribution for Employing a Disadvantaged Job Seeker

The contribution for employing a disadvantaged job seeker who has been registered in the register of job seekers for the specified duration may be granted to the employer employing the disadvantaged job seeker in a generated job (hereinafter referred to as contribution). The contribution shall be provided in monthly intervals, covering up to 100 % of the price of work per disadvantaged job seeker accepted by the employer in a generated job, but not exceeding the amount of the total price of labour calculated from the average gross monthly wage of an employee in the Slovak Republic's economy for the previous calendar year. No contribution shall be granted for employing a disadvantaged job seeker who is a disabled citizen and for whose employing was granted a contribution.

§54: Projects and Programmes

Projects and programmes designed to improve the employment situation development in the territorial boundaries of the Office in the framework of partnerships, approved by the Committee and realised by partnerships established for the purpose, such projects and programmes may be co-financed from the state budget upon approval by the Ministry. Projects and programmes in support of the development of regional employment, approved by the Committee and realised by the Office, which may be co-financed from the state budget. Projects and programmes for supporting the growth of regional employment and increasing employability, financed from the state budget, which are approved by the Ministry and implemented by the Social Development Fund.

Bibliography

Antman, F., McKenzie, D. (2007): *Poverty Traps and Nonlinear Income Dynamics with Measurement Error and Individual Heterogeneity,* The Journal of Development Studies, Volume 43, Issue 6, Pages 1057-1083

Azariadis, C., Stachurski, J. (2004): *Poverty Traps,* Melbourne: University of Melbourne, Department of Economics, Working paper

Bredgaard, T., Halkjaer, J. L. (2016): *Employers and the Implementation of Active Labour Market Policies,* Nordic Journal of Working Life Studies, Volume 6, Issue 1, Pages 47-59

Brown, A., Koettl, J. (2015): *Active Labour Market Programs: Employment Gain or Fiscal Drain?,* IZA Journal of Labor Economics, Volume 4, Issue 12, Pages 1-36

Burfisher, M. E. (2017): *Introduction to Computable General Equilibrium Models,* Cambridge: Cambridge University Press, ISBN 978-13-1645-074-1

Card, D., Kluve, J., Weber, A. (2010): *Active Labour Market Policy Evaluations: A Meta-Analysis,* The Economic Journal, Volume 120, Issue 548, Pages 452-477

Card, D., Kluve, J., Weber, A. (2018): *What Works? A Meta-Analysis of Recent Active Labour Market Program Evaluations,* Journal of the European Economic Association, Volume 16, Issue 3, Pages 894-931

Corong, E. L., Hertel, T. W., McDougall, R. A., Tsigas, M. E., Mensbrugghe, D. (2017): *The Standard GTAP Model: Version Seven,* Journal of Global Economic Analysis, Volume 2, Issue 1, Pages 1-119

Crepon, B., Van den Berg, G. J. (2016): *Active Labour Market Policies,* Annual Review of Economics, Volume 8, Issue 1, Pages 521-546

Dixon, P. B., Jorgenson, D. (2012): *Handbook of Computable General Equilibrium Modeling,* Amsterdam: North Holland Publishing Company, ISBN 978-04-4453-634-1

Domonkos, T., Jánošová, M., Ostrihoň, F. (2013): *Analysing Inclusive Growth: Empirical Evidence from the Slovak Republic,* Ekonomický Časopis / Journal of Economics, Volume 61, Issue 9, Pages 918-933

Domonkos, T., Dováľová, G., Furková, A., Groshek, G., Chocholatá, M., Chovanculiak, R., Jánošová, M., Juščáková, Z., Konig, B., Lichner, I., Mysíková, M., Ostrihoň, F., Šebo, J., Šebová, Ľ., Valovič, J., Večerník, J., Želinský, T. (2015): *Inclusive Growth and Employment in Europe,* Bratislava: Ekonomický Ústav Slovenskej Akadémie Vied, ISBN 987-80-7144-252-3

Escudero, V. (2018): *Are Active Labour Market Policies Effective in Activating and Integrating Low-Skilled Individuals? An International Comparison,* IZA Journal of Labor Policy, Volume 7, Issue 1, Pages 1-26

Ezaki, M. (2006): *CGE Model and Its Micro and Macro Closures,* Nagoya: Nagoya University, Graduate School of International Development, Working paper

Feenstra, R. C. (1994): *New Product Varieties and the Measurement of International Prices,* The American Economic Review, Volume 84, Issue 1, Pages 157-177

Furnham, A. (1982): *Explanations for Unemployment in Britain,* European Journal of Social Psychology, Volume 12, Issue 4, Pages 335-352

Gallaway, M., McDaniel, C., Rivera, S. (2003): *Short-Run and Long-Run Industry-Level Estimates of U.S. Armington Elasticities,* The North American Journal of Economics and Finance, Volume 14, Issue 1, Pages 49-68

Gharibnavaz, M. R., Verikios, G. (2018): *Estimating LES Parameters with Heterogenous Households for a CGE Model,* West Lafayette: Purdue University, Department of Agricultural Economics, Discussion paper

Harvan, P. (2011): *Hodnotenie Efektívnosti a Účinnosti Výdavkov na Aktívne Politiky Trhu Práce na Slovensku [An Evaluation of Effectiveness and Efficiency of Expenditures on Active Labour Market Policies in Slovakia],* Bratislava: Ministry of Finance of the Slovak Republic, Institute for Financial Policy, Working paper

Hertel, T., Hummels, D., Ivanic, M., Keeney, R. (2007): *How Confident Can We Be of CGE Based Assessments of Free Trade Agreements?*, Economic Modelling, Volume 24, Issue 4, Pages 611-635

Hidas, S., Lafférsová, Z., Machlica, G. (2018): *Inklúzia Rómov Je Celospoločenskou Výzvou [Roma Inclusion Is a Society-Wide Challenge],* Bratislava: Ministry of Finance of the Slovak Republic, Institute for Financial Policy, Policy brief

Hillberry, R., Hummels, D. (2012): *Trade Elasticity Parameters for a Computable General Equilibrium Model,* Handbook of Computable General Equilibrium Modeling, Cambridge: Cambridge University Press

Ianchovichina, E., Lundstrom, S. (2009): *Inclusive Growth Analytics: Framework and Application,* Washington, DC: The World Bank, Department of Economic Policy and Debt, Working paper

Imbs, J., Mejean, I. (2010): *Trade Elasticities: A Final Report for the European Commission,* Brussels: European Commission, Working paper

Jmurova, A. (2017): *Pro-Poor Growth: Definition, Measurement and Policy Issues,* Fisciano: University of Salerno, Department of Economics and Statistics, Working paper

Jung, H. S., Thorbecke, E. (2001): *The Impact of Public Education Expenditure on Human Capital, Growth and Poverty in Tanzania and Zambia: A General Equilibrium Approach,* Journal of Policy Modeling, Volume 25, Issue 8, Pages 701-725

Jusko, P. (2015): *Zvyšovanie Zamestnanosti Dlhodobo Nezamestnaných v Hmotnej Núdzi v Kontexte Stratégie Európa 2020* [*Increasing of Employment of Long-Term Unemployed in Material Distress in the Context of Europe 2020 Strategy],* Journal of Modern Science, Volume 26, Issue 3, Pages 397-410

Kabir, K., Dudu, H. (2020): *Using Computable General Equilibrium Models to Analyze Economic Benefits of Gender-Inclusive Policies,* Washington, DC: The World Bank, Macroeconomics, Trade and Investment Global Practice, Working paper

Kakwani, N., Pernia, E. (2000): *What Is Pro-Poor Growth?,* Asian Development Review, Volume 18, Issue 1, Pages 1-16

Kakwani, N., Son, H. (2008): *Poverty Equivalent Growth Rate,* The Review of Income and Wealth, Volume 54, Issue 4, Pages 643-655

Karasová, K., Baláž, V., Polačková, Z. (2019): *Efficiency of the Active Labour Market Policies: Evidence from the Slovak Republic,* Ekonomický Časopis / Journal of Economics, Volume 67, Issue 1, Pages 11-32

Kluve, J. (2010): *The Effectiveness of European Active Labour Market Policy,* Labour Economics, Volume 17, Issue 6, Pages 904-918

Křístková, Z. (2010): *Approaches to the Dynamization of the CGE Model Applied to the Czech Republic,* Emerging Markets Finance and Trade, Volume 46, Issue 1, Pages 59-82

Lemelin, A. (2007): *Bond Indebtedness in a Recursive Dynamic CGE Model,* Montreal: Interuniversity Center on Risk, Economic Policies and Employment, Working paper

Lichner, I., Miklošovič, T. (2011): *Odhad Elasticity Substitúcie CES Produkčnej Funkcie [The Estimation of Elasticity of Substitution of CES Production Function],* Forum Statisticum Slovacum, Volume 7, Issue 3, Pages 50-55

Martin, J. P., Grubb, D. (2001): *What Works and for Whom: A Review of OECD Countries Experiences with Active Labour Market Policies,* Swedish Economic Policy Review, Volume 8, Issue 2, Pages 9-56

McCulloch, N., Baulch, B. (2000): *Tracking Pro-Poor Growth,* Brighton: University of Sussex, Institute of Development Studies, Working paper

McDonald, S., Robinson, S., Thierfelder, K. (2005): *A SAM Based Global CGE Model Using GTAP Data,* Sheffield: University of Sheffield, Department of Economics, Working paper

McKenzie, D. (2017): *How Effective Are Active Labour Market Policies in Developing Countries? A Critical Review of Recent Evidence,* The World Bank Research Observer, Volume 32, Issue 2, Pages 127-154

Meager, N., Evans, C. (1998): *The Evaluation of Active Labour Market Measures for the Long-Term Unemployed,* Geneva: International Labour Organization, Working paper

Miklošovič, T. (2014): *CGE Model a Možnosti Jeho Aplikácie na Vybrané Zmeny v Slovenskej Ekonomike [CGE Model and Its Possible Application to the Selected Changes in the Slovak Economy],* Bratislava: Comenius University in Bratislava, Faculty of Mathematics, Physics and Informatics, Dissertation thesis

Okagawa, A., Ban, K. (2008): *Estimation of Substitution Elasticities for CGE Models,* Toyonaka: Osaka University, Graduate School of Economics, Discussion paper

Páleník, V., Páleník, M., Oravcová, I. (2013): *Inkluzívne Zamestnávanie [Inclusive Employment],* Bratislava: Inštitút Zamestnanosti, ISBN 978-80-9702-044-6

Páleník, V., Domonkos, T., Jánošová, M., Jusko, P., Lichner, I., Miklošovič, T., Ostrihoň, F., Páleník, M., Radičová, I., Radvanský, M., Štefánik, M., Záhorská, J. (2015): *Inkluzívny Rast v Stratégii Európa 2020: Naivita alebo Genialita? [Inclusive Growth in the Europe 2020 Strategy: Naivety or Geniality?],* Bratislava: Ekonomický Ústav Slovenskej Akadémie Vied, ISBN 978-80-7144-250-9

Páleník, M. (2015): *Štruktúra Dlhodobej Nezamestnanosti v Regiónoch SR [Long-Term Unemployment Structure in Slovak Regions],* Forum Statisticum Slovacum, Volume 11, Issue 2, Pages 79-85

Priesol, R. (2021): *Socially Excluded Communities and the Inclusive Labour Market in the Slovak Republic,* Ekonomický Časopis / Journal of Economics, Volume 69, Issue 10, Pages 1062-1084

Ravallion, M., Chen, S. (1999): *Measuring Pro-Poor Growth,* Washington, DC: The World Bank, Department of Policy Research, Working paper

Shen, K., Whalley, J. (2013): *Capital-Labour-Energy Substitution in Nested CES Production Functions for China,* Cambridge: National Bureau of Economic Research, Working paper

Štefánik, M. (2014): *Estimating Treatment Effects of a Training Programme in Slovakia Using Propensity Score Matching,* Ekonomický Časopis / Journal of Economics, Volume 62, Issue 6, Pages 631-645

Vooren, M., Haelermans, C., Groot, W., Van den Brink, H. M. (2018): *The Effectiveness of Active Labour Market Policies: A Meta-Analysis,* Journal of Economic Surveys, Volume 33, Issue 1, Pages 125-149

Tables and figures

Gross domestic product	81 226.073	**Private consumption**	44 372.371
Public consumption	15 739.218	**Domestic investment**	17 279.938
Domestic inventories	1 386.353	**Trade balance**	2 448.193
Domestic production	192 583.981	**Intermediate inputs**	119 147.786
Gross value added	73 436.195	**Total labour factor**	36 986.501
Total capital factor	36 386.714	**Production taxes**	62.980
Domestic employment	2 321.049	**Migration balance**	171.069
Total unemployment	265.996	**Total inactive persons**	1 836.095
Public sector deficit	2 320.207	**Public sector debt**	42 053.200

Table 1: Aggregate macroeconomic variables in a benchmark period (2016). Domestic employment, migration balance, total unemployment and total inactive persons are provided in thousands of persons. Gross domestic product, private consumption, public consumption, domestic investment, domestic inventories, trade balance, domestic production, intermediate inputs, gross value added, total labour factor, total capital factor, production taxes, public sector deficit and public sector debt are provided in millions of euro.

Standard population	4 528.133	**Excluded population**	66.076
Standard income	45 615.289	**Excluded income**	109.337
Standard production	189 138.540	**Inclusive production**	3 445.441
Standard labour costs	36 960.784	**Inclusive labour costs**	25.717

Table 2: Sectoral macroeconomic variables in a benchmark period (2016). Standard population and excluded population are provided in thousands of persons. Standard income, excluded income, standard production, inclusive production, standard labour costs and inclusive labour costs are provided in millions of euro.

Activation workers	9.609	**Inclusive employees**	3.752
Activation subventions	8.224	**Inclusive subventions**	10.135
Successful workers	0.217	**Successful employees**	0.440
Total unemployment	15.762	**Total inactive persons**	36.953

Table 3: Active labour market policies in a benchmark period (2016). Activation workers, inclusive employees, successful workers, successful employees, total unemployment and total inactive persons are provided in thousands of persons. Activation subventions and inclusive subventions are provided in millions of euro.

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
Gross domestic product	0.00	0.02	0.05	0.08	0.11	0.14	0.17	0.20	0.23	0.27
Private consumption	0.13	0.15	0.17	0.19	0.21	0.23	0.26	0.28	0.30	0.33
Domestic investment	-0.33	-0.26	-0.19	-0.12	-0.05	0.03	0.11	0.20	0.29	0.38
Trade balance (% GDP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Domestic employment	0.06	0.13	0.19	0.25	0.31	0.37	0.42	0.48	0.53	0.59
Excluded population	-2.26	-4.48	-6.64	-8.75	-10.8	-12.8	-14.8	-16.7	-18.6	-20.5
Households income	0.12	0.14	0.17	0.19	0.21	0.23	0.25	0.28	0.30	0.33
Rate of unemployment	-0.02	-0.04	-0.06	-0.08	-0.10	-0.11	-0.13	-0.15	-0.16	-0.18
Rate of participation	0.02	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21
Public balance (% GDP)	-0.07	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01	0.01	0.02	0.03
Public debt (% GDP)	0.07	0.12	0.15	0.17	0.18	0.18	0.16	0.13	0.09	0.04

Table 4: A potential impact of the activation works on the Slovak economy under a constant transformation function. Trade balance, rate of unemployment, rate of participation, public sector balance and public sector debt are provided in percentage points over the baseline scenario. Other macroeconomic variables are provided in per cents over the baseline scenario. We define the baseline scenario under an absence of active labour market policies.

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
Gross domestic product	0.00	0.01	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.15
Private consumption	0.35	0.36	0.36	0.36	0.37	0.38	0.38	0.39	0.40	0.41
Domestic investment	-0.91	-0.86	-0.80	-0.74	-0.68	-0.61	-0.54	-0.47	-0.39	-0.32
Trade balance (% GDP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
Domestic employment	0.06	0.13	0.19	0.25	0.31	0.37	0.42	0.48	0.53	0.59
Excluded population	-2.26	-4.48	-6.64	-8.75	-10.8	-12.8	-14.8	-16.7	-18.6	-20.5
Households income	0.34	0.35	0.35	0.35	0.36	0.37	0.38	0.38	0.39	0.41
Rate of unemployment	-0.02	-0.04	-0.06	-0.08	-0.10	-0.11	-0.13	-0.15	-0.16	-0.18
Rate of participation	0.02	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21
Public balance (% GDP)	-0.19	-0.18	-0.17	-0.16	-0.14	-0.13	-0.12	-0.11	-0.09	-0.08
Public debt (% GDP)	0.19	0.37	0.53	0.68	0.81	0.93	1.03	1.12	1.19	1.25

Table 5: A potential impact of the activation works on the Slovak economy under a linear transformation function. Trade balance, rate of unemployment, rate of participation, public sector balance and public sector debt are provided in percentage points over the baseline scenario. Other macroeconomic variables are provided in per cents over the baseline scenario. We define the baseline scenario under an absence of active labour market policies.

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
Gross domestic product	0.37	0.51	0.64	0.77	0.89	1.01	1.12	1.24	1.35	1.46
Private consumption	0.48	0.57	0.66	0.74	0.82	0.89	0.96	1.03	1.10	1.17
Domestic investment	0.50	0.89	1.27	1.62	1.97	2.31	2.64	2.96	3.28	3.59
Trade balance (% GDP)	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Domestic employment	0.34	0.63	0.89	1.12	1.33	1.51	1.67	1.81	1.93	2.04
Excluded population	-11.7	-22.1	-31.2	-39.3	-46.4	-52.7	-58.2	-63.1	-67.5	-71.3
Households income	0.46	0.55	0.64	0.73	0.81	0.88	0.96	1.03	1.10	1.17
Rate of unemployment	-0.10	-0.19	-0.27	-0.35	-0.41	-0.46	-0.51	-0.55	-0.59	-0.62
Rate of participation	0.12	0.22	0.31	0.40	0.47	0.53	0.59	0.64	0.68	0.72
Public balance (% GDP)	0.00	0.06	0.11	0.16	0.21	0.25	0.29	0.33	0.37	0.41
Public debt (% GDP)	-0.19	-0.32	-0.51	-0.74	-1.02	-1.35	-1.72	-2.12	-2.57	-3.05

Table 6: A potential impact of the inclusive programmes on the Slovak economy under a constant transformation function. Trade balance, rate of unemployment, rate of participation, public sector balance and public sector debt are provided in percentage points over the baseline scenario. Other macroeconomic variables are provided in per cents over the baseline scenario. We define the baseline scenario under an absence of active labour market policies.

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
Gross domestic product	0.37	0.48	0.58	0.68	0.79	0.89	0.99	1.09	1.20	1.30
Private consumption	1.05	0.99	0.96	0.96	0.96	0.98	1.01	1.05	1.09	1.14
Domestic investment	-0.96	-0.34	0.21	0.70	1.15	1.56	1.94	2.30	2.65	2.98
Trade balance (% GDP)	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Domestic employment	0.34	0.63	0.89	1.12	1.33	1.51	1.67	1.81	1.93	2.04
Excluded population	-11.7	-22.1	-31.2	-39.3	-46.4	-52.7	-58.2	-63.1	-67.5	-71.3
Households income	1.01	0.96	0.94	0.94	0.95	0.97	1.00	1.04	1.09	1.13
Rate of unemployment	-0.10	-0.19	-0.27	-0.35	-0.41	-0.46	-0.51	-0.55	-0.59	-0.62
Rate of participation	0.12	0.22	0.31	0.40	0.47	0.53	0.59	0.64	0.68	0.72
Public balance (% GDP)	-0.32	-0.20	-0.10	-0.01	0.07	0.13	0.19	0.25	0.29	0.34
Public debt (% GDP)	0.13	0.27	0.31	0.25	0.12	-0.08	-0.34	-0.66	-1.02	-1.43

Table 7: A potential impact of the inclusive programmes on the Slovak economy under a linear transformation function. Trade balance, rate of unemployment, rate of participation, public sector balance and public sector debt are provided in percentage points over the baseline scenario. Other macroeconomic variables are provided in per cents over the baseline scenario. We define the baseline scenario under an absence of active labour market policies.

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
Gross domestic product	0.05	0.08	0.10	0.13	0.15	0.18	0.21	0.24	0.27	0.30
Private consumption	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.24
Domestic investment	0.12	0.18	0.24	0.30	0.37	0.44	0.52	0.59	0.68	0.76
Trade balance (% GDP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Domestic employment	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.31	0.35	0.39
Excluded population	-1.39	-2.81	-4.26	-5.73	-7.24	-8.78	-10.4	-12.0	-13.6	-15.3
Households income	0.05	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.24
Rate of unemployment	-0.01	-0.02	-0.04	-0.05	-0.06	-0.07	-0.08	-0.10	-0.11	-0.12
Rate of participation	0.01	0.03	0.04	0.06	0.07	0.08	0.10	0.11	0.12	0.14
Public balance (% GDP)	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
Public debt (% GDP)	-0.04	-0.07	-0.11	-0.15	-0.21	-0.28	-0.36	-0.44	-0.54	-0.65

Table 8: Macroeconomic implications of a policy shift from the activation works to the inclusive programmes under a constant transformation function. Trade balance, rate of unemployment, rate of participation, public sector balance and public sector debt are provided in percentage points over the baseline scenario. Other macroeconomic variables are provided in per cents over the baseline scenario. We define the baseline scenario from a benchmark period (2016).

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y
Gross domestic product	0.05	0.08	0.10	0.12	0.15	0.17	0.20	0.23	0.26	0.29
Private consumption	0.07	0.09	0.10	0.12	0.14	0.16	0.18	0.21	0.23	0.25
Domestic investment	0.08	0.13	0.19	0.25	0.31	0.38	0.45	0.53	0.60	0.69
Trade balance (% GDP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Domestic employment	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.31	0.35	0.39
Excluded population	-1.39	-2.81	-4.26	-5.73	-7.24	-8.78	-10.4	-12.0	-13.6	-15.3
Households income	0.07	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.23	0.25
Rate of unemployment	-0.01	-0.02	-0.04	-0.05	-0.06	-0.07	-0.08	-0.10	-0.11	-0.12
Rate of participation	0.01	0.03	0.04	0.06	0.07	0.08	0.10	0.11	0.12	0.14
Public balance (% GDP)	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.07
Public debt (% GDP)	-0.03	-0.05	-0.07	-0.11	-0.16	-0.21	-0.28	-0.35	-0.44	-0.54

Table 9: Macroeconomic implications of a policy shift from the activation works to the inclusive programmes under a linear transformation function. Trade balance, rate of unemployment, rate of participation, public sector balance and public sector debt are provided in percentage points over the baseline scenario. Other macroeconomic variables are provided in per cents over the baseline scenario. We define the baseline scenario from a benchmark period (2016).

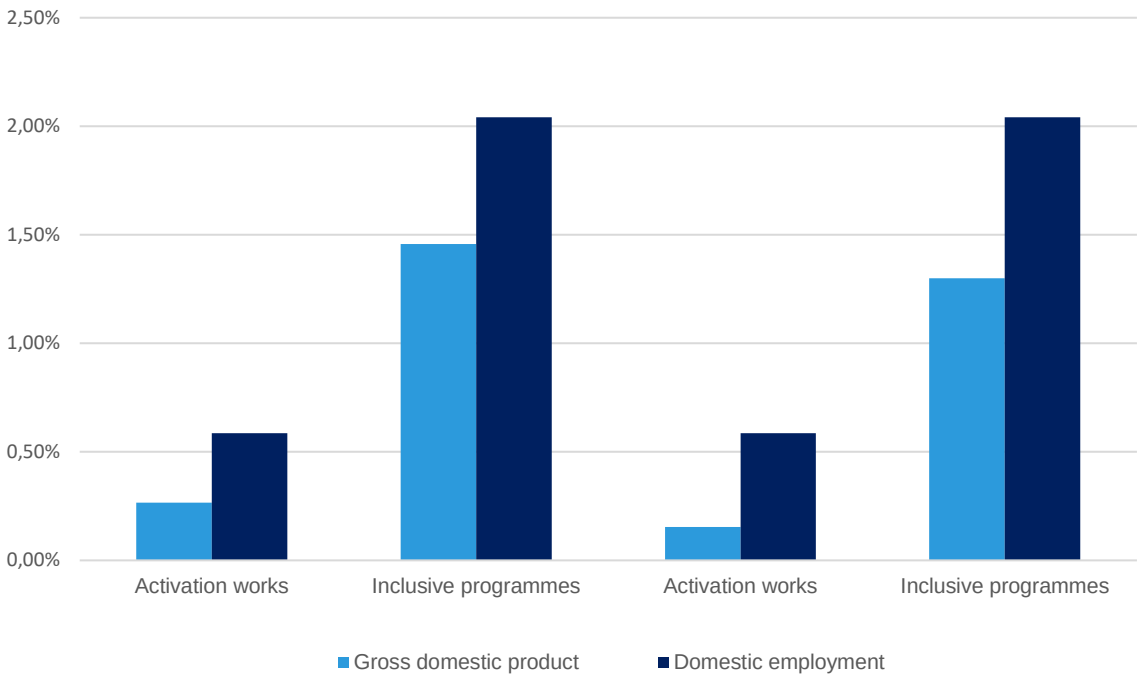

Figure 1: A potential impact of different types of active labour market policies on a gross domestic product and domestic employment on a 10-years simulation horizon. The model specification is based either on a constant relationship (left figures) or a linear relationship (right figures) between the number of participants and the subventions per person.

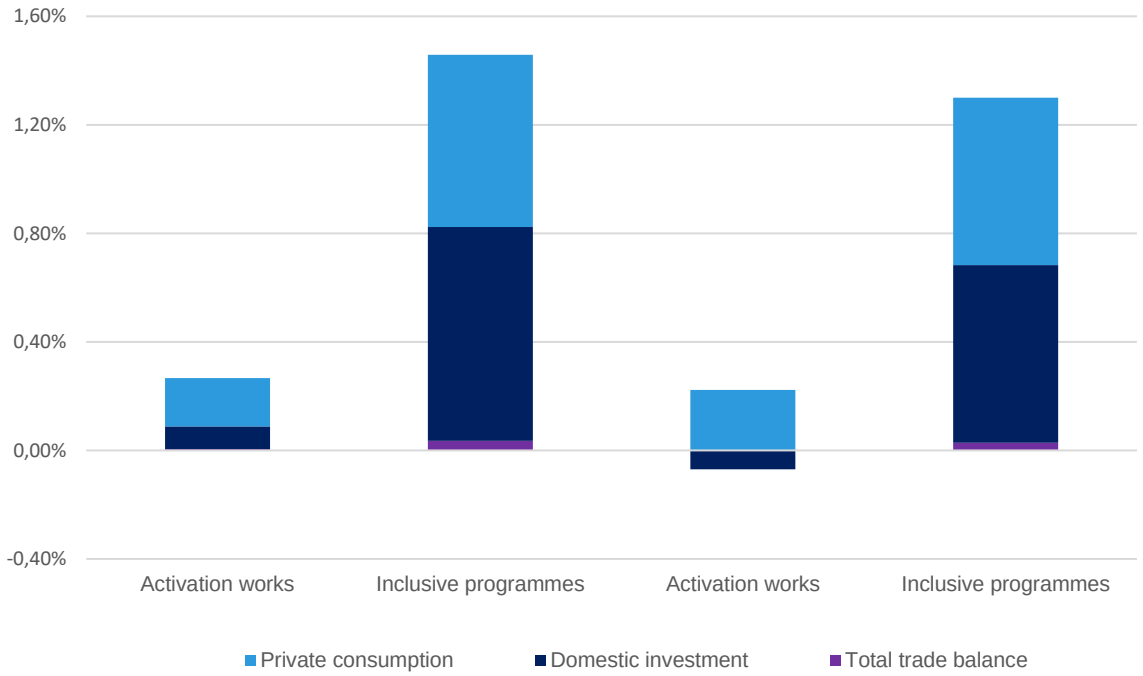

Figure 2: Contributions of expenditure components to a gross domestic product on a 10-years simulation horizon for different types of active labour market policies. The model specification is based either on a constant relationship (left figures) or a linear relationship (right figures) between the number of participants and the subventions per person.

Model parametrization

	Notation	Value	Notation	Value
Labour market subventions	Υ_t	0.8559	Λ_t	6.8542
Labour income per person	η_1	4.2601	η_2	0.0614
Activation transfer per person	τ_1	0.5970	τ_2	0.0269
Mobility on labour market	Σ_t	0.0226	Γ_t	0.1173
Share of excluded population	χ_u	0.2990	χ_i	0.7010

Table 10: Calibration of labour market parameters in a baseline scenario. Parameters Υ_t and Λ_t are applied only for a constant transformation function between the number of participants and the subventions per person. Parameters η_1 and η_2 are applied only for a linear transformation function between the number of inclusive employees and the labour income per person. Parameters τ_1 and τ_2 are applied only for a linear transformation function between the number of activation workers and the activation transfer per person.

	Notation	Value	Notation	Value
Total factor effectivity	ψ_s	2.5579	ψ_i	6.8425
Relative factor effectivity	φ_s	0.5005	φ_i	0.7586
Share of employment inputs	κ_s	1.0586	κ_i	0.2745
Total output effectivity	α_s	1.9797	α_i	1.9324
Relative output effectivity	β_s	0.4568	β_i	0.4198
Share of intermediate inputs	ω_s	0.9874	ω_i	0.0126

Table 11: Calibration of production sector parameters in a baseline scenario. Calibration of these parameters is based on a social accounting matrix in a benchmark period and an initial distribution of standard and inclusive employees.

	Notation	Value	Notation	Value
Necessary consumption value	ρ_s	0.4482	ρ_i	0.0052
Social transfers per person	o_s	1.9150	o_e	1.2753
Additional consumption share	γ_s	0.9885	γ_i	0.0115
Savings rate of households	ς_s	0.0296	ς_e	0.0000

Table 12: Calibration of household sector parameters in a baseline scenario. Calibration of these parameters is based on a social accounting matrix in a benchmark period and an initial distribution of standard and excluded population.

	Notation	Value	Notation	Value
Total export effectivity	υ_s	2.0113	υ_i	2.0254
Relative export effectivity	ξ_s	0.5267	ξ_i	0.5400
Total import effectivity	ν_s	2.0694	ν_i	1.0403
Relative import effectivity	ζ_s	0.4720	ζ_i	0.0000

Table 13: Calibration of trade sector parameters in a baseline scenario. Calibration of these parameters is based on a social accounting matrix in a benchmark period.

	Notation	Value	Notation	Value
Domestic investment share	μ_s	0.9873	μ_i	0.0127
Capital depreciation rate	δ_s	0.0448	δ_i	0.0448
Sectoral investment value	ε_s	0.0103	ε_i	0.0341
Effective interest rate	ι_s	0.0100	ι_i	0.0100

Table 14: Calibration of capital market parameters in a baseline scenario. Calibration of these parameters is based on a social accounting matrix in a benchmark period and an initial distribution of standard and inclusive capital stock.

	Notation	Value	Notation	Value
Domestic output elasticity	σ_p	2.7520	θ_p	0.6366
Domestic export elasticity	σ_x	3.9831	θ_x	1.2511
Domestic import elasticity	σ_m	3.8854	θ_m	0.7426
Domestic capital elasticity	σ_k	2.5000	θ_k	0.6000

Table 15: Calibration of macroeconomic elasticities in a baseline scenario. Calibration of these parameters is based on an econometric estimation of first order conditions and related literature on substitution and transformation elasticities.

List of model variables

Labour market variables

AN – Activation workers (Persons, Exogenous)

AS – Activation subventions (Nominal, Endogenous)

Υ – Activation subventions (Price, Exogenous)

IN – Inclusive employees (Persons, Exogenous)

IS – Inclusive subventions (Nominal, Endogenous)

Λ – Inclusive labour income (Price, Exogenous)

Π – Inclusive subventions (Price, Endogenous)

SP – Standard population (Persons, Exogenous)

NE – National employment (Persons, Endogenous)

Σ – Mobility from activation (Rate, Exogenous)

EP – Excluded population (Persons, Exogenous)

DE – Domestic employment (Persons, Endogenous)

Γ – Mobility from inclusion (Rate, Exogenous)

MB – Migration balance (Persons, Exogenous)

SU – Standard unemployment (Persons, Exogenous)

NU – Total unemployment (Persons, Endogenous)

Ψ – Rate of unemployment (Rate, Endogenous)

SI – Standard inactive persons (Persons, Exogenous)

NI – Total inactive persons (Persons, Endogenous)

Φ – Rate of participation (Rate, Endogenous)

Production sector variables

LT – Total labour factor (Real, Endogenous)

PL – Total labour factor (Price, Endogenous)

LE – Employment inputs (Real, Endogenous)

PE – Employment inputs (Price, Endogenous)

KT – Total capital factor (Real, Endogenous)

PK – Total capital factor (Price, Endogenous)

IC – Intermediate inputs (Real, Endogenous)

PC – Intermediate inputs (Price, Endogenous)

VA – Gross value added (Real, Endogenous)

PA – Gross value added (Price, Endogenous)

TP – Production taxes (Nominal, Endogenous)

YT – Domestic production (Real, Endogenous)

PY – Domestic production (Price, Endogenous)

Trade sector variables

DT – Domestic component (Real, Endogenous)

PD – Domestic component (Price, Endogenous)

XT – Export of commodities (Real, Endogenous)

PX – Export of commodities (Price, Endogenous)

QT – Domestic consumption (Real, Endogenous)

PQ – Domestic consumption (Price, Endogenous)

TQ – Consumption taxes (Nominal, Endogenous)

MT – Import of commodities (Real, Endogenous)

PM – Import of commodities (Price, Endogenous)

TM – Total import taxes (Nominal, Endogenous)

PW – External price index (Price, Exogenous)

ER – Nominal exchange rate (Price, Exogenous)

Household sector variables

LC – Total labour costs (Nominal, Endogenous)

TG – Public labour taxes (Nominal, Endogenous)

ST – Total social transfers (Nominal, Endogenous)

TF – Private labour taxes (Nominal, Endogenous)

LI – Total labour income (Nominal, Endogenous)

TL – Labour income taxes (Nominal, Endogenous)

TC – Total compensations (Nominal, Endogenous)

HI – Households income (Nominal, Endogenous)

NC – Necessary consumption (Real, Endogenous)

MS – Total mixed surplus (Nominal, Exogenous)

HF – Households transfers (Nominal, Exogenous)

DI – Disposable income (Nominal, Endogenous)

SM – Subsistence minimum (Nominal, Endogenous)

LB – Labour cost balance (Nominal, Exogenous)

HB – Households balance (Nominal, Exogenous)

HS – Households savings (Nominal, Endogenous)

CT – Private consumption (Real, Endogenous)

Institution sector variables

DS – Domestic surplus (Nominal, Endogenous)

DK – Capital depreciation (Nominal, Endogenous)

OS – Operating surplus (Nominal, Endogenous)

TK – Total capital taxes (Nominal, Endogenous)

FB – Balance of firms (Nominal, Exogenous)

FS – Savings of firms (Nominal, Endogenous)

TB – Trade balance (Nominal, Endogenous)

CA – Current account (Nominal, Endogenous)

GN – Public consumption (Nominal, Exogenous)

GT – Public consumption (Real, Endogenous)

GF – Government transfers (Nominal, Exogenous)

GR – Public revenues (Nominal, Endogenous)

GB – Government balance (Nominal, Exogenous)

GE – Public expenditures (Nominal, Endogenous)

GS – Government savings (Nominal, Endogenous)

GD – Public sector debt (Nominal, Endogenous)

Capital market variables

IP – Investment price index (Price, Endogenous)

IT – Domestic investment (Real, Endogenous)

VN – Domestic inventories (Nominal, Exogenous)

VT – Domestic inventories (Real, Endogenous)

SK – Standard capital stock (Real, Exogenous)

UK – Capital user costs (Price, Endogenous)

IK – Inclusive capital stock (Real, Exogenous)

RK – Capital return rate (Rate, Endogenous)

ID – Demand for investment (Real, Endogenous)

Ω – Share of investment (Rate, Endogenous)

KF – Gross capital formation (Real, Endogenous)

Market clearing variables

CP – Consumer price index (Price, Exogenous)

KI – Investment of capital (Nominal, Endogenous)

KS – Savings of capital (Nominal, Endogenous)

DP – Gross domestic product (Real, Endogenous)

Taxes and contributions

tp – Production taxes (Rate, Exogenous)

tq – Consumption taxes (Rate, Exogenous)

tm – Total import taxes (Rate, Exogenous)

tg – Public labour taxes (Rate, Exogenous)

tf – Private labour taxes (Rate, Exogenous)

tk – Total capital taxes (Rate, Exogenous)

List of model equations

Labour market equations

$$AS_t = \Upsilon_t * AN_t$$

$$IS_t = \Lambda_t * IN_t - PE_{i,t} * IN_t$$

$$\Pi_t = \Lambda_t - PE_{i,t}$$

$$SP_{t+1} = SP_t + \Sigma_t * AN_t + \Gamma_t * IN_t$$

$$NE_t = SP_t - SU_t - SI_t$$

$$EP_{t+1} = EP_t - \Sigma_t * AN_t - \Gamma_t * IN_t$$

$$DE_t = NE_t - MB_t$$

$$NU_t = SU_t + \chi_u * EP_t$$

$$\Psi_t = NU_t/(NE_t + NU_t)$$

$$NI_t = SI_t + \chi_i * EP_t$$

$$\Phi_t = (NE_t + NU_t)/(NE_t + NU_t + NI_t)$$

Production sector equations

$$LE_{i,t} = IN_t$$

$$LT_{i,t} * PL_{i,t} = LE_{s,t} * PE_{s,t} + LE_{i,t} * PE_{i,t}$$

$$PE_{s,t} = PL_{s,t}$$

$$1/\kappa_s * PE_{s,t} = 1/\kappa_i * PE_{i,t}$$

$$LT_{s,t} = DE_t - LE_{s,t}$$

$$KT_{s,t} = SK_t$$

$$LT_{i,t} = \kappa_s * LE_{s,t} + \kappa_i * LE_{i,t}$$

$$KT_{i,t} = IK_t$$

$$VA_{c,t} = \psi_c * LT_{c,t}^{\varphi_c} * KT_{c,t}^{1-\varphi_c}$$

$$VA_{c,t} * PA_{c,t} * (1 - tp_t) = LT_{c,t} * PL_{c,t} + KT_{c,t} * PK_{c,t}$$

$$TP_t = tp_t * VA_{s,t} * PA_{s,t} + tp_t * VA_{i,t} * PA_{i,t}$$

$$(1 - \varphi_c) * LT_{c,t} * PL_{c,t} = \varphi_c * KT_{c,t} * PK_{c,t}$$

$$IC_{c,t} = IC_{c,s,t} + IC_{c,i,t}$$

$$IC_{c,t} * PC_{c,t} = IC_{c,s,t} * PQ_{s,t} + IC_{c,i,t} * PQ_{i,t}$$

$$1/\omega_s * IC_{c,s,t} = 1/\omega_i * IC_{c,i,t}$$

$$YT_{c,t}^{\theta_p} = \alpha_c^{\theta_p} * \beta_c * VA_{c,t}^{\theta_p} + \alpha_c^{\theta_p} * (1 - \beta_c) * IC_{c,t}^{\theta_p}$$

$$YT_{c,t} * PY_{c,t} = VA_{c,t} * PA_{c,t} + IC_{c,t} * PC_{c,t}$$

$$VA_{c,t} * PA_{c,t}^{\sigma_p} * (1 - \beta_c)^{\sigma_p} = IC_{c,t} * PC_{c,t}^{\sigma_p} * \beta_c^{\sigma_p}$$

Trade sector equations

$$YT_{c,t}^{\theta_x} = \upsilon_c^{\theta_x} * \xi_c * XT_{c,t}^{\theta_x} + \upsilon_c^{\theta_x} * (1 - \xi_c) * DT_{c,t}^{\theta_x}$$

$$YT_{c,t} * PY_{c,t} = DT_{c,t} * PD_{c,t} + XT_{c,t} * PX_{c,t}$$

$$DT_{c,t} * PX_{c,t}^{\sigma_x} * (1 - \xi_c)^{\sigma_x} = XT_{c,t} * PD_{c,t}^{\sigma_x} * \xi_c^{\sigma_x}$$

$$PX_{c,t} = PW_t * ER_t$$

$$QT_{c,t}^{\theta_m} = \nu_c^{\theta_m} * \zeta_c * MT_{c,t}^{\theta_m} + \nu_c^{\theta_m} * (1 - \zeta_c) * DT_{c,t}^{\theta_m}$$

$$QT_{c,t} * PQ_{c,t} * (1 - tq_t) = DT_{c,t} * PD_{c,t} + MT_{c,t} * PM_{c,t}$$

$$TQ_t = tq_t * QT_{s,t} * PQ_{s,t} + tq_t * QT_{i,t} * PQ_{i,t}$$

$$MT_{c,t} * PM_{c,t}^{\sigma_m} * (1 - \zeta_c)^{\sigma_m} = DT_{c,t} * PD_{c,t}^{\sigma_m} * \zeta_c^{\sigma_m}$$

$$PM_{c,t} = PW_t * ER_t * (1 + tm_t)$$

$$TM_t = tm_t * MT_{s,t} * PW_t * ER_t + tm_t * MT_{i,t} * PW_t * ER_t$$

Household sector equations

$$LC_{s,t} = DE_t * PE_{s,t}$$

$$ST_{s,t} = o_s * SP_t$$

$$TG_t = tg_t * DE_t * PE_{s,t} + tg_t * IN_t * \Lambda_t$$

$$LC_{e,t} = IN_t * \Lambda_t$$

$$ST_{e,t} = o_e * EP_t$$

$$TF_t = tf_t * DE_t * PE_{s,t} + tf_t * IN_t * \Lambda_t$$

$$LI_{h,t} = LC_{h,t} * (1 - tg_t - tf_t)$$

$$TL_t = TG_t + TF_t$$

$$TC_t = LC_{s,t} + LC_{e,t} + LB_t$$

$$HI_{s,t} = LI_{s,t} + ST_{s,t} + MS_t + HF_t + LB_t + HB_t$$

$$NC_{s,c,t} = \rho_c * SP_t$$

$$HI_{e,t} = LI_{e,t} + ST_{e,t} + AS_t$$

$$NC_{e,c,t} = \rho_c * EP_t$$

$$DI_{h,t} = HI_{h,t} - HS_{h,t}$$

$$SM_{h,t} = NC_{h,s,t} * PQ_{s,t} + NC_{h,i,t} * PQ_{i,t}$$

$$HS_{h,t} = \varsigma_h * HI_{h,t}$$

$$CT_{c,t} = CT_{s,c,t} + CT_{e,c,t}$$

$$CT_{h,c,t} * PQ_{c,t} = NC_{h,c,t} * PQ_{c,t} + \gamma_c * DI_{h,t} - \gamma_c * SM_{h,t}$$

Institution sector equations

$$DS_{c,t} = KT_{c,t} * PK_{c,t}$$

$$DK_{c,t} = \delta_c * DS_{c,t}$$

$$OS_t = DS_{s,t} + DS_{i,t} - DK_{s,t} - DK_{i,t} - MS_t$$

$$TK_t = tk_t * OS_t$$

$$FS_t = OS_t + TF_t + FB_t - TK_t - HF_t - GF_t$$

$$TB_{c,t} = XT_{c,t} * PX_{c,t} - MT_{c,t} * PM_{c,t}$$

$$CA_t = TB_{s,t} + TB_{i,t} + LB_t + HB_t + FB_t + GB_t$$

$$GT_{c,t} = GN_{c,t}/PQ_{c,t}$$

$$GR_t = TG_t + TK_t + TP_t + TQ_t + TM_t + GF_t + GB_t$$

$$GE_t = GN_{s,t} + GN_{i,t} + ST_{s,t} + ST_{e,t} + AS_t + IS_t$$

$$GS_t = GR_t - GE_t$$

$$GD_t = GD_{t-1} - GS_t$$

Capital market equations

$$IT_t = IT_{s,t} + IT_{i,t}$$

$$IT_t * IP_t = IT_{s,t} * PQ_{s,t} + IT_{i,t} * PQ_{i,t}$$

$$1/\mu_s * IT_{s,t} = 1/\mu_i * IT_{i,t}$$

$$VT_{c,t} = VN_{c,t}/PQ_{c,t}$$

$$SK_{t+1} = (1 - \delta_s) * SK_t + \Omega_{s,t} * IT_t$$

$$UK_{c,t} = \delta_c * IP_t + \iota_c * IP_t$$

$$IK_{t+1} = (1 - \delta_i) * IK_t + \Omega_{i,t} * IT_t$$

$$RK_{c,t} = PK_{c,t}/UK_{c,t}$$

$$ID_t = ID_{s,t} + ID_{i,t}$$

$$ID_{c,t} = \varepsilon_c * KT_{c,t} * RK_{c,t}^{\sigma_k}$$

$$\Omega_{c,t} = ID_{c,t}/ID_t$$

$$KF_{c,t} = IT_{c,t} + VT_{c,t}$$

Market clearing equations

$$QT_t = QT_{s,t} + QT_{i,t}$$

$$QT_t * CP_t = QT_{s,t} * PQ_{s,t} + QT_{i,t} * PQ_{i,t}$$

$$QT_{c,t} = IC_{s,c,t} + IC_{i,c,t} + CT_{s,c,t} + CT_{e,c,t} + GT_{c,t} + IT_{c,t} + VT_{c,t}$$

$$KI_t = KF_{s,t} * PQ_{s,t} + KF_{i,t} * PQ_{i,t}$$

$$KS_t = DK_{s,t} + DK_{i,t} + HS_{s,t} + HS_{e,t} + FS_t + GS_t - CA_t$$

$$DP_t = DP_{s,t} + DP_{i,t}$$

$$DP_{c,t} = CT_{c,t} + GT_{c,t} + IT_{c,t} + VT_{c,t} + XT_{c,t} - MT_{c,t}$$

$$KI_t - KS_t = 0$$