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To Work or Not to Work?
Estimates of Labour Supply Elasticities [1]

Zuzana Siebertová[2], Matúš Senaj[3], Norbert Švarda[4], Jana Valachyová[5]

ABSTRACT

This paper provides a microeconometric analysis of extensive margin labour supply elasticities in Slovakia. We find that a one percent increase in net wage increases the probability of economic activity by 0.263 percentage points. Taking into account tax and transfer system details valid in 2009-2011, a one percent increase in transfers decreases the semi-elasticity of labour force participation by 0.04 percentage points. These results are broadly in line with the elasticities usually reported in the literature. Our results show that low-skilled, females and the elderly are the groups that are particularly responsive to changes in taxes and transfers. Labour market policies aimed to boost employment should concentrate on increasing marginal gains to work, especially for low-educated individuals and women.

Keywords: labour supply elasticity, extensive margin, Heckman model, probit

JEL classification: H31, H53, I38, J21

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1 Introduction

Motivation to work is greatly affected by income taxes levied and social system valid in a country. Analysis of labour supply behaviour is a key element when evaluating reforms of tax and transfer systems and the impact of different policies on changes in tax revenues, employment or wealth redistribution. We employ a full-parametric method to assess how the Slovak tax-benefit system can affect work incentives.

We document that participation probabilities are in general dependent on the level of net income and transfers. We find that a one percent increase in net wage increases the probability of economic activity by 0.263 percentage points. Taking into account tax and transfer system details valid from 2009 to 2011, a one percent increase in transfers decreases the semi-elasticity of labour force participation by 0.04 percentage points. These results are broadly in line with the elasticities usually reported in the literature. Hence, our general message is that in terms of labour market behaviour, the Slovaks respond to incentives much the same way as their peers in V4/OECD economies.[6] Policy initiatives likely to increase gains to work should result in higher participation and employment rates. Our results also show that, in line with findings for other countries, low-skilled, females and the elderly are the groups that are particularly responsive to changes in taxes and transfers. Labour market policies aimed at boosting employment should, therefore, be primarily targeted at low-educated individuals and women.

These findings are important, as inactivity and unemployment rates persist to be high in Slovakia, and little has been done to formally assess the effects of taxes and social transfers on labour market inactivity.[7] Our results help understanding the incentive effects of tax and benefit policies, and should help policy makers to achieve the right balance between the generosity of social benefits and financial incentives to find a job.

Our estimates are based on a structural model of labour supply where both taxes and transfers are simultaneously taken into account. We use a fully parametric approach to estimate a fully specified structural labour supply model where we address the questions of wage endogeneity[8], following Benczur et al. (2012). We enrich their approach with more complex tax-benefit

[6] The Visegrád Group, also V4, is an alliance of four Central European states: Czech Republic, Hungary, Poland and Slovakia – established for the purposes of cooperation and furthering their European integration.
[7] See Appendix.
[8] Labour demand shifters are used as instruments for wages.

simulation tool. Our tax-benefit model covers in minute detail the joint effects of tax and benefit systems on individuals' net income. Using this methodology, individual participation probabilities are determined by comparing two states: being in labour force and being out of labour force. A key component of this approach is to precisely evaluate disposable income (including also non-labour income and social transfers) of every individual in both states. In order to do so, a concept of *gains-to-work* is introduced and defined as the sum of net wage and transfers lost due to taking up a full-time job. Slovak tax system is incorporated in our model in detail and key elements of transfer system are taken into account. A major advantage of this method is that it allows computing predictions of the impact of tax and transfer system reforms and moreover, it permits evaluation of specific government interventions and policies.

The rest of the paper is organized as follows. In the next section, we briefly summarize existing empirical approaches and the literature on estimation of labour market participation. In section 3, we present our empirical strategy (modelling approach). Section 4 follows with the data description, a brief introduction of the Slovak tax and transfer system and identification of variables in a model. Main results are reported and discussed in section 5. Finally, section 6 concludes and discusses major implications of the presented results on tax and welfare policy. In the Appendix we list definitions of main variables; we also provide some background information on labour market outcomes and policies in Slovakia, detailed information on the tax-benefit system simulations, and present some additional details of our estimations.

2 A Brief Review of Existing Approaches and Literature

Literature on microeconometric estimations of labour supply elasticities is vast[9]. A number of studies conclude that extensive margin is much more important than intensive margin. Existing studies usually evaluate labour supply elasticities of some special demographic subgroups (single individuals, married women, couples, etc.). They usually find that wage elasticities are larger for women than for men.

However, despite the multitude of methodologies and information covered by existing studies, analyses focusing on Central and Eastern European countries are rather scarce and the

[9] Chetty et al. (2011) presents an interesting meta-analysis of estimates of extensive margin elasticities. They find average participation elasticity of 0.25. An overview of recent estimates of labour supply elasticities in the U.S. economy can be also found in McClelland and Mok (2012).

case of Slovakia has been covered only in one paper so far. Chase (1995) compares labour force participation and wage elasticities between Communist and post-Communist regimes in Slovakia and the Czech Republic. He shows that women's participation in the labour market was higher under Communism. He concludes that the effects of changes in earnings are smaller in Slovakia compared to the Czech Republic. This is probably a result of slower transformation of the Slovak economy.

In this study, we follow the approach proposed by Benczur et al. (2012). Their paper studied labour supply at the extensive margin in Hungary. The authors extend an existing structural approach by including a tax and benefit system. As a result, earnings are defined as net wage plus transfers received when working minus hypothetical transfers that are lost when taking up a job. Non-labour income is composed of social benefits, other non-labour income of the individual and income of other members of the households. On top of that, they consider hypothetical non labour income for employed individuals. As regards the participation decision, they report marginal effects of 0.29 and -0.29 for earnings and non-labour income, respectively. They also show that wages, taxes and transfers have a stronger influence on the participation decision of individuals that are older, low skilled or married women and women at child-bearing age.

Bicakova, Slacalek and Slavik (2011) focus on the Czech Republic. Their approach is more or less comparable to ours as they concentrate on the extensive margin only. After examining the outcomes of probit models it turns out that better statistical properties are achieved with the effective net wage. Authors find that wage semi-elasticities of labour supply are larger for women compared to men. However, the estimated wage semi-elasticities are very close to zero, they report 0.06 for women and 0.01 for men.

Most recent evidence on comparing labour supply elasticities in Europe and the US can be found in Bargain et al. (2012). The tax-benefit simulations are based on the Euromod project. Authors use a discrete choice model and, in a unifying framework, they confirm that the extensive margin dominates the intensive, and that own-wage elasticities are rather small.

3 Methodology

In this paper we examine the effects of income taxation and transfers on the participation decision of individuals, i.e. the labour supply responsiveness at the extensive margin. We use a

fully parametric estimation of a structural labour supply model where taxes and transfers are treated in a unifying framework.

First we briefly summarize the setup of the model and its identification. In the next subsection we present the structure of tax and benefit system in Slovakia and corresponding simulations.

3.1 Model and Identification

Methodologically, we closely follow the approach presented in Benczur et al. (2012). The underlying theory starts with a standard utility maximization problem (defined as a labour-leisure trade off) by using an additively separable utility function. Adding taxes and transfers to the model leads to redefinition of the reservation wage, such that the participation decision needs to be constrained to a full time job[10] (otherwise undefined in the structural model, see Benczur et al. (2012) for details). Estimating the probability of being economically active or employed then yields a structural probit equation.

To derive formal expressions, in the first step we introduce the concept of a *gains-to-work* variable W_i defined as a difference between net wage w_i and change in conditional transfers ΔT_i:

$$W_i = w_i - \Delta T_i \,, \tag{1}$$

where $\Delta T_i = T_i^{hyp} - T_i^{obs}$ denotes a difference between hypothetical and observed transfers.

Based on the underlying theory, gains-to-work W_i should be interpreted as a difference between the net effect from being employed full-time and the net effect gained from transfers at zero hours worked. Therefore, we construct gains-to-work W_i for an individual i as follows:

- For the *employed* we first compute the net income – as a sum of net income from employment, non-labour income and transfers that an individual i is entitled to at a given level of income. Net income from employment is computed from the reported gross income less the simulated (by our tax-benefit model) personal income tax and social security contributions. In the next step we assume a hypothetical scenario: income from employment is set to zero (non-labour income is left at its original level) and we compute

[10] In Slovakia, most typical form of employment is a full-time employment. Only 2% of respondents in SK-SILC survey reported that they work part-time. Similar situation has been documented in Hungary.

the corresponding amount of transfers an individual is entitled to. W_i is then defined as a difference between the former and latter scenario.

- For the *unemployed and inactive* we predict their gains-to-work by using a Heckman selection model (see below).

The second variable of principal interest to us is *non-labour income* NY_i which is defined as a sum of three components, namely conditional transfers, other non-labour income that an individual receives (e.g. pensions, income from property, interest, dividend payments, etc.) and income of other members of the household. Other non-labour income and income of other members of the household are independent of the labour market status of an individual, therefore they are computed in the same way for every person. However, the construction of the conditional transfers component T_i in the variable NY_i should be divided into the following steps:

- For the *employed* we assume hypothetical situation where labour income is set to zero (i.e. income "at zero hours worked") and non-labour income is left at its original values. Conditional transfers are then computed as hypothetical values an individual is entitled to by using our model of the tax-benefit system described below.
- For the *unemployed* we add one more step. First, we assign to all unemployed individuals predicted potential gross income (wage) using Heckman's methodology, where the driving factors in the model are based on personal characteristics. Then we proceed like in the case of the employed and we compute their conditional transfers.
- For *pensioners* and *other inactive* we use the actual transfers they are entitled to. [11]

Equipped with vectors of gains-to-work and non-labour income we can focus on modelling and identification of driving factors of participation decisions to enter the labour market. Therefore, we consider two specifications of a structural probit regression model; the first one

[11] In fact, to be consistent in the whole set up of our labour-supply model, we use the *simulated* values of transfers and other non-labour income when they are available, i.e. when they can be computed by our tax-benefit model. We use the actually observed values, as they were reported by survey participants, only when these are not simulated with our tax-benefit model.

uses *economic activity* and the second one uses a dummy variable *employed* as dependent variable:

$$\Pr(\text{activity}_i) = \Phi(\gamma \widehat{\log W_i} + Z_i' \alpha + \psi \log NY_i), \qquad (2)$$
$$\Pr(\text{employed}_i) = \Phi(\gamma \widehat{\log W_i} + Z_i' \alpha + \psi \log NY_i),$$

where vectors of gains-to-work $\widehat{\log W_i}$ and non-labour income $\log NY_i$ enter the model in a logarithmic form[12] and Z_i denotes a vector of characteristics that affect the labour supply of an individual.

When unobserved characteristics of employed people systematically differ from the unobserved characteristics of unemployed, a simple wage regression estimated by OLS will provide biased estimates. Since income from employment is unobservable for those who are unemployed (it's an endogenous dummy variable), we first apply Heckman's sample selection methodology to predict the gains-to-work. In Heckman's framework, the model consists of two equations: a selection equation that estimates the probability (propensity score) of an individual to be employed/unemployed:

$$\Pr(\text{employed}_i) = \Phi(X_i'\beta + Z_i'\alpha + \psi \log NY_i)\ , \qquad (3)$$

where X_i is a vector of those characteristics that affect the labour demand of an individual. The estimated propensity score model is then used to estimate the coefficients of a second regression equation that models the market wage (more specifically the gains-to-work). Formally, we estimate the wage regression by using the Heckman methodology to overcome the sample selection problem:

$$\log W_i = X_i'\beta + \rho\lambda(X_i'\beta + Z_i'\alpha + \psi \log NY_i) + u_i\ , \qquad (4)$$

where X_i is a vector of those characteristics that affect the labour demand of an individual, u_i is an error term and λ denotes the inverse Mill's ratio[13]. We assume that the error terms corresponding to equations (3) and (4) are independent across individual observations and jointly normally distributed with correlation ρ. The model is estimated jointly by maximum likelihood method.

[12] This comes from the derivation of the structural form of the model, see Benczur et al. (2012) for details.
[13] Inverse Mill's ratio is defined as a ratio of probability density function to the cumulative distribution function of a distribution.

Finally, $\widehat{\log W_i} = X_i'\hat{\beta}$ comes as a result of the unconditional linear prediction from Heckman's model. These estimates then enter the structural probit equation (2). In order to reduce the division bias, we use the predicted gains-to-work $\widehat{\log W_i}$ for all observations (i.e. not only for employed but also for unemployed and inactive , as it is common in the labour supply literature, e.g. Bargain et al., 2012 or Breunig and Mercante, 2010).

Identification

The model is parametrically identified due to nonlinearities present in the tax-benefit system. Based on different personal characteristics (including not only the basic demographic variables but also family and household controls) and different levels of non-labour income, individuals may receive different net wages, although their gross wage is the same. As a result, they face different effective average and marginal tax rates. This provides enough cross sectional variation to estimate the gains-to-work and subsequently the elasticity of employment and participation probabilities.

Elasticities

Income elasticities in the structural labour supply model can be derived analytically. Notice that since the structural probit model is non-linear, point estimates of the coefficients do not indicate marginal effects of a unit change in the corresponding variables. To compute the marginal impact of a percentage change in gains-to-work, the probit function given by (2) should be evaluated at certain vectors Z and $\log NY$.

Since our wage measure gains-to-work is given in logarithm, note that in fact we evaluate semi-elasticities [14]. To calculate the corresponding income elasticities, one has to divide the computed semi-elasticities by the predicted probability of economic activity, evaluated at sample means of variables.[15]

[14] Income semi-elasticity (η) of labor force participation is defined as $\eta = \frac{\partial \Pr(activity=1)}{\partial W} \times W$ implying that marginal effect of wage on the probability of economic activity can be expressed as $MFX = \frac{\partial \Pr(activity=1)}{\partial \log W} = \gamma \Phi\left(\widehat{\log W_i} + Z_i'\alpha + \psi \log NY_i\right)$. The estimated effect should be interpreted such that a 1% rise in income leads to the increase of the probability of supplying labor by 0.01 x MFX.

[15] Income elasticity (ε) of labor force participation is defined as $\varepsilon = \frac{\partial Pr(activity=1)}{\partial W} \times \frac{W}{\Pr(activity=1)}$ and can be calculated as $\varepsilon = \frac{\eta}{\Pr(activity=1)}$, knowing the values of semi-elasticity η and predicted probability of activity $\Pr(activity = 1)$.

Moreover, in the structural probit model of labour force participation we evaluate directly the effect of gains-to-work and non-labour income. The separate impact of change in the net wage (w) can be derived as follows:

$$\frac{\partial \log W}{\partial \log w} = \frac{\delta \log(w - \Delta T)}{\delta \log w} = \frac{\delta \log\left(e^{\log w} - \Delta T\right)}{\delta \log w} = \frac{e^{\log w}}{e^{\log w} - \Delta T} = \frac{w}{w - \Delta T}$$

Using the previous relationship we find that the net wage semi-elasticity of probability of supplying labour can be expressed as:

$$\frac{\partial \Pr(\text{activity} = 1)}{\partial \log w} = \frac{\partial \Phi}{\partial \log w} = \frac{\partial \Phi}{\partial \log W}\frac{\partial \log W}{\partial \log w} = \hat{\gamma}\frac{w}{w - \Delta T} \qquad (5)$$

Similarly, for the separate effect of transfers (T), which are only a part of non-labour income, we can write:

$$\frac{\partial \Pr(\text{activity} = 1)}{\partial \log T} = \frac{\partial \Phi}{\partial \log T} = \frac{\partial \Phi}{\partial \log NY}\frac{\partial \log NY}{\partial \log T} + \frac{\partial \Phi}{\partial \log W}\frac{\partial \log W}{\partial \log T} = \hat{\psi}\frac{T}{NY} + \hat{\beta}\frac{-T}{w - \Delta T} \qquad (6)$$

4 Data and tax-benefit system simulations

The data used for microeconometric analysis come from three waves (2010-2012) of SK-SILC, the national version of EU-SILC[16]. Data are collected on an annual basis from 2004 by the Statistical Office of the Slovak Republic on behalf of EUROSTAT. The dataset contains cross-sectional data on household and individual level and it provides information on income, living conditions, social exclusion and poverty. The original datasets contain information on more than 15,000 individuals and 5,200 households annually[17]. We combined these three datasets to a pooled cross-section and estimate structural models as a pooled regression[18].

The SK-SILC comprises detailed information describing the personal characteristics of individuals. These include age, gender, education and region of permanent residency and marital status. The dataset also reports detailed information related to labour market status –

[16] Abbreviation SILC stands for "Statistics on Income and Living Conditions". 2010 SK-SILC denotes the fact that survey data were collected in 2010, while the reference period is 2009.

[17] 2010 SK-SILC database collects information on 16,275 individuals living in 5,376 households, 2011 SK-SILC database contains 15,327 individuals in 5,200 households and 2012 SK-SILC database contains 15,440 individuals in 5291 households.

[18] EU-SILC database for Slovakia is constructed as a rotating panel database with one fourth of data updated each year. However, in our micro-simulations we need to work with a national extended version SK-SILC, which is not available as a panel.

whether an individual was employed (full-time, part-time), self-employed or whether he stayed unemployed in the reference period. Information on the length of working history (in years) is also available. Furthermore, extensive information on the structure of individual income is available. Survey participants were asked to declare their yearly gross earnings from employment (self-employment), fringe benefits, and also transfers from the state, e.g. unemployment benefits or pensions (old-age, disability). Further description and summary statistics of variables can be found in Tables A1-A2 in the Appendix.

4.1 Slovak tax-benefit system simulations

The simulations of the tax-benefit system in Slovakia follows EUROMOD, a microsimulation tool designed to simulate the redistributive systems of EU countries. Simulations cover direct taxes (namely labour and capital income taxes), social insurance contributions and selected transfers. Our contribution is that we provide a more precise simulations of selected transfers compared to EUROMOD. In the Appendix, we report a comprehensive description of the Slovak tax-transfer system and we discuss the key modelling challenges of simulating the Slovak transfer system (in particular those which are beyond the current state of EUROMOD).

4.2 Identification of variables in the model

We first focus on the definition of economic activity and employment status that are dependent variables in the structural probit model. We define employed/unemployed status of an individual based on the prevailing economic activity in the reference period. Being active is defined in terms of ILO definition of economic activity[19].

Income variables are necessary to generate gains-to-work; those which are collected on the individual level are listed in gross terms in SK-SILC. The only exception is the net profit (loss) from self-employment. Information on disposable income, income taxes and social security contributions are available in the SK-SILC database only as an aggregate at the household level. Therefore, all income variables are used in gross terms and the net income is simulated.

[19] For the definition of labour market status we use the SILC variable „prevailing activity in the income reference period", it comprises the following categories: children, employed, unemployed, pensioners and other inactive. Economically active are those who declared themselves as employed or unemployed, category of inactive consists of pensioners and other inactive.

Actually, we distinguish between three different types of income: labour-income, non-labour income and transfers from the government. Labour-income includes gross wage from main and second job, income from self-employment, income from company shares and income from agreements. Information on fringe benefits, severance and termination payments, and company car is also available. Non-labour income covers income from rental of a property or land, interests, dividends and profit from capital investments.

Referring to equation (4), covariates in the Heckman selection model consist of two sets of variables: labour demand shifters X_i and labour supply shifters Z_i. As it has already been documented in the literature (see e.g. Kimmel and Kniesner, 1998 or Benczur et al., 2012) labour demand shifters X_i contain controls that affect market wage while the labour supply shifters Z_i include demographic and family characteristics.

In our implementation, the labour demand group composed of X_i controls for the wage and therefore does not affect labour supply directly (or has only marginal impact). These variables contain the degree of urbanization of a region where a person resides (dense, normal and sparse density) and regional value added per capita. These two variables should capture differences in regional economic environment and thus control for the activity indirectly. We include also age and age squared and interaction terms of age with education dummies. These variables serve as instruments for our wage estimations – we argue that age as a proxy for experience significantly influences the market wage, but it does not affect selection into employment, i.e., it can serve as a labour demand shifter. Besides this, these variables also serve as a source of additional variation in the model (consider prediction of the $\widehat{\log W_i}$ in Heckman's model). Note that different phases of individual life cycle (pre-prime age, prime-age, elderly, student, pensioner) are already controlled for in the labour supply equation.

Labour supply shifters group Z_i contains controls like gender, three age groups (15-24, prime age 25-49 and elderly 50+), three educational groups (education level is stated as a dummy of the highest level achieved) and working experience expressed as a share of actual to potential experience. Here, age group dummies are included as a labour supply shifter that control for the life-cycle position. We also include health status (whether person reports a chronic or longstanding illness), family status (single, divorced, married, widowed), living with working partner, being a mother of child under 3 years of age, being a pensioner and attending a full-

time education. Moreover, we include dummy variables for car ownership and monthly instalments of mortgage and loans.

4.3 Setup of the sample

The dataset we use is restricted by age to persons older than 15 and younger than 75, to exclude children in full-time education and those in retirement. Persons who declare themselves as employed (reporting positive number of months being employed), but who report income below minimal wage, are also dropped. Moreover, we also exclude those individuals, where the prevailing economic activity in the income reference period could not be defined. These adjustments leave us with approximately 36,000 individual observations in the estimation sample.

5 Findings

In this section we present and discuss a large set of estimation results. We start with the estimation of the standard Heckman selection model to obtain predictions of wages of all individuals in the sample, such that we take into account selection into employment (see equation (4)). The estimation results of the two equations of the Heckman model are reported in Table A3 in the Appendix. Statistically significant effect of selection has been proved by the likelihood ratio test. The results are in line with findings that can be found in the academic studies analysing other market economies. In particular, wages rise with age and education and a concave shape of age-earnings profiles could be detected. Higher regional value added increases income. The selection equation shows that the probability of employment rises with age and education, and working experience acts also as a positive determinant. Looking at the family status controls; living with working partner, being married, divorced or widowed effects selection positively. Notice that car ownership and repayment of mortgage or loan positively determines selection into employment. On the other hand, non-labour income (including transfers) has a significant negative effect on selection, which is in line with results documented in the literature. Reporting chronic illness, being female, mother of a small child, student or pensioner decreases probability of employment.

Equipped with the prediction of the constructed variable gains-to-work $\widehat{\log W_i}$, we estimate two specifications of the structural probit model using labour force participation and

employment status as dependent variables. Point estimates and goodness-of-fit measure pseudo R2 are listed in Table A4 in the Appendix. Estimates of parameters are again in line with usual findings, significance and direction of dependencies is similar to those described for the selection equation of the Heckman model above. Note that the effect of different years (benchmark is reference year 2009) is mixed. The effect of 2010 is significantly negative, implying that with on-going economic crisis the probability of participation activity as well as employment decreases. The effect of 2011 is statistically insignificant.

Table 1: Marginal effects – main specification

Dependent variable	**ACTIVE**		**EMPLOYED**	
Point estimates	**coef**	**std err**	**coef**	**std err**
Gains to work (*logW)*	0.670	0.062	0.572	0.069
Non-labour income (*logNY)*	-0.305	0.019	-0.357	0.016
Marginal effects*	**dy/dx**	**std err**	**dy/dx**	**std err**
Gains to work (*logW)*	0.233	0.020	0.226	0.027
Non-labour income (*logNY)*	-0.106	0.007	-0.142	0.006
Net wage	0.263	0.023	0.255	0.031
Transfers	-0.039	0.003	-0.042	0.003

**Note: Marginal effects are evaluated at sample means. Bootstrapped standard errors, 200 replications.*

In Table 1 we report our main results: the marginal effects from the estimated structural probit model evaluated at sample means. Later we concentrate mainly on labour force participation (economic activity), for the probability of employment we display only results of the main specification. In the upper part of the table, the point estimates of the gains-to-work and non-labour income are reported. Looking at both specifications, the computed results are statistically significant and have the expected sign, i.e. an increase in gains-to-work increases the probability of participation, while the opposite is true for non-labour income. Qualitatively the results of both specifications are comparable[20].

A one percent rise in gains-to-work increases the individuals' probability of economic activity by 0.233 percentage points, this effect is even more pronounced for the net wage (see equation (5)). On contrary, the effect of non-labour income and transfers is lower (in absolute value); a one percent increase in non-labour income leads to 0.106 percentage points decrease in

[20] Conditional marginal effects for the dependent variable "Employed" divided by subgroups are available upon request.

supplying labour. Since transfers are only a part of non-labour income, the effect of transfers is substantially smaller.

Table 2: Marginal effects by educational subgroups*

Marginal effects by subgroups**	Prime age		Full sample	
	dy/dx	std err	dy/dx	std err
Elementary education				
Gains to work (*logW*)	0.236	0.022	0.122	0.015
Non-labour income (*logNY*)	-0.107	0.007	-0.055	0.004
Net wage	0.274	0.025	0.128	0.015
Transfers	-0.058	0.004	-0.007	0.001
Secondary education				
Gains to work (*logW*)	0.083	0.008	0.211	0.019
Non-labour income (*logNY*)	-0.038	0.003	-0.096	0.007
Net wage	0.098	0.009	0.241	0.021
Transfers	-0.022	0.002	-0.039	0.003
Tertiary education				
Gains to work (*logW*)	0.051	0.008	0.114	0.012
Non-labour income (*logNY*)	-0.023	0.003	-0.052	0.005
Net wage	0.061	0.009	0.132	0.014
Transfers	-0.015	0.002	-0.025	0.002

**Note: Probit estimates are computed using full sample and marginal effects are evaluated at sub-group specific sample means. Bootstrapped standard errors, 200 replications.*

***Note: Dependent variable ACTIVE*

Our results are similar to the results reported for Hungary by Benczur et al. (2012) and are also consistent with the preliminary results of a similar analysis conducted for the Czech Republic (mimeo). In terms of the magnitude of the computed elasticities, we found somewhat lower values (both net income and transfers elasticities) compared to the ones reported in Benczur et al. (2012) for Hungary, and our results came close (in terms of low transfers elasticities) to the preliminary results computed for the Czech Republic.

Next we focus on selected subgroups of individuals and explore how the estimated semi-elasticities change. In Table 2 we present a comparison of marginal effects computed for the three educational subgroups (elementary or less, secondary and tertiary education). The estimated semi-elasticities are substantially different by educational subgroups: the highest responsiveness is observed in the low-educated group with elementary education (these individuals are often highly transfers-dependent). Our results suggest that participation elasticities substantially decrease with educational level, especially when prime-age sub-sample is considered. Notice that in agreement with previous studies, the prime-age subgroup of higher

educated individuals exhibits overall low responsiveness to the tax and transfer system reforms compared to the full sample of entire population.

Table 3: Marginal effects by selected subgroups*

Marginal effects by subgroups**	dy/dx	std err	Marginal effects by subgroups**	dy/dx	std err
Prime age, males			**Prime age, females**		
Gains to work (*logW)*	0.052	0.004	Gains to work (*logW)*	0.112	0.013
Non-labour income (*logNY)*	-0.023	0.002	Non-labour income (*logNY)*	-0.051	0.004
Net wage	0.060	0.005	Net wage	0.136	0.016
Transfers	-0.014	0.001	Transfers	-0.032	0.003
Prime age, single males			**Prime age, single females**		
Gains to work (*logW)*	0.085	0.008	Gains to work (*logW)*	0.125	0.014
Non-labour income (*logNY)*	-0.039	0.003	Non-labour income (*logNY)*	-0.057	0.005
Net wage	0.104	0.010	Net wage	0.156	0.017
Transfers	-0.036	0.002	Transfers	-0.053	0.004
Prime age, married males			**Prime age, married females**		
Gains to work (*logW)*	0.035	0.003	Gains to work (*logW)*	0.104	0.012
Non-labour income (*logNY)*	-0.016	0.002	Non-labour income (*logNY)*	-0.047	0.004
Net wage	0.040	0.004	Net wage	0.123	0.015
Transfers	-0.007	0.001	Transfers	-0.024	0.002
Prime age (25-49)			**Elderly (>=50)**		
Gains to work (*logW)*	0.079	0.008	Gains to work (*logW)*	0.261	0.025
Non-labour income (*logNY)*	-0.036	0.003	Non-labour income (*logNY)*	-0.118	0.007
Net wage	0.093	0.009	Net wage	0.280	0.027
Transfers	-0.021	0.002	Transfers	-0.027	0.002

**Note: Probit estimates are computed using full sample and marginal effects are evaluated at sub-group specific sample means. Bootstrapped standard errors, 200 replications.*

***Note: Dependent variable ACTIVE*

In Table 3 we report results for the sub-groups classified by gender and marital status. Overall, the responsiveness of females is larger than that of males. Prime-age married males are identified as the sub-group with the smallest elasticity. We do not find substantial differences in responsiveness when single and married prime-age women are compared. The group of elderly (above 50 years) shows the highest responsiveness, this can explain the large difference between prime age group semi-elasticity and semi-elasticity of the whole sample.

Table 4: Marginal effects by income quintiles*

Marginal effects by Gains to Work quintiles**	**dy/dx**	**std err**	**dy/dx**	**std err**
Q1 (below 3,570 euro)	**Prime Age**		**Full sample**	
Gains to work (*logW)*	0.164	0.023	0.252	0.027
Non-labour income (*logNY)*	-0.075	0.006	-0.115	0.008
Net wage	0.233	0.032	0.348	0.037
Transfers	-0.083	0.010	-0.109	0.010
Q2 (below 4,712 euro)	**Prime Age**		**Full sample**	
Gains to work (*logW)*	0.101	0.013	0.112	0.013
Non-labour income (*logNY)*	-0.046	0.004	-0.051	0.004
Net wage	0.132	0.017	0.147	0.018
Transfers	-0.042	0.004	-0.045	0.004
Q3 (below 5,807 euro)	**Prime Age**		**Full sample**	
Gains to work (*logW)*	0.072	0.008	0.087	0.009
Non-labour income (*logNY)*	-0.033	0.003	-0.040	0.003
Net wage	0.091	0.011	0.110	0.012
Transfers	-0.026	0.003	-0.031	0.003
Q4 (below 7,317 euro)	**Prime Age**		**Full sample**	
Gains to work (*logW)*	0.053	0.006	0.061	0.006
Non-labour income (*logNY)*	-0.024	0.002	-0.028	0.002
Net wage	0.063	0.007	0.071	0.007
Transfers	-0.014	0.001	-0.015	0.001
Q5 (above 7,317 euro)	**Prime Age**		**Full sample**	
Gains to work (*logW)*	0.068	0.004	0.267	0.024
Non-labour income (*logNY)*	-0.031	0.003	-0.121	0.008
Net wage	0.074	0.004	0.275	0.024
Transfers	-0.010	0.001	-0.012	0.001

**Note: Probit estimates are computed using full sample and marginal effects are evaluated at sub-group specific sample means. Bootstrapped standard errors, 200 replications.*

***Note: Dependent variable ACTIVE*

Finally, in Table 4, we look at the sub-groups divided by income levels, here represented by the gains-to-work quintiles. Results for the full sample of entire population are mixed: elasticities decrease with income level, but for the fifth quintile they show to be unexpectedly high. This may result from the presence of working pensioners with high non-labour income in the sub-group. Therefore, we report separately results for the prime age group and in line with previous analyses we find that the overall elasticity of this group decreases with income level. Cross quintiles differences in computed elasticities are larger at the lower end, i.e. between first, second and third quintiles. There is practically no difference between the reported elasticities in the fourth and fifth quintile.

Overall, thus, our results suggest that policies that make work pay would lead to an increase in participation and employment. The low-skilled, females and the elderly are groups that are more responsive to changes in taxes and transfers. This implies that labour market policies (i.e. tax and transfer system reforms) that are aimed at boosting employment should be primarily targeted at low-educated individuals and women.

6 Conclusion

In this paper we provide the first estimates of the responsiveness of labour supply at the extensive margin for Slovakia. We use a structural labour supply model that takes into account both taxes and transfers and estimate net income semi-elasticity of labour force participation.

This analysis shows several clear results. We identify significant individual responsiveness to the tax and transfer system. It turns out that the results are qualitatively comparable to those reported for mature market economies: highly responsive groups of population are the low-skilled, females and the elderly. These findings are in line with our initial expectations, however the overall elasticity to transfers has been found low. On reflection, this is also not surprising, since a more detailed examination of the composition of the individual non-labour income reveals that transfers constitute only a small part of it, which is a consequence of the relatively low generosity of the Slovak benefit system. Our results are similar in both principle and magnitude to those found in the literature for both countries in the region and for more distant mature economies.

In future work, we plan to investigate if labour supply elasticities at the extensive margin vary with the state of the aggregate economy. By extending our sample period, we also plan to investigate the consequences of major tax reforms for participation elasticities among different groups of the population. The model presented in this study is a static microsimulation model and its value lies primarily in assessing how the Slovak tax-benefit system affects willingness to work. It can be used as an a priori assessment tool to evaluate different policies, but this will only lead to partial equilibrium results. In a more comprehensive evaluation of the long-run fiscal and labour market consequences of larger policy reforms, the behavioural effects of policy measures should also be taken into account. Therefore, as a next step, we plan to link our microsimulation exercise, together with an assessment of labour supply elasticities at the intensive margin, to a small general equilibrium macro model.

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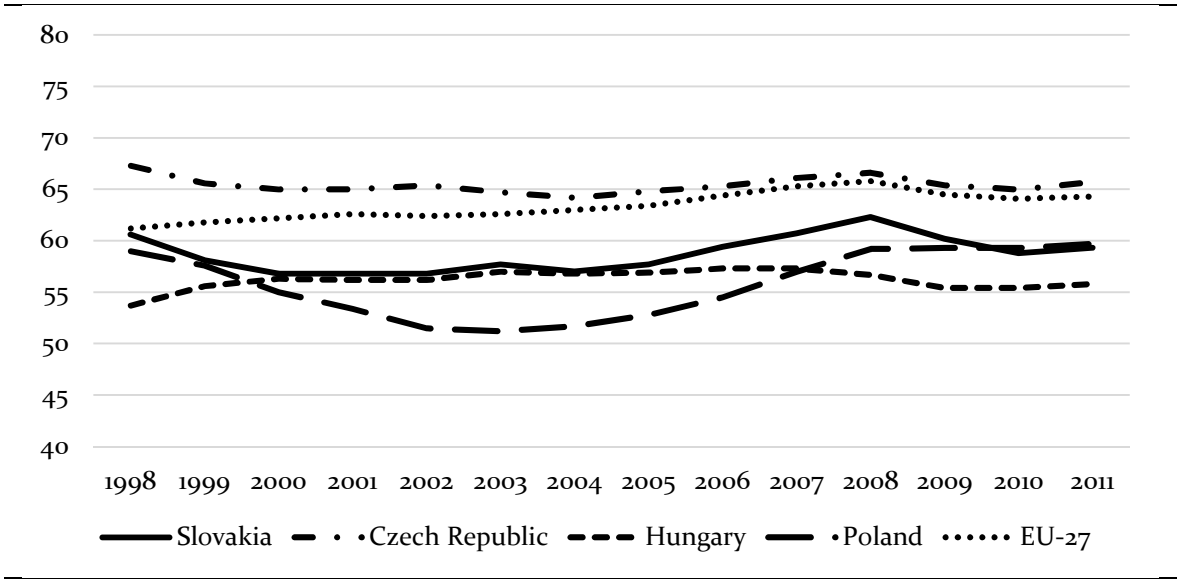
Appendix

Labour market outcomes and policies in Slovakia

The empirical evidence on labour supply behaviour in transition and post-transition countries is limited. From the historical point of view, in Central and Eastern European (CEE) countries that experienced communist regimes, labour force participation was obligatory. In general, after the change of regimes at the beginning of 1990's and during the transition period when national economies changed from planned to market-based ones, a continual withdrawal from the labour force has been detected on labour markets in all CEE countries.

Figure 1: Employment rates in Slovakia and selected countries, 1998-2011

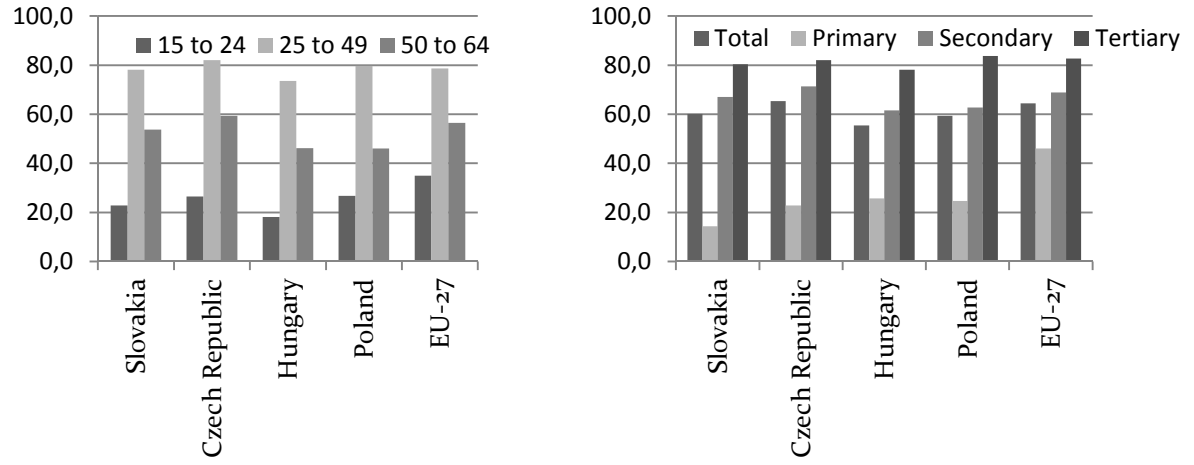


Note: 15 to 64 years *Source: Eurostat*

Participation and employment rates in Slovakia reached their bottom in the early 2000s. Later, in the period of economic growth, an increase in both rates has been observed; they started to decline again in 2009 as a consequence of the global financial crisis. The present situation in post-transition Slovakia can be characterized by employment rates (see Figure 1) permanently below the EU-27 average but still rather high compared to neighbouring Hungary and Poland. Lack of job opportunities in Slovakia especially for labour market entrants and for individuals with low qualification persist. Employment rates of youth and low-skilled (low

educated) workers are extremely low, also compared to neighbouring V4 countries (see Figure 2).

Figure 2: Employment rates by age and education in 2009



Note: 15 to 64 years *Source: Eurostat*

The motivation to work is greatly affected by income taxes levied and social system valid in the country. The Slovak tax-benefit system experienced major changes over the last 10 years. Both tax and social transfer systems were considerably modified[21] in 2004 when a flat personal income tax scheme was implemented and social transfers were significantly cut down in levels in order to increase work incentives. A report by the World Bank (2012) shows that these reforms considerably improved work incentives for low-income workers. However, this improvement has been achieved mainly due to a reduction in transfer levels. The tax-benefit system currently valid in Slovakia seems to encourage work more than the system valid before reforms in 2004. On the other hand, low-wage part time work is still not sufficiently attractive for those who are eligible to receive material needs benefit (MNB). The Slovak transfer system is restrictive especially for labour market entrants and low-skilled workers employed at low-paid jobs. Structural changes both in tax and transfer systems that followed in 2005-2012 were minor and are well documented in Porubsky et al. (2013).

Public social expenditure (expressed as a percentage of GDP) tends to be low in Slovakia also compared to neighbouring V4 countries and is significantly below OECD average (see OECD

[21] Due to data limitation, we cannot evaluate the effects of these reforms using our methodology.

Employment Outlook 2011, Figure 2.1). Moreover, both passive (providing income replacement) and active (government interventions aimed to help unemployed to find a job) labour market policies in Slovakia can be described as some of the least inclusive among the EU countries. Protection against unemployment is low, both in terms of generosity and coverage of the allowance. Unemployment benefit coverage measured by the ratio of beneficiaries to the number of unemployed is currently around 12% in Slovakia (for detailed numbers see World Bank (2011), Table 3) and this compares to almost 50% coverage as an OECD average in 2007-08 (see OECD Employment Outlook 2011, Figure 2.5). Note that neighbouring Czech Republic and Hungary are placed among OECD countries with average coverage with respect to both indicators, i.e. public social expenditures and unemployment benefit recipiency rates. Since the access to unemployment benefit in Slovakia is rather tedious, benefit in material needs partly supplies its role as a non-contributory unemployment allowance.

The current Slovak system of social assistance is rather insensitive to overall changes in labour market conditions. As documented by the World Bank (2011), a decline in the number of registered unemployed (jobseekers) during the period of growth in 2004-08 was not reflected in a drop in MNB recipients. Later, the rise in unemployment during the financial crisis did not lead to a corresponding increase in number of MNB recipients. This suggests that there exist a stable group of prime-age population locked in the social assistance system.

Tax-Benefit System in Slovakia and Simulations

At this stage of the project we can simulate the Slovak tax-benefit system valid in 2009- 2011[22]. However, the only major change in the Slovak tax system has taken place in 2004 (the so called flat tax reform) and now from 2013, when tax brackets were introduced. This chapter is largely based on EUROMOD country report for Slovakia by Porubsky et al. (2013), which comprises detailed information about the EUROMOD[23] system for Slovakia and describes taxes and benefits that can be simulated with it.

[22] We have adopted (coded) EUROMOD model to our own STATA program, such that we are capable to make independent alterations in the code if necessary.

[23] Description of EUROMOD system can be found at https://www.iser.essex.ac.uk/euromod.

The tax and social insurance contributions system

The Slovak tax system is largely unified; all important components are set at the state level. Taxation of income is conducted on an individual level and it is levied on gross income including wages, income from business activities, fringe benefits, capital incomes (dividends excluded), interest and rental income. Social insurance contributions and social benefits are exempt from the tax base.

All relevant parameters needed to compute personal income tax (PIT) are available - both those which are related to individual and household level. The PIT is simulated in the model as a final tax liability, i.e. it is computed after all tax allowances and tax credits. During the years 2009 to 2011 PIT amounts to a 19% flat tax rate.

Tax expenditures in the PIT include:

(a) Basic tax allowance: tax allowance each individual can apply, the amount of the allowance is based on the actual minimum subsistence level.

(b) Spouse tax allowance: an individual may be entitled to a spouse tax allowance if the income of spouse satisfies certain conditions (earnings under certain level).

(c) Employee tax credit: amount depends on employee's income and on the period he has been working (at least 6 months). It is targeted at low-income groups who have to pay social insurance contributions.

(d) Child tax credit: one spouse may claim an allowance for the children in the household (per every child) if the child satisfies certain conditions (e.g., aged under 18 or aged under 26 and in full time education or aged under 26 when physically or mentally disabled and not receiving disability pension).

Withholding income taxes are not simulated. Other direct taxes (such as local taxes) and indirect taxes (such as VAT, excise taxes) are also not simulated.

The Slovak social insurance system is made up of two components; namely social insurance contributions and health insurance contributions. Assessment base for contributions is narrower compared to the PIT base since capital income is not considered.

(a) Social insurance contributions

Both employers and employees pay unemployment, sickness, disability and old age insurance (but different percentages from the assessment base). Old-age insurance is composed of public and private pillar; employees may choose whether they split their

contributions between public and private pillar or pay the whole amount to the public pillar.

In addition, employers pay also contributions to reserve solidarity fund, accident insurance and guarantee insurance.

Self-employed are treated differently; they pay sickness, disability and old age insurance and contributions to the reserve solidarity fund.

(b) Health insurance contributions

These contributions are paid by employers, employees and self-employed. The percentage to be paid is different for the three categories of payers (employers, employees and self-employed).

All social insurance contributions paid by employers, employees and self-employed are simulated in the model.

Benefit System

The Slovak benefit system consists of three components, termed as contributory, social assistance and poverty, and state social support.

(a) Contributory benefits include old-age pension, early old-age pension, disability pension, widow's and widower's pension, orphan's pension, sickness cash benefit, benefit for nursing a sick relative, equalization allowance, maternity benefit, and unemployment insurance benefit.

(b) Social assistance program covers material need benefit.

(c) State social support includes several programs, namely child birth grant, additional birth grant, multiple birth benefit, child benefit, additional child benefit, parental allowance, funeral benefit, scholarships for pupils in elementary school, scholarships for students in secondary school, and social scholarships for university students.

Based on the information available in the SILC data, benefits that can be fully simulated include family related programs (child birth grant, child benefit including additional child benefit and parental allowance). Means-tested material needs benefit and contributory unemployment insurance benefit can be simulated partially. For the simulations of other benefits listed above we do not have enough information on contribution record (needed for contributory benefits

like old-age pensions). Scholarships, which are means-tested, are not simulated – since the grades of potentially eligible students are not available.

For our labour force participation modelling, two aspects of simulations should be considered. First, eligibility to certain benefits depends on the labour market status of a person (being employed / unemployed), namely contributory unemployment benefit[24] and means-tested material needs benefit[25]. The remaining three simulated benefits mentioned in the previous paragraph are family related instruments. Eligibility conditions for these benefits do not change when labour market status of a person changes. A second aspect that should be taken into account is the fact that several benefits, namely maternity benefit, parental allowance and unemployment benefit are supposed to be received subsequently and not simultaneously. Moreover, their eligibility period might be shorter than the length of income reference period (which is one year). In order to allow for changes in receiving different benefits during the income reference period, a key modelling challenge is to simulate respective transfers on monthly basis depending on their eligibility requirements. The benefits are simulated in the following order: maternity benefit, parental allowance and unemployment benefit if one is eligible for it. These simulations are already beyond the current extent of EUROMOD.

[24] Unemployment benefit is a payment to individuals who are registered as unemployed and fulfil the eligibility conditions. The amount is proportional to the previous earned salary and the benefit is paid for a maximum period of 6 months. Benefit is simulated under a set of simplifying assumptions – regarding both amount and allocation.

[25] Material needs benefit is a social assistance instrument that is designed to guarantee the basic living standards. It is composed of the basic benefit and four different allowances (activation, protection, health care and housing). The assessment unit for the evaluation of this benefit is a family. The actual amount is computed as a difference between all claims to which a family is entitled to and their assessed income. The benefit is allocated to the head of the assessment unit. This benefit can be simulated only partially; all components needed to compute the assessed income, health care and housing allowances are available, but the dataset does not contain all the information necessary to allocate the activation and protection allowances precisely. Therefore, simulations are performed under simplifying assumptions.

Table A1: Components of constructed variables in the model[26]

List of variables - definitions	
Active	Binary indicator that equals 1 if the person is economically active in the income reference period.
Employed	Binary indicator that equals 1 if the person is employed in the income reference period.
Gains to work (*logW*)	Variable defined as the difference between net income and transfers lost due to taking up a job. Net income is defined as the sum of income from employment and non-labour income. Income from employment is given in net terms, i.e. as a gross wage minus social security contributions and taxes. Labour income consists of the following SILC variables: *Gross wages, Self-employment income, Other payments made by employers, Income from agreements, Fringe benefits, Severance payments, Termination pay (lump sum), Income from abroad*. Non-labour income consists of the following SILC variables: *Private pensions, Investment income-interests, Disability benefit, Old-age pensions, Widow's, widower's and orphan's pension, Other survivor benefits, Sickness and nursing benefits, Means-tested scholarships, Maternity benefit, Child birth grant, Child benefit*. Transfers comprise of*: *Parental allowance, Contributory unemployment benefit, Material needs benefit*.
Non-labour income (*logNY)*	Variable defined as the sum of transfers, other individual's non-labour income and income of other members of the household.
Female	Binary variable that equals 1 if the person is woman, 0 if man.
Education group dummies	3 binary variables are created based on ISCED classification (**EDU: Primary** [reference cat.], **EDU: Secondary**, **EDU: Tertiary**). If the person belongs to a group according to his highest degree awarded, the corresponding binary variable equals 1, otherwise 0.
Age group dummies	3 binary variables are created based on age groups (**Age 15-24** [reference cat.], **Age 25-49**, **Age 50+**). If the person belongs to a group according to his age, the corresponding dummy variable equals 1, otherwise 0.
Actual/Potential experience	Variable representing the ratio of person's actual and potential experience in years. Actual experience in paid work is reported. Potential experience is expressed as the number of years since the person has finished his education.
Chronic disease	Binary indicator that equals to 1 if the person reports a chronic/long standing disease.
Mother with child under 3y.	Binary indicator that equals to 1 if the person is a mother of a child that is younger than 3 years.
Student	Binary indicator that equals to 1 if the person is a student, 0 otherwise.
Pensioner	Binary indicator that equals to 1 if the person is a pensioner, 0 otherwise.
Working Partner	Person has a working partner

[26] Variable names are given in bold.

Family status dummies	5 binary variables are created based on family status (**Single** [reference category], **Married**, **Separated**, **Divorced**, **Widowed**). If the person belongs to a group according to his family status, the corresponding dummy variable equals 1, otherwise 0.
Age	Variable indicating the person's age.
Age^2	The person's age squared.
Degree of urbanisation	3 binary variables are created based on number of inhabitants of the area where the person resides (**Dense** [reference category], **Average**, **Sparse**). If the person belongs to a group according to the degree of urbanization of his residence, the corresponding dummy variable equals 1, otherwise 0.
Regional value added per capita	Variable representing the value added per capita in the region of the person's residence (in log).
Mortgages and loans	Binary indicator that equals 1 if the person pays a mortgage or loan in the income reference period.
Car ownership	Binary indicator that equals 1 if the person owns a car.

**Note: Transfers that do not change subject to change in the labour market state of the person are included in non-labour income. We denote as transfers those variables that change their value subject to change of the labour market state.*

Table A2: Descriptive statistics of the estimation samples SK-SILC 2010 -2012

Dataset	SK-SILC 2010		SK-SILC 2011		SK-SILC 2012	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Active	0.643	0.479	0.629	0.483	0.635	0.482
Employed	0.583	0.493	0.571	0.495	0.572	0.495
Gains to work	435.708	289.214	455.490	374.488	484.665	298.725
Log of Gains to work	5.839	0.851	5.864	0.875	5.966	0.800
Non-labour income	643.883	446.706	680.971	551.937	697.309	475.057
Log of Non-labour income	6.198	0.846	6.241	0.851	6.270	0.857
Transfers	54.656	78.507	59.830	84.918	64.840	90.783
Male	0.471	0.499	0.469	0.499	0.468	0.499
Female	0.529	0.499	0.531	0.499	0.532	0.499
Education: Primary	0.161	0.368	0.158	0.365	0.153	0.360
Education: Secondary	0.664	0.472	0.655	0.475	0.651	0.477
Education: Tertiary	0.175	0.380	0.187	0.390	0.196	0.397
Age 15-24	0.209	0.407	0.205	0.404	0.200	0.400
Age 25-49	0.439	0.496	0.430	0.495	0.429	0.495
Age 50+	0.352	0.478	0.364	0.481	0.371	0.483
Actual/Potential experience	0.924	1.891	0.893	1.820	0.872	1.728
Chronic disease	0.267	0.442	0.277	0.448	0.262	0.440
Mother with child under 3y.	0.028	0.165	0.025	0.157	0.026	0.160
Pensioner	0.176	0.381	0.183	0.387	0.183	0.387
Student	0.154	0.361	0.154	0.361	0.152	0.359
Working Partner	0.371	0.483	0.361	0.480	0.359	0.480
Family: Single	0.343	0.475	0.352	0.478	0.358	0.479
Family: Married	0.542	0.498	0.527	0.499	0.517	0.500
Family: Separated	0	0	0	0	0	0
Family: Divorced	0.056	0.231	0.062	0.241	0.065	0.247
Family: Widowed	0.058	0.234	0.060	0.237	0.059	0.236
Age	41.767	16.422	42.257	16.552	42.373	16.492
Density: Dense	0.265	0.441	0.253	0.435	0.242	0.428
Density: Average	0.323	0.467	0.321	0.467	0.310	0.463
Density: Sparse	0.412	0.492	0.426	0.494	0.448	0.497
Regional value added per capita (in log)	-4.684	0.359	-4.638	0.359	-4.588	0.372
Mortgages and loans	0.283	0.451	0.248	0.432	0.247	0.431
Car ownership	0.699	0.459	0.707	0.455	0.716	0.451
Sample size	13,071		12,555		12,686	

Table A3: Potential Wage for the Unemployed computed via Heckman Selection Methodology

Regression Equation			
Density: Average	0.017	*	(0.010)
Density: Sparse	0.012		(0.010)
Regional value added per capita (log)	0.103	***	(0.011)
Age	0.119	***	(0.003)
Age^2	-0.137	***	(0.003)
(EDU : Secondary)*Age	0.001	**	(0.000)
(EDU : Tertiary)*Age	0.006	***	(0.000)
Constant	6.605	***	(0.068)
Selection Equation			
logNY	-0.327	***	(0.014)
FEMALE	-0.242	***	(0.018)
EDU: Secondary	1.175	***	(0.073)
EDU: Tertiary	1.161	***	(0.089)
Age up to 25	-0.043		(0.044)
Age 50+	0.096	***	(0.037)
Actual/Potential experience	0.161	***	(0.010)
Chronic disease	-0.523	***	(0.020)
Mother with child under 3y.	-1.755	***	(0.047)
Pensioner	-2.192	***	(0.046)
Student	-1.508	***	(0.038)
Family: MARRIED	0.38	***	(0.032)
Family: DIVORCED	0.32	***	(0.043)
Family: WIDOWED	0.396	***	(0.054)
Has Working Partner	0.455	***	(0.026)
Mortgages and loans	0.11	***	(0.019)
Car ownership	0.392	***	(0.019)
Density: Average	-0.184	***	(0.024)
Density: Sparse	-0.318	***	(0.023)
Regional value added per capita (log)	0.185	***	(0.026)
Age	-0.004		(0.007)
Age^2	0.003		(0.008)
(EDU : Secondary)*Age	-0.01	***	(0.002)
(EDU : Tertiary)*Age	-0.002		(0.002)
Year 2010	-0.002		(0.021)
Year 2011	0.09	***	(0.020)
Constant	3.381	***	(0.218)
N	36,283		
N censored	16,254		
LR test of indep. eqns. (rho = 0): chi2(1)	2,795	***	
inverse Mills ratio (lambda)	-0.431		

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Reference categories for the dummies: Density of settlement (ref. Dense), Education (ref. Elementary), Family status (ref. Single), Year (ref. 2009)*

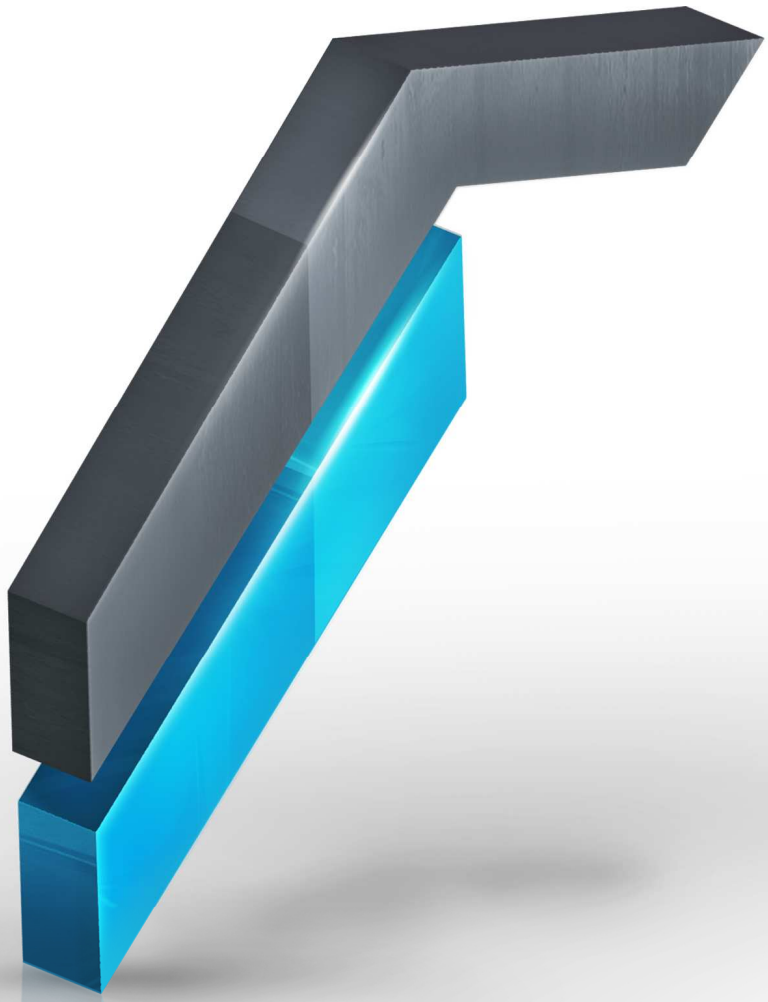
Table A4: Structural probit model

Dependent variable: ACTIVE			
$\widehat{\log W}$	0.670	***	(0.062)
logNY	-0.305	***	(0.019)
FEMALE	-0.124	***	(0.023)
EDU: Secondary	0.646	***	(0.039)
EDU: Tertiary	0.758	***	(0.049)
Actual/Potential exper.	0.164	***	(0.041)
Age up to 25	0.469	***	(0.051)
Age 50+	-0.199	***	(0.030)
Chronic disease	-0.833	***	(0.027)
Mother w. child < 3y.	-2.409	***	(0.057)
Pensioner	-2.284	***	(0.049)
Student	-1.916	***	(0.051)
Family: MARRIED	0.160	***	(0.040)
Family: DIVORCED	0.290	***	(0.055)
Family: WIDOWED	0.134	**	(0.058)
Has Working Partner	0.388	***	(0.033)
Mortgages and loans	0.167	***	(0.025)
Car ownership	0.127	***	(0.024)
Year 2010	-0.060	**	(0.026)
Year 2011	0.026		(0.027)
Constant	-2.568	***	(0.551)
N	36,283		
R2 pseudo	0.628		

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Reference categories for the dummies: Education (ref. Elementary), Family status (ref. SINGLE), Year (ref. 2009).*

Dependent variable: EMP			
$\widehat{\log W}$	0.572	***	(0.069)
logNY	-0.357	***	(0.016)
FEMALE	-0.100	***	(0.018)
EDU: Secondary	0.868	***	(0.034)
EDU: Tertiary	1.104	***	(0.044)
Actual/Potential exper.	0.156	***	(0.053)
Age up to 25	0.150	***	(0.047)
Age 50+	-0.055	*	(0.029)
Chronic disease	-0.601	***	(0.024)
Mother w. child < 3y.	-1.984	***	(0.059)
Pensioner	-1.858	***	(0.050)
Student	-0.837	***	(0.042)
Family: MARRIED	0.252	***	(0.032)
Family: DIVORCED	0.336	***	(0.048)
Family: WIDOWED	0.309	***	(0.060)
Has Working Partner	0.576	***	(0.028)
Mortgages and loans	0.142	***	(0.020)
Car ownership	0.329	***	(0.023)
Year 2010	-0.030		(0.022)
Year 2011	0.018		(0.023)
Constant	-2.440	***	(0.603)
N	36,283		
R2 pseudo	0.507		

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Reference categories for the dummies: Education (ref. Elementary), Family status (ref. SINGLE), Year (ref. 2009).*



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