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Employment Effects of Income Tax Reforms: Lessons from Slovakia[1]

Michal Horvath[2] and Zuzana Siebertova[3]

ABSTRACT

Fundamental income tax reforms are usually justified by or opposed because of large employment implications. The employment gains and losses are supposed to originate from various behavioural and dynamic effects of tax reforms over the medium to long term. To test the limits of such arguments, we study hypothetical radical measures designed to have potentially large employment effects in the context of Slovakia. A close inspection of the different implications of such tax reforms for adjustment on the extensive margin of the labour market reveals that promises or worries of large employment effects have little empirical support. This is because labour supply responses to 'making work pay' are small, the requirement of revenue neutrality limits the extent to which (dis)incentivising work is feasible, and because income effects arising from positive assortative mating within families counteract total individual-level effects. Our framework suggests the focus of tax reformers should be on the variation in effective labour supply coming from intensive margin effects.

Keywords: microsimulation, dynamic general equilibrium, employment, labour supply elasticity, tax reform

JEL classification: E24, H24, H31, J22

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1 Introduction

Fundamental income tax reforms are usually justified by the promise of large employment gains.[4] One also often hears warnings that even moderate changes to the income tax schedule could destroy jobs on a large scale. Such employment gain and losses are supposed to originate from various behavioural and dynamics effects of tax reforms over the medium to long term. Our argument in this paper is that such promises or worries would have little empirical support in the context of Slovakia, and that the relative contribution of tax changes to variation in the employment rate is small. We argue that this lesson and our explanations for it should apply more generally.

We provide a detailed analysis of the simulated effects of large-scale hypothetical revenue-neutral tax reforms. We offer a close inspection of the different implications of such tax reforms for adjustment on the extensive margin of the labour market in Slovakia. We show that the simulated small overall employment responses to radical measures designed to affect labour supply incentives in a significant way can be traced back to the following three factors.

First, extensive margin elasticities of the labour supply decision are small. Our estimates of participation income elasticities yield 0.05 for males and 0.1 for females, while elasticities of non-labour income yield -0.04 for males and -0.07 for females on a pooled sample. These values are broadly in line but near the lower end of the international estimates, which supports our assertion about the broader relevance of our results.[5] Looking beyond pooled regression results, we uncover significant time variation in the measured elasticities, which suggests that the state of the economy at the time of the tax reforms may matter, although the impact of such time/state-variation on the aggregate outcomes is likely to be limited.

Second, we impose the requirement of revenue neutrality ceteris paribus so that we focus on the structural element of changes in the tax system isolating it from the broader general equilibrium and welfare effects pertinent in the case of fiscally non-neutral reforms or balanced-budget expansions (contractions) of wider government spending. The requirement of revenue neutrality involves raising more payroll tax from some groups while favouring other groups or often the same groups via different channels. The positive impact on labour supply incentives of

[4] The US tax reform of 2017, for example, linked the two directly in the title of the legal act.
[5] For an overview of labour supply elasticities estimates in Europe or US, see Bargain et al. (2014).

some groups will then be offset by similar considerations going in the opposite direction perhaps in a different part of the income distribution. Given the shape of the income distribution, generating a meaningful net income gain (loss) for the individuals affected by extensive margin considerations via the tax system is difficult in the first place. But should we consider fiscally non-neutral strategies and leave the implications of large shifts in the government's asset position aside, the employment effects could be larger by up to one magnitude.

Third, we identify a new channel through which tax changes affect individual behaviour. This channel rests on positive assortative mating for which we find evidence in our sample. One implication of positive assortative mating in our context is that the income of other members of a household rises and falls in line with individual incomes in a tax reform scenario. Labour supply elasticity estimations suggest that people tend to respond to such variation in household income by a compensating adjustment in their individual labour supply. The resulting 'household income effect' thus acts to moderate an individual's response to a tax reform. We show that this effect influences the behaviour of the relatively numerous dual-earner household types, and so it matters on aggregate.

Our paper concentrates on the effects of income tax reform at the extensive margin of the labour supply decision. Our argument cannot be generalised to hours worked which would include intensive margin considerations. They can be significant, as also discussed in our section on general equilibrium simulations. It follows that reformers pursuing a particular distributive change should focus their attention on the intensive margin impact of their reform, as the implications for effective (productivity-adjusted aggregate) labour supply, and hence aggregate output and tax revenues may be significant even if the number of employed remains little affected.

The analysis in the paper is motivated by findings in Horvath et al. (2019) according to which even radical revenue-neutral changes to the current Slovak tax system would only be associated with limited employment effects. The paper, however, only quantifies the aggregate effects but does not provide a detailed analytical explanation. Nor does it establish whether the simulated subdued effects are a consequence of the specific parameterisations considered or whether it is a broader phenomenon. This paper identifies the key factors that will dampen the impact of any

tax reform on employment to an almost negligible quantity by studying hypothetical measures designed to maximise the impact on employment.

The effects we identify can be related to literature on other countries and are thus not country-specific. For Australia, for example, Creedy et al. (2009) identify revenue and distribution neutrality as an impediment to improving labour supply incentives in an exercise similar to one of our scenarios. Our results also echo the findings of Fuest et al. (2008). They, too, find limited labour supply effects on the extensive margin from hypothetical large-scale revenue-neutral tax reforms in Germany. In addition to some of the effects we refer to, they highlight the consequences of joint taxation of married couples as a key mechanism that acts to dampen the labour supply effects. This is another example of household composition interacting with the tax system to deliver individual-level outcomes, often unintended, that matter on aggregate. The story we identify is different though. Its essence is about individuals within households pooling similar rather than different incomes due to assortative mating. This is a novel argument we have not seen articulated in this context elsewhere in the related literature.

The rest of the paper is organised as follows. Section 2 briefly describes the model used to obtain our results. Readers interested in the technical details are referred to a few related journal articles. Section 3 describes the tax reform scenarios considered in the paper and the rationale for them. Section 4 presents the main results supporting the narrative from the introduction. Section 5 concludes.

2 The model in brief

The framework we use to study the responsiveness of aggregate employment to tax reforms is a behavioural microsimulation model linked with a dynamic macroeconomic framework. Such a framework combines empirical work – evaluating the effects of tax reforms on a sample of individuals – with a theoretical framework that is meant to capture feedbacks from the aggregate economy the dynamic of which affects and is affected by individual behavioural responses.[6]

The microsimulation part calculates the consequences of the tax reform scenarios for individuals' net tax payments. The behavioural response to an income shock at the extensive

[6] Horvath et al. (2019) and Senaj et al. (2018) contain a detailed description of the framework.

margin of the labour market is evaluated as the adjustment of individuals' probability of being economically active, using the econometric approach presented in Senaj et al. (2016).

The individuals' decision about supplying labour is based on the rationale of utility maximization. Individual participation probabilities are determined by comparing income in two labour market states: being economically active (and work full-time) and being inactive (and receiving full amount of transfers).[7] In other words, it is necessary to accurately evaluate the disposable income of an individual. To do so, the concept of the gains to work (effective net wage) of an individual j is defined as the difference between the net wage and the amount of social benefits lost when the individual is working:

$$GTW_j = \widehat{w_j} - (SB^{NW} - SB^{W}) = \widehat{w_j} - \Delta SB. \quad (1)$$

We use SIMTASK[8] calculator to compute individual net wage ($\widehat{w_j}$) from gross wage and simulate the amount of social benefits the corresponding household is entitled to when the individual j is working (SB^{W}) and when not working (SB^{NW}). Obviously, income from employment is unobservable for those who are unemployed or inactive. Therefore, in the first step, we apply Heckman's sample selection methodology to predict an individual's gross wage.

The probability of being economically active of an individual j in the sample is estimated by the probit equation:

$$\Pr\left(\text{activity}_j = 1\right) = \Phi\left(\gamma \log GTW_j + Z_j'\alpha - \psi \log NY_j\right). \quad (2)$$

NY_j stands for non-labour income of an individual and sums three components: the social transfers that one receives when not working; the non-labour income of all household members (including that particular individual) and the net labour income of other household members. The construction of this variable also involves using our microsimulation tool SIMTASK. Finally, Z_j denotes a set of observable individual characteristics (age, education, being a student or pensioner, etc.).

[7] Our methodology is directly comparable with the approach by Benczur et al. (2014) applied for Hungary or Galuscak and Katay (2014) for the Czech Republic. Its use - instead of the popular approach that involves modelling the labour supply decision as a discrete choice over options entailing different hours worked - is motivated by the relative scarcity of part-time work in Slovakia, as well as in Hungary and the Czech Republic, when compared with the experience of EU-15 countries (see Appendix).
[8] For details on the SIMTASK microsimulation model, see Siebertova et al. (2016).

The results from the estimation of the probit model directly feed into the assessment of the participation effect of the analysed reforms. Using the microsimulation model SIMTASK of tax and transfer system, the gains to work and non-labour income are evaluated for every individual j both in baseline (pre-reform) and scenario (post-reform). In the next step, using the estimated coefficients from the probit model, individual participation probabilities $\hat{p}_j = \Phi\left(\hat{\gamma} \log GTW_j + Z_j'\hat{\alpha} - \hat{\psi} \log NY_j\right)$ are evaluated both in baseline and scenario cases.

Employment is then modelled so that the labour supply model of individual participation decision is combined with a rationing risk model (Bargain et al., 2010). Individual employment probabilities in the sample are summed up to get an estimate of the aggregate employment rate.

Effective aggregate labour, that is labour supply in the economy adjusted for individual productivity levels, is computed also taking into account adjustments on the intensive margin (hours worked) by individuals near the top end of the income distribution. Individual productivity is proxied by the normalized labour income (given as the share of individual wage to average wage). For the intensive margin, we use calibrated values: the effective marginal tax rate elasticity is set to 0.2 for the top 20 percent of income distribution.[9] Effective labour supply is the variable that then enters the dynamic macroeconomic model described in detail in Horvath et al. (2019), and is the key variable through which income heterogeneity interacts with tax reforms to generate a non-trivial macroeconomic effect.

The macroeconomic framework in Horvath et al. (2019) is a standard small open economy model of the labour market with a matching friction with one notable modification. Instead of explicitly modelling a bargaining process over the surplus generated by matches, equilibrium wage determination is enabled by an approximated relationship between the wage rate and employment coming from the behavioural microsimulation exercise.

In other words, we operationalise the two-way interaction between the macroeconomic and the microeconomic block in a dynamic context by estimating a reduced-form relationship between the variables that carry the information from one framework to another using data points generated by the microsimulation exercise. The procedure is as follows. Once individual labour supply responses to a tax reform scenario are obtained, they are summed up into an aggregate

[9] We used the estimates for Hungary based on Kiss and Mosberger (2015).

employment response, together with effective (productivity-adjusted) labour and total household disutility. Such aggregate responses are calculated assuming simultaneous aggregate real wage shocks of different magnitudes. Polynomial approximation is then used to obtain a continuous schedule in the (real wage, employment) plane, among others, that is embedded into the dynamic macroeconomic framework. Under the assumptions of the model, this setup permits the computation of the post-reform long-run steady state as well as the sequence of rational expectations equilibria occurring in transition to that steady state in a single numerical exercise. In Horvath et al. (2019), we show that the long-run results from such an exercise are very close to the results one would obtain from an iterative algorithm à la Savard (2003) which has been used in Senaj et al. (2018).

3 Tax reform scenarios

We examine two radical hypothetical tax reform scenarios that are approximately fiscally neutral in a static microsimulation relative to the tax and benefit system in Slovakia. We take the year 2015 as the baseline year in our analysis.[10] A rough description of the Slovak tax and transfer system is provided in the Appendix.

In Horvath et al. (2019), we simulated a hypothetical reversal of the flat tax regime enacted in Slovakia in 2004 to a system it replaced. Documents from the time reveal that the flat tax reform was intended to be revenue-neutral in the sense it is understood here (see Krajcir and Odor, 2005). Our previous work suggests this goal was broadly met and the resulting (un)employment effects were simulated to be very limited. We found this somewhat puzzling initially given the scale of the change in the system and wanted to see if the subdued impact of the tax changes on employment is a matter of specific parameterisation or a more general feature of the way the economy and the tax system interact. The scenarios studied in this paper are therefore designed to generate large variation in take-home pay for low and middle-income earners with a view to have a considerable impact on 'making work pay' for groups identified as particularly sensitive in this regard in other research, including ours.

[10] As the underlying microdata, the SK-SILC dataset with the income reference period corresponding to 2015 has been used.

The main element of the first hypothetical scenario we examine, labelled 'flat tax', is designed to reduce labour supply incentives in the bottom half of the income distribution. Starting from the existing Slovak system featuring two marginal tax rates and relatively large non-taxable allowances for both the income earners and their non-working spouses, we abolish all tax allowances.[11] This measure on its own would significantly increase the tax liability of those at the bottom of the income distribution. To maintain revenue neutrality, however, we also introduce a low single marginal rate. Bar a small tax child credit, this system would be a flat-tax regime in a strict sense, unlike the 2004 Slovak tax reform. This experiment is in many ways similar to the one examined in Creedy et al. (2009).

Table 1: Two hypothetical fiscally neutral scenarios

		Baseline (2015)	Scenario
Scenario 1 "Flat tax"	Personal Income Tax - standard rate	19 %	10.5 %
	Personal Income Tax - higher rate	25 %	10.5 %
	Personal Income Tax - rate for dividends	7 %	10.5 %
	Tax base threshold for the higher rate	35 022 €	-
	Tax base threshold for basic tax allowance	19 809 €	0
	Basic and spouse tax allowance	3 803 €	0
	Tax base threshold for spouse tax allowance	35 022 €	0
Scenario 2 "Progressive"	Personal Income Tax - standard rate	19 %	25 %
	Personal Income Tax - higher rate	25 %	40 %
	Personal Income Tax - rate for dividends	7 %	7 %
	Tax base threshold for the higher rate	35 022 €	12 000 €
	Tax base threshold for basic tax allowance	19 809 €	12 000 €
	Basic and spouse tax allowance	3 803 €	5 000 €
	Tax base threshold for spouse tax allowance	35 022 €	12 000 €
	Tax credit for dependent children (per child)	257 €	360 €

Note: The tapering in the basic and spouse's tax allowance has been abolished in the hypothetical scenarios. Allowances, tax credit and thresholds are annual values.

By contrast, in the second hypothetical scenario, labelled 'progressive', all allowances – including the child tax credit - are significantly increased relative to their current levels. This measure alone would significantly improve labour supply incentives. Fiscal neutrality is ensured by

[11] In Slovakia, individuals are subject to the personal income tax and joint taxation of married couples is not permitted.

increasing both of the marginal tax rates and lowering the threshold from which the higher one applies. Table 1 provides a detailed overview of the calibrated parameters in the tax system relative to the baseline.

Both scenarios represent probably the best attempt to generate large shifts in labour supply incentives at the extensive margin through non-arbitrary changes in the tax system in a short-run revenue-neutral way. In both of our scenarios, the system of social and health contributions paid by employers and employees as well as the social transfer system are left unchanged.

4 Results

The reform scenarios introduce significant changes in disposable incomes, ceteris paribus, for all income groups both at group level and for significant shares of the population within those groups (see Figure 1).

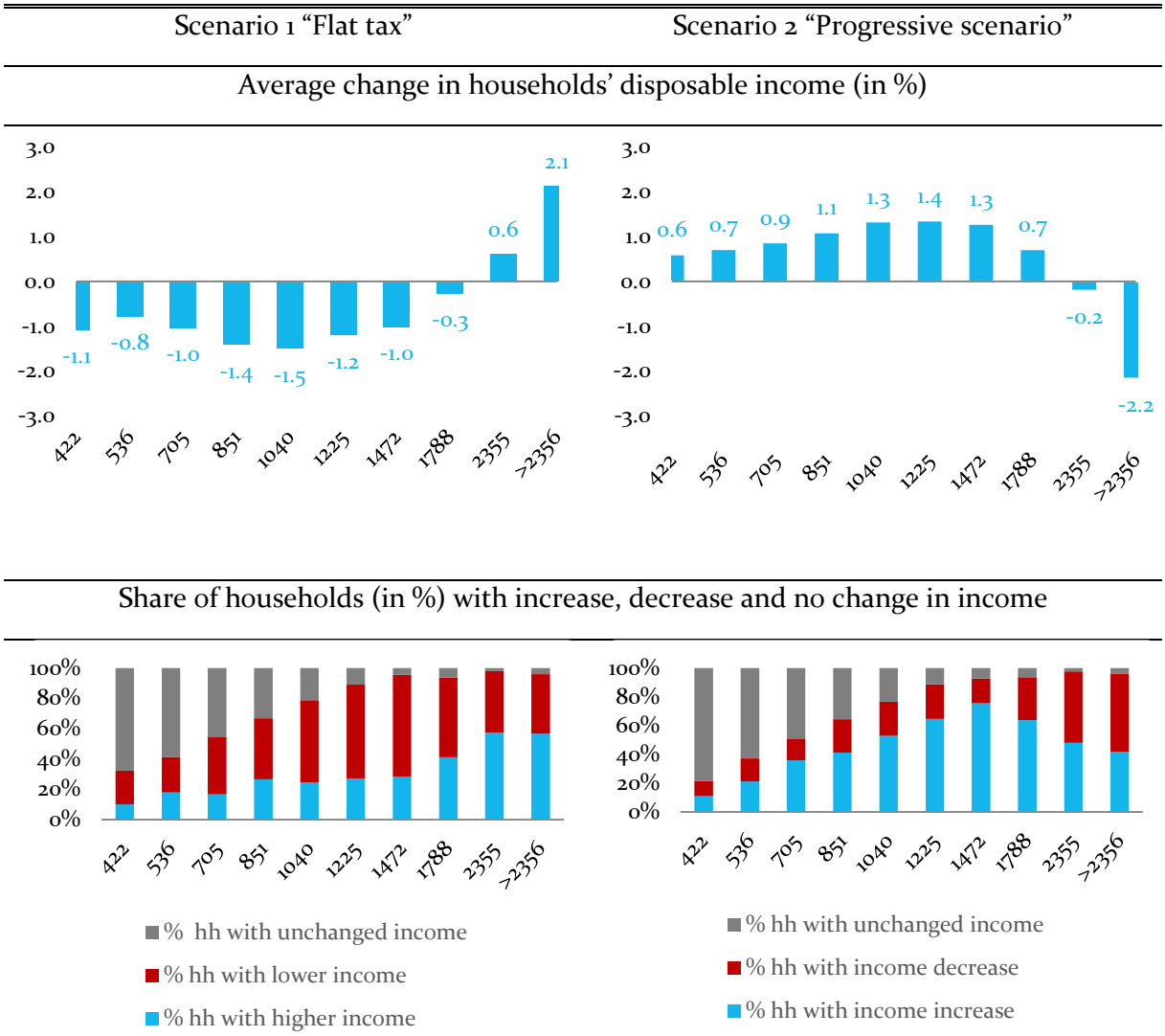
In the first hypothetical 'flat tax' scenario, low- and middle-income households face a decrease in their disposable income on average. The bottom left panel in Figure 1 shows the share of households in various disposable income groups experiencing a change in income. A majority of households in the lowest income group exhibits no change in their disposable income since many household members in this group do not have taxable earnings.[12] A minority of households in which their members have taxable earnings encounter a decrease in their disposable income after losing the allowances. The share of that group rises as we move towards middle-income cohorts. As the disposable income increases along the horizontal axis, we also see that the share of households experiencing an income gain increases, too. These households benefit from the lower tax rate.

On the other hand, in the 'progressive' scenario, low- and middle-income households experience, on average, an increase in their disposable income. Again, the lowest income groups already pay very little or no income tax. Increasing the allowances makes no or little difference to them. The share of households unaffected by the reform scenario decreases with increasing income (see the bottom right panel in Figure 1). At the top end, the share of households

[12] Note that the values on the horizontal axis are monthly non-equivalised household disposable income. This includes income from transfers as well as non-labour income or income from abroad. Changes in income taxation do or may not directly affect those. Therefore, we observe households with unchanged disposable income following our reforms even in high(er) disposable income categories.

experiencing an income loss increases. These households are affected by the increased tax rate and the lower threshold from which that higher rate applies.

Figure 1: Static effects on disposable income



Note: Authors' calculations. Numbers on horizontal axes indicate upper border of households' monthly disposable income (in €).

When these significant net income changes get translated into behavioural effects (which include individual and households' reaction to reform changes), the resulting changes in aggregate probabilities of participation and employment become small. In Table 2, we report the changes in probabilities of being economically active both on aggregate and for different

population groups. In line with expectations, the young, females and low-income earners display an above-average response.

On aggregate, these changes in participation probabilities translate into a 0.04 drop in employment under the 'flat tax' scenario while the increase in employment under the 'progressive scenario' is 0.01 percent in a simulation that takes into account the behavioural response.

In what follows, we explain in greater detail the individual factors that underlie the timid response in aggregate employment.

Table 2: Changes in probabilities of being economically active

	Scenario Baseline, 2015	„Flat tax" change (in p.p.)	„Progressive" change (in p.p.)
All	63.66	-0.035	0.009
Age			
15-24	34.98	-0.246	0.122
Female 25-50	74.39	-0.090	-0.003
Male 25-50	92.08	0.009	0.025
50+	50.17	0.049	-0.038
Parents with child up to 3y.			
Female	26.20	-0.157	0.028
Male	97.12	-0.013	-0.011
Education, age 25-50			
Primary	67.45	0.945	-1.161
Secondary	85.37	-0.150	0.145
University	83.61	-0.069	0.044
Income quintiles			
Q1	79.89	-0.647	0.742
Q2	87.67	-0.335	0.202
Q3	92.55	-0.050	0.053
Q4	95.80	0.013	0.004
Q5	96.59	0.040	-0.028

4.1 Low labour supply elasticity

Our estimated elasticities are broadly in line with the results usually reported in the literature, although may be closer to the bottom end of the scale. Results computed on a pooled SILC dataset (corresponding to 2012-15) document that participation probabilities in general depend on the level of net income and social transfers and that low-skilled and females are the groups that are particularly responsive to changes in taxes and transfers (see Senaj et al., 2016).[13] On average, a one percent rise in 'gains to work' (GTW) – our key indicator of the overall net income change achieved at the individual level when moving from inactivity to activity (and subsequently from unemployment to employment) - leads to 0.06 percentage point increase in the participation probability for females and 0.03 for males. The effect of non-labour income (NY) on the participation probability is comparable for both genders: a one percent increase yields around 0.04 percentage points decrease in supplying labour for both genders. These estimates correspond to semi-elasticities since our key variables gains to work and non-labour income are given in natural logarithms. Income elasticities can be obtained by dividing the semi-elasticities by the average predicted probability of activity. Estimated elasticities of gains to work yield 0.05 for males and 0.1 for females, while elasticities of non-labour income -0.04 for males and -0.07 for females.

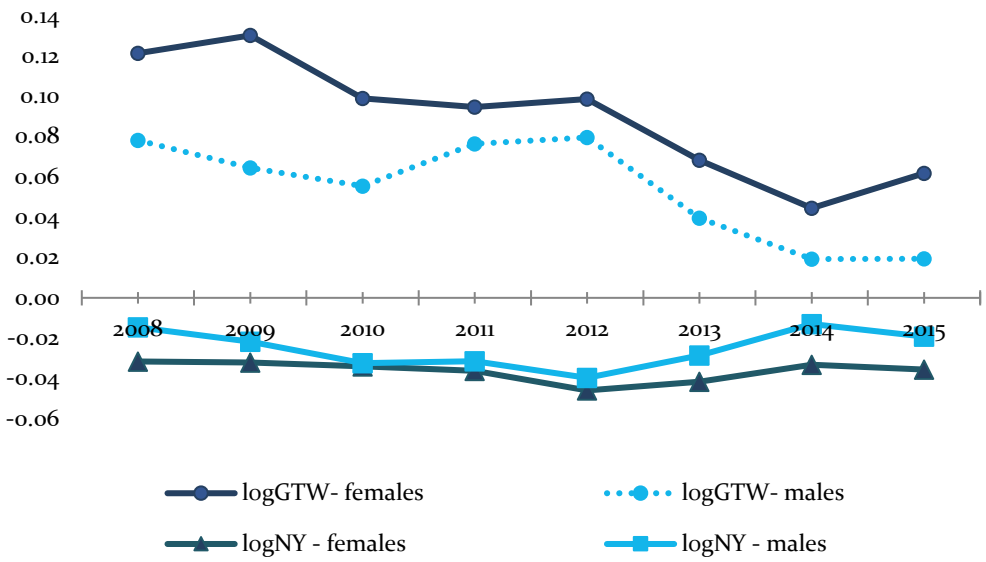
Estimates obtained on a pooled sample, however, hide potentially interesting developments in time. Estimates obtained from individual annual samples shown in Figure 2 suggest a downward trend in the magnitude of the elasticity with respect to GTW in the years between 2008 and 2015. Income semi-elasticities estimated for females (average marginal effects of *logGTW*) are consistently larger than that of males. The latter applies (in absolute value) for the effect of non-labour income on participation probability (average marginal effect of *logNY*) in which we observe some decline particularly since 2012.

Participation rates have been historically high and further increasing in recent years in Slovakia. At the same time, the unemployment rate has been on a downward trajectory towards historical lows. This may well explain both the low estimated elasticities and the declining sensitivity of labour supply to net wage developments. In terms of our estimated coefficients, we do observe

[13] Note that in this analysis the labour force participation probabilities are estimated on a pooled sample corresponding to period 2012-15, while in our published analysis model is estimated on the sample 2010-12. This induces differences in the numerical results. The main messages, however, remain unchanged.

changes in the coefficient at *logGTW* in our probit regressions over the years, that are consistent with the picture for the calculated elasticity, while the coefficients at *logNY* and other socio-demographic explanatory variables remain relatively stable over the reported time period.[14]

Figure 2: Semi-elasticities of a labour force participation decision, 2008-2015



Source: Authors' calculations. Average marginal effects from the probit model of labour participation decision are evaluated for each year separately. In each year, we have used the SILC dataset corresponding to the income reference period and the microsimulation model SIMTASK with the relevant tax-benefit system.

4.2 Revenue neutrality

Structural tax reform is normally understood to be distinct from changes in the tax system motivated by aggregate demand considerations, the need to address budgetary imbalances or to accommodate a particular view of the optimal size of the state. We have imposed revenue neutrality to isolate the impact of the changes in the structure of the tax system itself on the economy from various potential secondary feedback effects through aggregate demand or some even broader general equilibrium implications.

The requirement of revenue neutrality understood here in the context of a static microsimulation, however, has profound implications for the potential changes in the labour supply incentives on aggregate that can be achieved through tax reform. We show that the

[14] See the Appendix for key contextual data for Slovakia.

resulting changes in the number of employed can be larger by up to a magnitude in fiscally non-neutral scenarios (see Table 4 below). Our argument here is similar to that in Creedy et al. (2009).

The implication of the requirement of revenue neutrality is that on aggregate, what is given to some, must be taken away through other means in the system. Usually, it is other groups in the population that are affected by compensating measures, but it may well happen that the same group is affected by two different measures in opposite ways.

We have studied the scenarios described in section 3 with and without compensating measures ensuring revenue neutrality. Table 3 provides the precise calibration for the fiscally non-neutral scenarios.

Table 3: The fiscally neutral and non-neutral scenarios

		Baseline (2015)	Neutral	Non-neutral
Scenario 1 "Flat tax"	Personal Income Tax - standard rate	19 %	10.5 %	19 %
	Personal Income Tax - higher rate	25 %	10.5 %	25 %
	Personal Income Tax - rate for dividends	7 %	10.5 %	7 %
	Tax base threshold for the higher rate	35 022 €	n.a.	35 022 €
	Tax base threshold for basic tax allowance	19 809 €	0	0
	Basic and spouse tax allowance	3 803 €	0	0
	Tax base threshold for spouse tax allowance	35 022 €	0	0
Scenario 2 "Progressive"	Personal Income Tax - standard rate	19 %	25 %	19 %
	Personal Income Tax - higher rate	25 %	40 %	25 %
	Personal Income Tax - rate for dividends	7 %	7 %	7 %
	Tax base threshold for the higher rate	35 022 €	12 000 €	35 022 €
	Tax base threshold for basic tax allowance	19 809 €	12 000 €	19 809 €
	Basic and spouse tax allowance	3 803 €	5 000 €	5 000 €
	Tax base threshold for spouse tax allowance	35 022 €	12 000 €	19 809 €
	Tax credit for dependent children (per child)	257 €	360 €	360 €

Note: The tapering in the basic and spouse's tax allowance has been abolished in the hypothetical scenarios. Allowances, tax credit and thresholds are annual values.

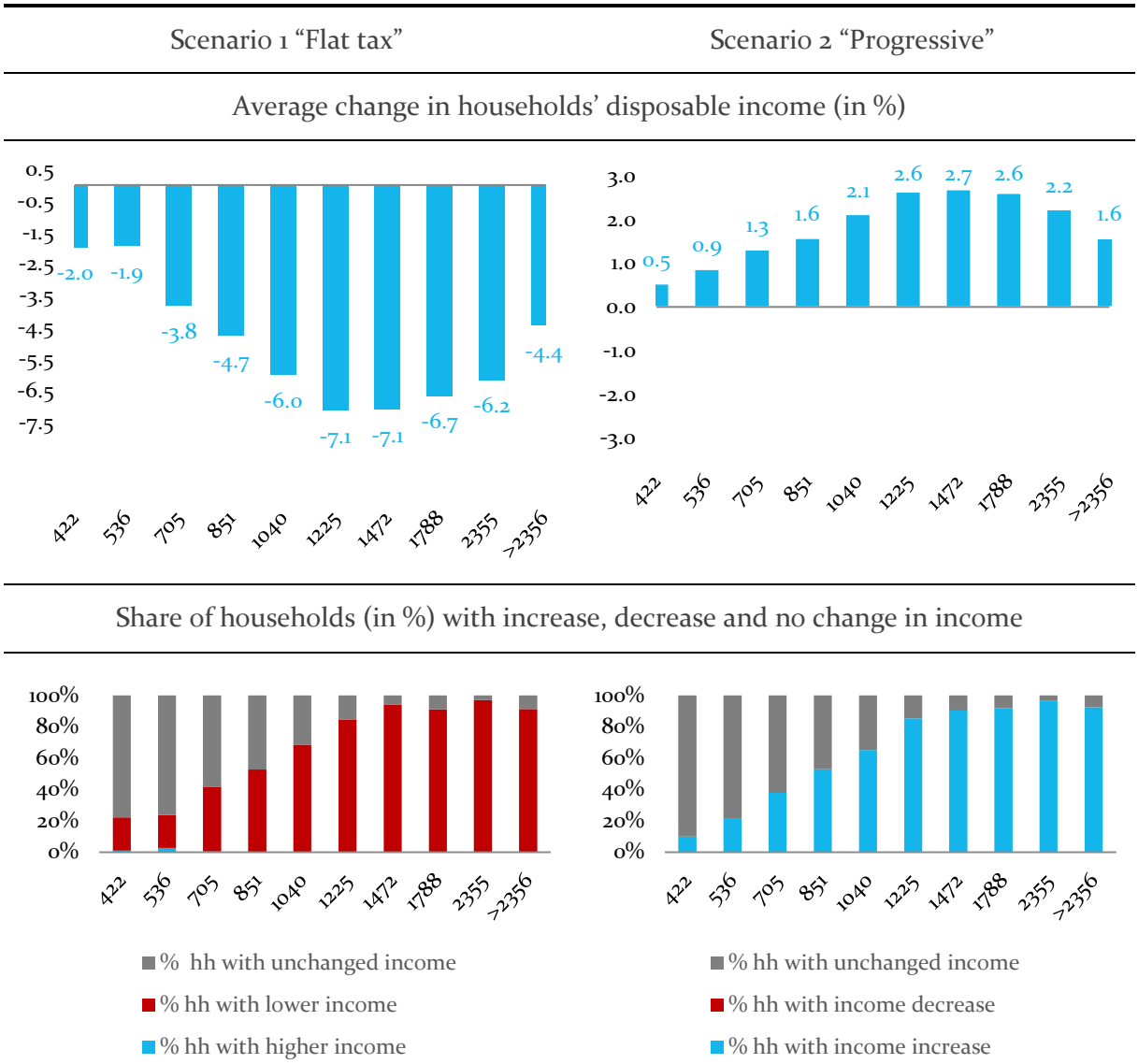
In Figure 3, we then plot the average impact of the non-neutral scenarios on households' disposable income by the ten income groups used above. As we have done before, for each income group, we also plot the share of households affected in different ways by the tax reform. Figure 3 is directly comparable with Figure 1 above. It is clear that the impact of the measures on various groups is now larger. The figures also demonstrate the difficulty of achieving large disposable income shifts through changes in the tax system for the very bottom of the income distribution. The reason is that the taxable labour income does not constitute a substantial part of the disposable income of these groups.[15] Nevertheless, the gains or losses for the lower middle classes – for whom extensive margin considerations are still very relevant – can be significant.

For the 'flat-tax' scenario, the compensating cut in the marginal rate ensures that the income groups at the bottom of the income distribution are little affected by the reform and the bulk of the income losses resulting from the tax reform falls on the middle-income groups both in terms of magnitude and prevalence. By contrast, if the marginal rates were left unchanged, the impact on those to whom extensive margin consideration apply most would be much more severe. In line with this, the percentage change in the aggregate number of employed would be -0.52 once behavioural reaction is considered. The effect is approximately six times larger than in the fiscally neutral scenario (see Table 4).

Similarly, under the 'progressive' scenario, should tax rates be left unchanged, the gains in the lower middle spectrum of the income distribution would be higher. One should note, however, that people at the lower end of the income distribution already pay very little or no labour income tax, and so there is a limit to how much labour supply incentives can be stimulated through tax reform. In line with this, the estimated employment response in a behavioural microsimulation would be 0.13 percent rise. This is an employment impact larger by a third compared to the fiscally neutral case (0.1 percent rise).

[15] The difficulty is greater when it comes to generating net income gains. For this reason, the departure from neutrality and thus the overall fiscal effect is not the same in the two studied non-neutral scenarios. In the first scenario, the cancellation of all tax allowances leads to a substantial increase in tax revenues, while the increase in allowances in the second scenario leads to a reduction of revenues compared to baseline. The positive fiscal effect of the first scenario in absolute terms is approximately 2.6 times larger than the fiscal loss induced by the second scenario.

Figure 3: Static effects on disposable income – revenue non-neutral scenarios



Note: Authors' calculations. Numbers on horizontal axes indicate upper border of households' monthly disposable income (in €).

It should be emphasised though that the reported aggregate results in the hypothetical fiscally non-neutral cases are based on simulations that do not consider the feedback effects from the implied large changes in the net asset position of the general government sector.

Table 4 : Employment effects – fiscally neutral vs. fiscally non-neutral scenarios

	Scenario 1 "Flat tax"	Scenario 2 "Progressive“
	% change	% change
Fiscally neutral	-0.09	0.10
Fiscally non-neutral	-0.52	0.13

4.3 The household income effect

The effect of tax reforms on the net income gains from employment at the level of individual is often offset by income changes at the level of the household, as the income of other members of the household are also affected by the same reform in the same way. Table 5 shows a simple comparison of the simulated mean changes in monthly income gains from employment versus the simulated changes in labour incomes of other household members under the two hypothetical tax reforms. The population groups examined are the same as in Table 1. We see that the individual- and household-level income effects often go in the same direction. The income of other members of the household, however, enters the probit equation of the economic activity with the opposite sign – the sign of the coefficient at *logNY* is negative. This 'household income effect' thus works to counteract the incentive effects achieved through changes in gains to work.

The results in Table 5 for different education levels and income groups suggest that assortative mating is a phenomenon one should take into account when designing the tax system in Slovakia.[16] A quick inspection of our underlying samples confirms that there is statistically significant positive correlation in education levels of spouses as well as income levels, with the latter being highest for low-educated couples (see Figure 4).

[16] See Frankel (2014) for some theoretical insights into the implications of the presence of assortative mating for tax policy design.

Table 5: Individual- vs household-level incentives to work

	Scenario 1 „Flat tax“		Scenario 2 „Progressive“	
	Gains to work	Income of other household members	Gains to work	Income of other household members
Age				
15-24	-17.11	-9.39	12.47	16.32
Female 25-50	-6.59	-1.58	4.28	4.04
Male 25-50	4.80	-7.80	-2.43	6.45
50+	20.11	-3.20	-11.28	2.52
Parents with child up to 3y.				
Female	-7.86	-9.51	3.93	13.92
Male	-4.90	-6.59	10.91	5.43
Education, age 25-50				
Primary	-4.75	-14.28	-2.98	12.90
Secondary	-7.48	-9.52	6.34	9.06
University	15.32	8.53	-10.31	-5.30
Income quintiles				
Q1	-21.11	-9.78	14.94	9.47
Q2	-24.43	-18.15	18.48	15.98
Q3	-11.65	-8.11	13.07	7.94
Q4	2.23	-0.48	3.81	0.42
Q5	45.84	12.27	-35.01	-10.95

Note: The figures in the table are mean changes in terms of monthly income (population-weighted) in a given category.

Figure 4: Correlation between spouses

Note: Education denotes highest education level of both partners. EDU 1 stands for primary education, EDU2 denotes secondary and EDU3 university education.

We also provide a more direct comparison to see if the hypothesis that individual-level and household-level effects counteract each other to an extent that this matters on aggregate, and that this has roots in assortative mating.

We compare single-earner households with dual-earner households, both types with and without children.[17] In Figure 5, we display graphically the same type of information as shown in Table 2. The filled dots show the baseline activity rates for different sub-groups in the sample. The empty circles then show (on the right-hand scale) the change relative to baseline in the probability of being economically active for the different sub-groups in percentage points.[18] We see that the baseline activity rates across single- and dual-earner households are very similar both in cases when they do and when they do not have children. The changes in the probability of being economically active are, however, significantly different. Typically, the absolute value of the percentage-point change in the probability of being economically active is smaller for dual-earner households (the darker empty circles are closer to zero than the lighter empty circles).

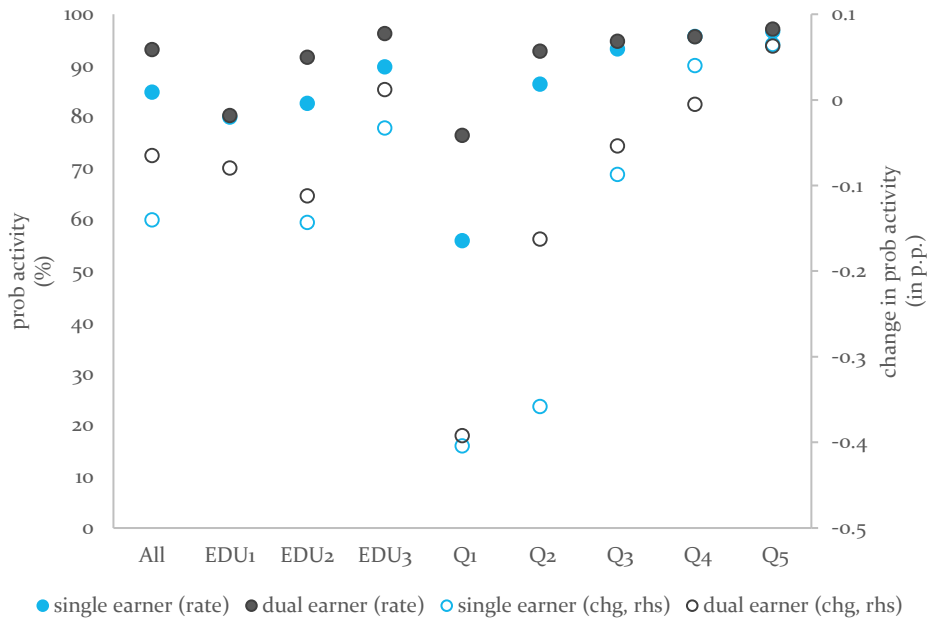
Figure 6 provides an explanation for these results and further evidence for assortative mating. The incentive effects of tax reforms operating at the individual level are being counteracted by the effects of family-level income changes that happen because members of families tend to be alike whether in terms of education or income level.

In Figure 6, like in Table 5, we look at monthly changes in nominal EUR amounts in the 'gains to work' (GTW, on the horizontal axis) variable and the income of other members of the household (IOM, on the vertical axis). The light circles represent households with two earners but no children while the dark circles show dual-earner families with children. The data labels show the further sub-categories we examine. Whether we slice up the broader categories of dual-earner households by education (filled circles, labelled E) or income levels (empty circles, labelled Q), the changes in our measure of incentives to work at the individual level and the changes in income of the rest of the family are positively correlated.

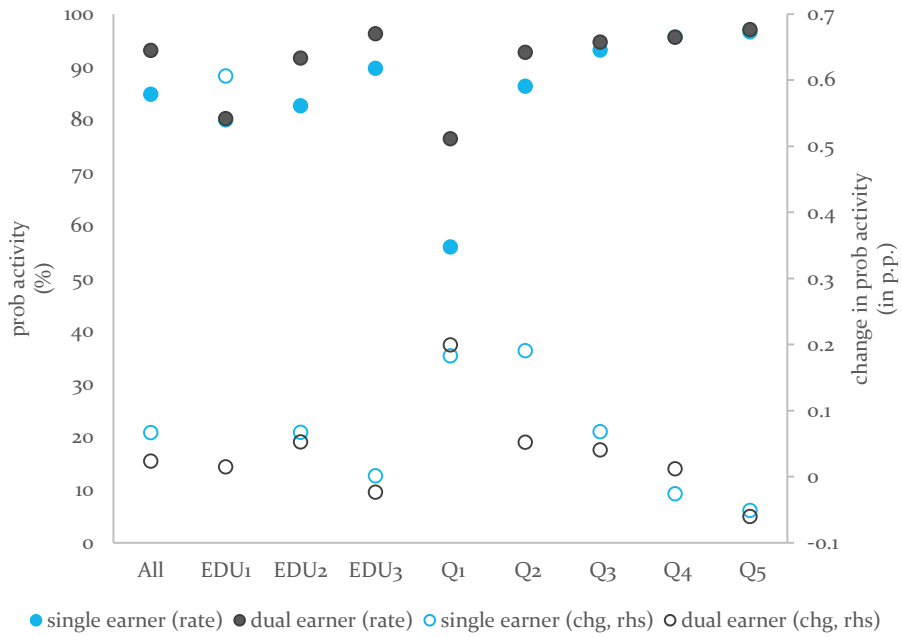
[17] Results for a broader set of family types are available upon request from the authors. Here, we pick the two pairs that are interesting to compare to support our argument and numerous enough to matter on aggregate. Earners from households with two earners account for approximately a third of the sample.
[18] Some of the observed changes for single earners are excluded from the figures as outliers. They are based on very small sample sizes and take on extreme values, generally corroborating the main narrative.

Figure 5: Economic activity of single versus dual-earner households

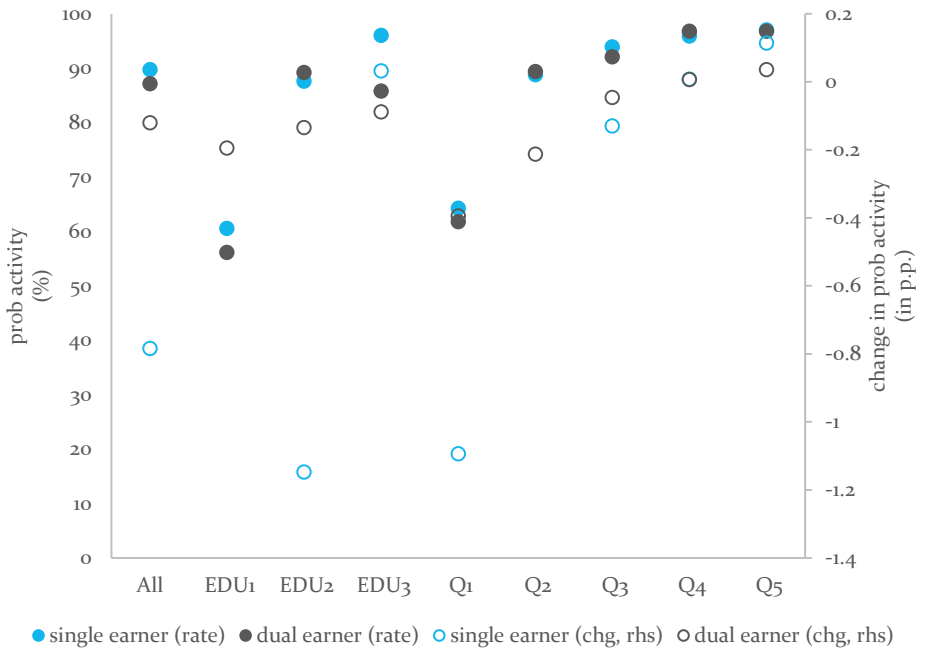
Households without children: Scenario 1 "Flat tax"



Households without children: Scenario 2 "Progressive scenario"



Households with children: Scenario 1 "Flat tax"



Households with children: Scenario 2 "Progressive scenario"

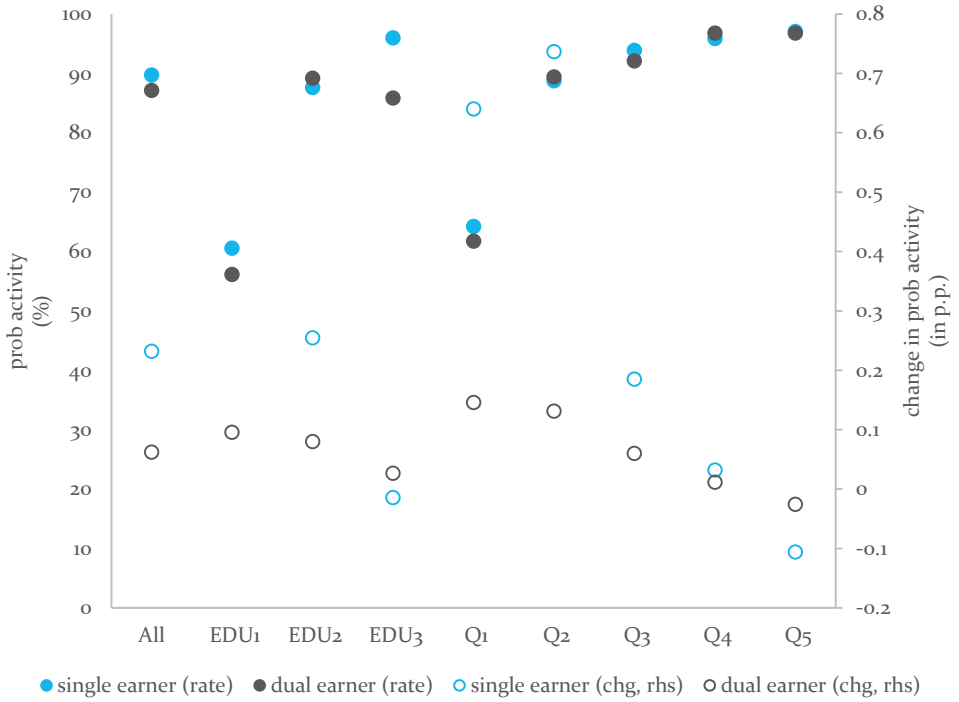
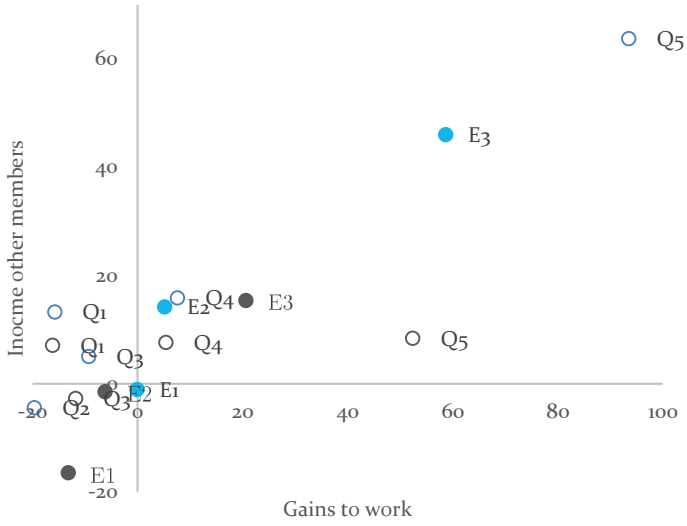
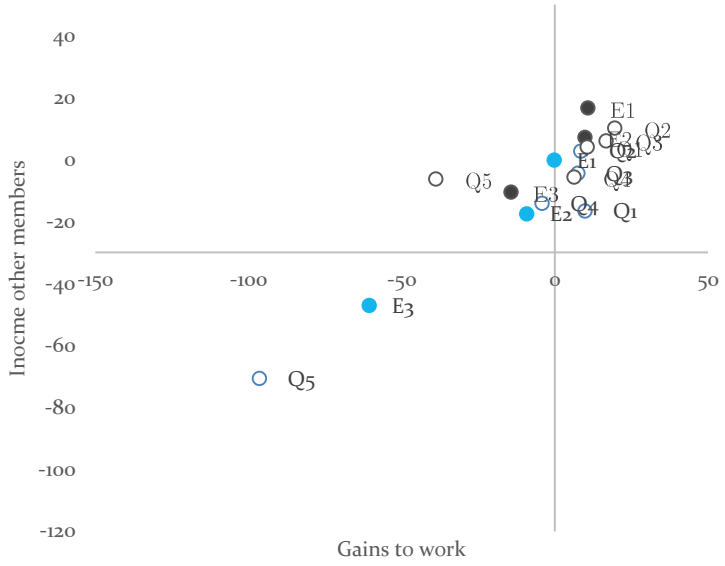


Figure 6: Household income effects: changes in 'gains to work' and income of other household members (monthly, in EUR)

Scenario 1 "Flat tax"



Scenario 2 "Progressive scenario"



4.4 General equilibrium considerations

In the general equilibrium context of our integrated micro-macro model, gains (losses) in hours worked imply a reduction (an increase) in the relative scarcity of effective (productivity-adjusted) labour as a factor of production. In transition to a new post-reform steady state, this has implications for the aggregate gross real wage rate, and in turn an effect on labour supply incentives, including those at the extensive margin.

In the reform scenarios we examine, revenue neutrality is ensured largely by varying the marginal rate of tax on top earners in a way that offsets the revenue (loss) generated on earners from the lower part of the income distribution. A reform that would improve (worsen) labour supply incentives at the extensive margin thus worsens (improves) labour supply incentives at the intensive margin. Given the size of elasticities, intensive margin considerations dominate the impact on effective labour supply. Effective labour supply expands by 0.45 percent in our flat-tax scenario while it shrinks by 0.46 percent under the progressive reform scenario in the long run. The aggregate gross wage rate effectively remains flat in the long run, as capital expands approximately proportionately to effective labour maintaining a stable capital-to-effective-labour ratio in the economy – an implication of the small open economy assumption.[19] The effect on the aggregate output is significant in both cases we consider. Under the "flat tax" scenario, GDP expands by 0.5 percent while it shrinks by 0.5 percent in the case of the "progressive" scenario. Table 6 provides the details.

Should one consider one of the scenarios in this paper, for example, to achieve a desired distribution of income, the message from this study is that it is the impact on aggregate activity driven by intensive margin labour supply effects one should concentrate on.

[19] The wage rate, however, departs significantly from its steady-state value in transition as the economy adjusts to the long-run steady state (see Horvath et al., 2019 for examples of full dynamic simulations from this model). Given the argument in section 0, the results and the message would be robust to relaxing the small-open-economy assumption, and allowing some variation in the gross wage rate in the long run.

Table 6: General equilibrium effects

	Scenario 1 "Flat tax"	Scenario 2 "Progressive"
	% change	% change
nr of economically active	-0.055	0.013
nr of employed	-0.089	0.056
nr of unemployed	0.211	-0.330
intensive margin	0.256	-0.233
hours worked per quarter	0.339	-0.352
effective labour	0.450	-0.462
gross wages	0.000	0.000
capital	0.450	-0.462
GDP	0.450	-0.462

5 Conclusions

We have studied the implications of hypothetical radical tax reform scenarios for aggregate labour market participation and employment in Slovakia. The reforms examined were designed to alter significantly the incentives of individuals to supply labour at the extensive margin of the labour market. Nevertheless, we saw the impact of the measures on aggregate participation and employment was rather limited. We have documented that this was due to the low estimated extensive-margin elasticities of labour supply, the requirement of revenue neutrality and the influence of family income on individuals' incentives to supply labour.

There are two policy implications that directly follow from these results. First, intensive rather than extensive margin considerations should be of concern when radically redesigning the tax system. Second, the effectiveness of measures designed to increase or reduce labour force participation of an individual via income changes depends on the impact of those measures on the incomes of other members of the facility. For this reason, mating patterns should be taken into account when designing tax reforms.

Our study also implies that increasing employment of selected groups of the population will require a more fundamental structural reform of the institutions linked to labour market performance. The model we use is not rich enough to consider a broad set of such reforms in a meaningful way. Simple simulations with reduced labour market frictions provide tentative support for this claim. More fundamentally, however, education comes out clearly as a key determinant of labour market outcomes at the individual level in our estimations. Capturing the consequences, including general equilibrium implications, of an improvement in educational attainment of key target groups in a suitable extension of our model is a potentially fruitful research agenda.

Data availability has so far prevented a thorough assessment of the intensive margin of labour supply in Slovakia. Our analysis relies on parameter estimates obtained for a neighbouring economy which may well be the best available solution at the moment. Given the importance of this channel demonstrated also in this paper, however, developing a better understanding of the determinants of hours worked in Slovakia is an important research agenda that should be pursued vigorously as the data environment improves.

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Appendix

The Slovak tax and transfer system

The system is largely unified, and its components are set mainly at the national level. PIT is levied on gross income including wages from employment, self-employment income, fringe benefits, capital, rental and interest income. Social and health insurance contributions (SIC) are exempt from the tax base which is given as gross earnings net of paid SIC. Deductions from the tax base include basic tax allowance, spouse tax allowance and child tax credit. Every individual is entitled to the basic tax allowance that is derived from the statutory national minimum subsistence level. Its amount is tapered once earnings exceed a certain threshold value. If earnings of one's spouse are under a given level, the taxpayer can apply for a spouse tax allowance. In addition, one of the spouses can claim a child tax credit, an allowance for every child in the household. Income tax is calculated by applying the appropriate tax rate schedule to the tax base. The basic tax rate is currently set at 19 percent while a 25-percent rate is applied to incomes exceeding a threshold. This threshold is, however, sufficiently high for the higher tax rate to apply to less than 2 per cent of employees in our sample.

The SIC payments are split between the employer and the employee. The assessment base for contributions differs from the tax base used for the PIT and has a maximum. Payments by employers and employees consist of health, unemployment, sickness, disability, and old age insurance, but the two categories pay different percentages from the assessment base. Besides this, employers pay contributions to a reserve solidarity fund, accident insurance and a so-called guarantee fund.

The Slovak benefit system consists of contributory benefits, social assistance and state social support. Each component consists of several programs.

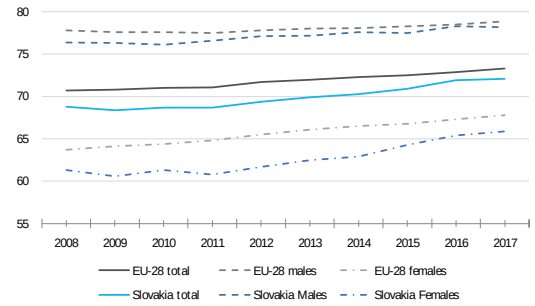
Contributory benefits cover various pensions (old-age, disability, widower's, orphans), sickness pay, maternity pay and unemployment benefit.

Social assistance program includes material needs benefit which is a means-tested transfer provided to families to provide them basic living standard if their income is below the minimum subsistence level.

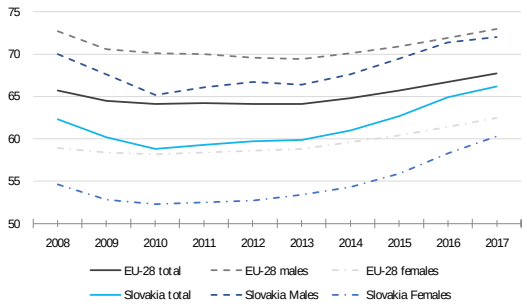
The state social support program includes several family related benefits (e.g. child birth grant, child benefit, or parental allowance). Eligibility to these transfers does not depend on the contribution history and is not means-tested.

Contextual data

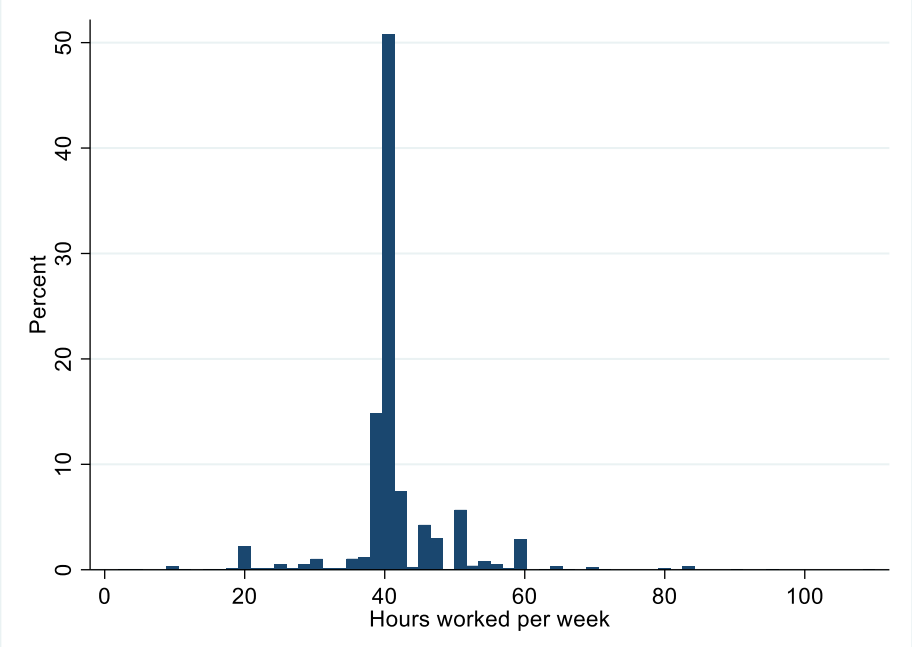
Participation rates (percent)



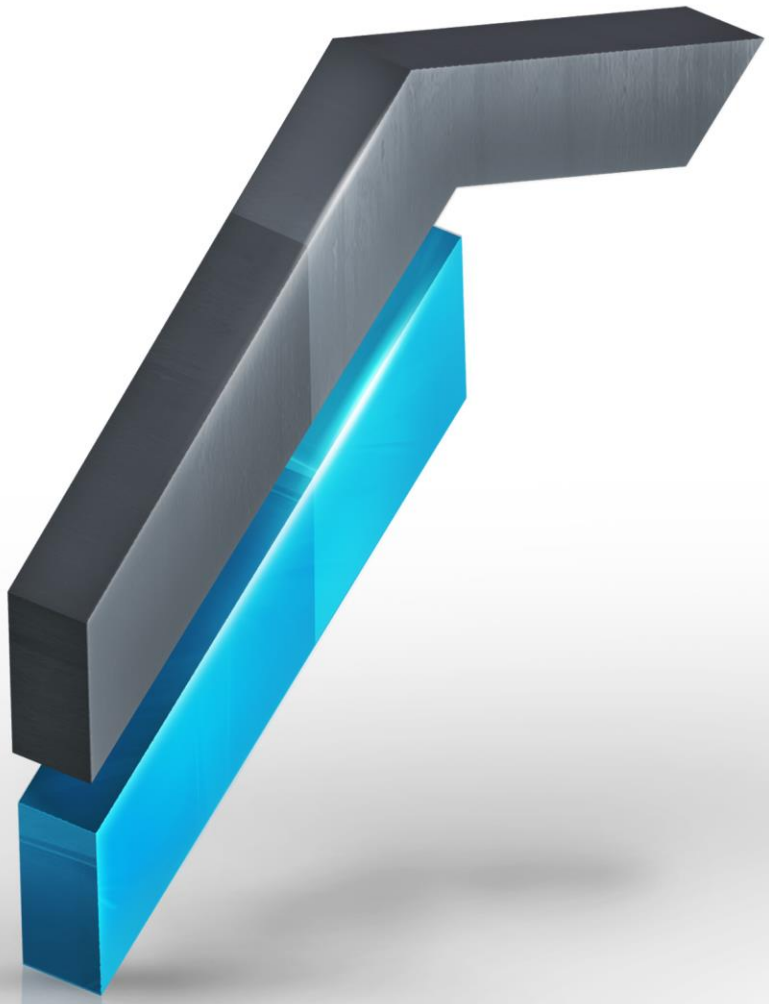
Employment rates (percent)



Scarcity of part-time employment in Slovakia



Source: SK-SILC 2015



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