# IN FOCUS – I
# TAXES, TRANSFERS AND THE LABOUR MARKET

Edited by
PÉTER BENCZÚR

# EDITOR'S FOREWORD

PÉTER BENCZÚR

My 2007 review article in the *Hungarian Review of Economics* started with the following words: "Our recent and distant past is rich in hot debates about the macroeconomic impact, budget revenue implication, or social desirability of various tax, social contribution or transfer reforms. This is natural, and not specific to Hungary. One crucial element, however, is usually missing from these often fierce debates: the objective quantification of the particular reform's detailed impact on household and corporate behaviour. This would involve drawing lessons from past events and assessing the likely impacts of current reforms. It is usually the former that creates the opportunity for the latter." (*Benczúr,* 2007, p. 125.)

Since then, this research program has generated many new results, viewpoints and interesting debates: building on the rich heritage of Hungarian labour economics research, we saw important advances especially in the analysis of the labour market impact of taxes and transfers. Moreover, the discussion was not restricted to academic circles. Rather, there were numerous attempts to communicate the results to policymaking and to emphasize the importance of evidence-based policymaking.

These new results were often "echoing" the general lessons the original review article drew: "(1) Elasticities or behavioural responses that appear to be small can still lead to important consequences. (2) Thus it is key to estimate them precisely, using micro-level datasets (of households, individual taxpayers, corporations). Macro approaches and arguments may easily lead us astray. (3) We often need even more: a typical cross-section analysis is insufficient to estimate the impact of taxes on labour market participation or corporate investment. In such cases, the solution is to utilize tax reform episodes, calling for sophisticated micro-econometric analyses on appropriate (panel) datasets. (4) Behavioural Responses can substantially influence output [...], social welfare, and budget revenue developments after the reform." (*Benczúr,* 2007, p. 139.)

Meanwhile, there was a rapid acceleration in international public economics research as well, driven to a large degree by the activity of Raj Chetty and Emmanuel Saez. This will be demonstrated in the overview offered by the forthcoming fifth volume of the *Handbook of Public Economics*. The compilation of the new volume is happening so much in real time that new excerpts kept being posted publicly as we were finalizing the chapters of *In Focus – I.* These

drafts were then enthusiastically forwarded to us by US-based public economics graduate students. No surprise that the Introduction of *In Focus – I* has become a review article in its own right, filling an important gap for the Hungarian readership: its focus was broadened from the originally intended conceptual framework to an overview of the most relevant ideas and results of the corresponding Handbook chapter drafts.

Besides producing new, more and more precise and inventive empirical estimates, this new literature was consistently attempting to communicate its results to the policy world. The most representative example is the UK-based *Mirrlees Review*, created by leading international and UK researchers and experts, and edited by the Nobel laureate James Mirrlees. The two-volume book first reviews the *state-of-the-art* empirical and theoretical knowledge about practically all components of a modern tax system. Then, in light of the lessons, it evaluates the current UK tax code and proposes a potential direction for reform.

Good empirical studies require good quality datasets – which are more and more frequently obtained by gaining access to administrative data. The last thirty years has witnessed a two third decline in the number of survey-based empirical studies published in leading economics journals, while the number of similarly placed studies using administrative data has doubled (*Chetty,* 2012). It is no accident that a large number of influential studies use data from Scandinavian countries, where statistical offices are assembling and maintaining linked databases which cover the entire population – and the data are actively shared with researchers. Fearing that the United States would be *lagging behind*, David Card, Raj Chetty, Martin Feldstein and Emmanuel Saez – four key researchers in empirical labour and public economics – were calling for increased and facilitated electronic access to such databases in the US (*Card et al.* 2010). A research group, led by Chetty and Saez, has voluntarily cleaned – and made publicly accessible – the raw data of all US tax declarations (see *Chetty,* 2012 for details). Such databases have many exceptional advantages: (i) there are almost no missing data or attrition problems, (ii) both the filer and the maintainer is interested in good quality data and cross-checking, (iii) long-horizon longitudinal studies are possible, (iv) the large (complete) sample size allows for convincing, non-parametric quasi-experimental setups (and requires less theoretical assumptions). Besides the academic advantages, let me emphasize again that good public policy decisions also hinge on such detailed impact studies.

This exciting period – when, for example, a "new consensus" is emerging regarding the empirical assessment of the elasticity of labour supply to taxation – also brought normativity, optimal tax rate and tax system considerations back into the picture. It certainly involves serious debates – mostly about the taxation of the top 1% of the income distribution, or that of capital income. One should not be thus surprised to learn that in our preparatory and informal

Symposium on *In Focus – I*, the most lively discussions all involved normative conclusions. It sometimes happens that even authors of the same chapter have somewhat diverging views on normative issues.

This is natural, since normative conclusions always involve some social welfare criteria – which is a value judgement, and thus belongs to the sphere of political decision making. The most recent international results and the emerging "new consensus" highlights, however, that one can make certain important normative statements based on a small number of well-defined and well-measured parameters. This is of utmost importance for economic policy debates, since it allows the shift from "faith debates" into disputes about questions like the size and interpretation of certain parameters. For example, the key issues for the optimal top personal income tax rate – discussed in depth in *Chapter 2* – are the shape of the income distribution, the elasticity of taxable income, the margins of adjustment it does and does not capture (shifting between various tax bases versus long-run reactions, human capital accumulation), and obviously the social welfare function.

We would like to bring this diverse, innovative and active literature to a broad Hungarian readership. The chapters of *In Focus – I* all bring a multitude of additional aspects and starting points for the reader. The number of contributing authors has probably exceeded that of any previous volume, representing almost all local research groups that are active in the topic. We hope that our compilation will serve as a useful benchmark for Hungarian academic and public policy circles, giving them valuable and thought-provoking reading, which can also be utilized in their everyday work.

* * *

*In Focus – I* consists of six chapters. The introductory first chapter (authors: Péter Benczúr and László Sándor) sets up the common conceptual framework for the role of taxes and transfers in the static determination of labour supply and demand. In addition, the chapter provides the Hungarian audience with a new, more comprehensive review of the empirical literature on labour supply elasticities, with in-depth coverage for some selected issues.

The second part of the Introduction surveys the major results and open questions from the recent academic literature on income taxation, drawing heavily on the *Mirrlees Review* and the forthcoming Volume 5 of the *Handbook of Public Economics*. It first presents the classical setup of income taxation, then it proceeds with results and considerations about the "optimal tax base", and finally, it discusses tax differentiation along other aspects than income (tagging). From this collection, many issues will reappear in later chapters, with a more detailed treatment, and often adapted to Hungarian data.

The *Appendix* of *Chapter 1* (written by Mónika Bálint) enlists a set of Hungarian databases, which are particularly useful in the analysis of labour mar-

ket impacts of taxes and transfers but not yet widely employed by researchers. These are: personal income tax files, the Hungarian Central Statistical Office's *(Központi Statisztikai Hivatal)* Household Budget and Living Conditions Survey *(HKÉF),* and the linked administrative database of the Central Administration of National Pension Insurance *(Országos Nyugdíjbiztosítási Főigazgatóság)*, National Health Insurance Fund *(Országos Egészségpénztár),* Hungarian State Treasury *(Magyar Államkincstár),* and the National Labour Office *(Nemzeti Munkaügyi Hivatal)*.

*Chapter 2* looks at the intensive margin of labour supply, more precisely: at the elasticity of taxable income (authors: Péter Benczúr, Áron Kiss and Pálma Mosberger). It first surveys the results of the international literature – at greater depth than previous Hungarian reviews –, mostly from a policy applicability aspect. The authors find that international taxable income elasticity estimates tend to be smaller than those in the US. Its most likely cause is that the tax base can be influenced by much more deductions and exemptions in the US than in most other countries. The chapter then proceeds by presenting the results of the two studies that use Hungarian data, partly updating previous estimates of *Bakos et al.* (2008). The results are broadly in line with the international experience: elasticities are not large in general, but they are sizeable for certain subgroups. Relative to the original results of *Bakos et al.* (2008), the new estimates suggest smaller elasticities overall. High income taxpayers are typically more responsive to the marginal tax rate, while – unlike in the international evidence – there is often a significant estimate for the average tax rate, both in the positive and the negative.

Finally, the chapter demonstrates the use of estimated elasticities in "optimal tax rate" model simulations. Based on the corresponding theory, the optimal top income tax rate depends on three parameters: the elasticity of taxable income, a parameter describing the shape of the (top of the) income distribution, and a parameter representing social preferences. According to the calculations, the pre-2010 top marginal tax rate was optimal under a strongly redistributive social welfare function, while the post-2010 top tax rate is consistent with optimality under a less redistributive social welfare function, or a much larger elasticity than the estimates suggest. Such elasticities cannot be supported by existing results. Moreover, the income effect would point towards an even larger revenue-maximizing top tax rate.

*Chapter 3* looks at employment, more precisely: the labour market participation decision, also known as the extensive margin of labour supply (authors: Gábor Kátay and Ágota Scharle). It covers two main topics: mostly based on results from a recent study, it first explores whether the tax and transfer system affects labour market participation; and second, it reviews the impact of unemployment benefits on efficient labour market search and job take-up. The empirical analysis of the participation decision suggests that both taxes and

transfers significantly reduce labour supply; while studies of particular types of transfers indicate that it is rather the tightening of eligibility and not the cut of the transfers themselves that could increase labour market activity. Results are similar for job finding rates: when looking at the impact of a cut on unemployment benefits on the timing of taking up a job, no study has found substantial positive effects.

*Chapter 4* presents the utilization of a heterogeneous household microsimulation model for assessing the impact of tax and transfer reforms on the economy (authors: Dóra Benedek, Gábor Kátay and Áron Kiss). Heterogeneity can mean that a reform impacts different households differently, or that different households respond differently to a common change.

The chapter first reviews the use of microsimulation methods both in an international and a national context. Then it describes a microsimulation model, developed recently in the Magyar Nemzeti Bank (the central bank of Hungary), and uses the model to assess the long-run impact of hypothetical and actual tax and transfer reforms on the labour market and the macroeconomy.

Let me briefly list and summarize the simulation exercises. The first one compares three alternatives of reforms that are aimed at increasing the labour market participation of low income, and typically also low activity groups. The second part evaluates some revenue-neutral tax restructuring proposals. According to the results, an across-the-board personal income tax cut, financed by an increase in capital income taxes, would boost effective employment. Its impact on GDP, however, is negative, due to the highly elastic response of capital. Cutting transfers brings about positive long-run effects: it leads to lower government expenditures and higher labour market incentives for those who are affected. It is important to note, however, that the simplifications of the model are likely to cause an overprediction of the true long-run effects.

Finally, the authors present an attempt to use the model for quantifying the long-run impact of the most relevant reforms of the last two years. Broadly speaking, the tax and transfer changes enacted (or planned) since 2010 lead to an increase in output, through the intensive margin of labour supply. Their impact on employment is much smaller though still positive: the slight negative impact of all tax changes is reversed by the cut in unemployment benefits. A permanent increase in the required rate of capital can easily turn all the gains negative.

*Chapter 5*, consisting of many independent subchapters by different authors, shifts the focus from labour supply (employees) to labour demand (employers). According to the most basic framework, labour demand is determined by the price the company can get for its products, wages and labour productivity. In reality, labour markets are more complex, and there are many channels of state intervention: taxes and contributions, minimum wages, firing restrictions and

regulations on the length of working hours. The main topic of the chapter is the impact of payroll taxes, or more precisely: the impact of payroll tax exemptions and wage subsidies.

After a brief introductory part (authors: Árpád Földessy and Ágota Scharle), *subchapter 5.2* summarizes previous results and experiences concerning wage subsidies (authors: Péter Galasi and Gyula Nagy). It draws two main conclusions. 1) According to the single program evaluation study looking at the wage subsidy programs in the mid-90s, those programs did not increase employment probabilities. 2) The impact of similar programs in the 2000s shows a marked heterogeneity, along gender, age and education.

*Subchapter 5.3* (authors: Zsombor Cseres-Gergely, Árpád Földessy and Ágota Scharle) describes a recent study on the impact of the wage subsidy scheme "Start card". It finds that even a temporary wage subsidy can be efficient, if it is well-designed and targeted. In particular, the program "Start Extra", which was offered to jobseekers above 50 and with at least a secondary education, was cost-efficient for men, even when one only looks at short-run benefits. The overall efficiency of the program could be increased by restricting its target group to the less-than-secondary education group, and by adding extra job search incentives for women.

*Subchapter 5.4* analyses another main type of government intervention: minimum wages (authors: Ágota Scharle and Balázs Váradi). It first reviews the international and Hungarian evidence and experience about the use of differentiated minimum wage cuts as a tool to increase employment. Then the authors summarize the main arguments they had in a previous proposal, calling for regional differentiation in minimum wages.

The last subchapter summarizes the literature on the long-run equivalence of employer and employee contributions (author: Árpád Földessy). Though there is sufficient empirical evidence for the equivalence, there are some assumptions of the theoretical reasoning which can be violated in reality. The theoretical result may not hold under strong union influence, progressive taxation, if the minimum wage is close to the equilibrium wage, or if unemployment benefits are proportional to gross wages or are taxed. Another departure can come from the possibility that net wages are not the only determinant of employer attitudes, but social norms are also important. Though it is not obvious to analyse the impact of social norms by standard economic techniques, there is evidence for their influence. It nevertheless does not lead to a violation of the equivalence of employer and employee contributions.

The last chapter of *In Focus – I* analyses the issue of labour market related tax avoidance and evasion (authors: Dóra Benedek, Péter Elek and János Köllő). In other words, it looks at black and grey employment patterns. These topics get a central stage in Hungarian economic policy debates, and for a good reason. Their prevalence crucially influences the total economic ef-

fect of a minimum wage increase, a tax cut for low earners and many other policy actions.

After a short introduction, the chapter first presents an overview of existing international evidence on the importance of the shadow economy and employment. Then it proceeds with a detailed, micro-based analysis of employment-related tax evasion in Hungary, looking at black and grey employment, and the self-employed. Finally, its last subchapter uncovers the (re)distribution aspects of tax evasion, also building on microdata.

Based on studies comparing the *Hungarian Labour Force Survey* and administrative data, the estimated share of unreported (black) employment was between 10 and 17 percent over the time period of 2001–2007. The results vary with the estimation method and the particular subsample considered, but they show no clear time pattern. Black employment is particularly relevant for men, the self-employed, in the central region of Hungary, and in certain professions like structural architecture and personal services.

Looking at grey employment, the authors present evidence that disguised minimum wage earners tend to be concentrated in certain subgroups: they are more frequent in the construction and retail sector, and in very small enterprises. In other sectors, also exhibiting high rates of minimum wage earners – such as the cleaning industry and unskilled labour in general – the degree of income under-reporting is much smaller. An important result is that more than half of the total unreported income bill comes from the top quintile of the (true) wage distribution.

Consequently, a minimum wage increase has a limited impact on the amount hidden from the tax base; while it adversely impacts the employment of the unskilled, who are true minimum wage earners. A well-designed differentiation of the minimum wage (for example, a higher minimum wage for university graduates), on the other hand, can perform well as a whitening device.

Finally, the chapter presents estimates about the full amount of income underreporting. By comparing income data from the *Household Budget Survey* and personal income tax files, average income underreporting is estimated to be in a range of 9–13%. Its incidence is higher among low and high earners. Income distribution patterns of income underreporting broadly coincide with those of black and grey employment: tax evasion is higher among men and the self-employed, and in the central region of Hungary.

The chapter also contains three special topic boxes. István János Tóth and Mihály Fazekas preview their recent results from a survey on envelope wages, providing a first evaluation of the impact of the crisis on income underreporting. Mirco Tonin reviews his earlier research results on the link between minimum wage regulation and tax evasion. And finally, Árpád Földessy and Ágota Scharle analyse the impact of temporary employment booklets *(alkalmi munkavállalói könyv)* on black and grey employment.

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# 1. INTRODUCTION

PÉTER BENCZÚR & LÁSZLÓ SÁNDOR

In this introductory chapter we sketch the common conceptual framework of this *In Focus – I*. Foremost, we show what roles taxes and transfers play in determining labour supply and demand.[1] Several other reviews are already available in Hungarian, e.g. the survey of *Benczúr* (2007) and the comprehensive tax reform study of *Scharle et al.* (2010). In order to facilitate the reading of the ensuing chapters, we repeat here the basics from these two prior studies. Occasionally, we make significant extensions and updates, in which cases we also flesh out some insights in more detail. The second half of the introduction briefly reviews the international literature of income taxation, its cornerstone results and open questions, largely relying on the extensive *Mirrlees Review*[2] of the British tax system and the fifth volume of the *Handbook of Public Economics* now under preparation. Finally, the Appendix (written by *Mónika Bálint*) describes Hungarian databases which allow microempirical analysis of labour taxation, and summarizes their availability.[3]

## The conceptual framework

### *Labour supply*

The (static) approach to labour supply supposes that each individual chooses how much to work according to the utility derived from leisure and consumption.[4] When the net wage falls, they can afford less leisure (this is the *income effect*), while the income forfeited when not working also falls, and the *substitution effect* drives the worker to buy more of the now-cheaper leisure. The compound effect of these two forces has an ambiguous sign even in theory: at high wages a pay raise (tax cut) can drive a person to lower their labour supply, as their higher income increases their demand for leisure more than how much the higher wage incentivizes extra work. This is the phenomenon of the *backward bending labour supply curve*.

Two fundamental aspects of the labour supply decision can be distinguished: first, the decision whether one works or not (*the extensive margin*); second, the amount the person works (*the intensive margin*). In the latter case, not only hours worked but also *the quality and intensity of work* is a choice of the worker. Though this can be observed less directly, one can assume that total earnings are intimately related to work intensity – think of performance pay, bonuses, promotions, or human capital accumulation.

1 We are grateful for comments from *Peter Hudomiet*, *Attila Lindner*, and *Áron Tóbiás*. All remaining errors are our own.

2 Two excellent critical reviews of *Mirrlees et al.* (2011) came from *Atkinson* (2012) and *Feldstein* (2012). A similar project for France was completed by *Landais et al.* (2010). The link of theoretical results and practical policy is reviewed by *Boadway* (2012), looking both back and forward in time.

3 The appendix primarily surveys databases newly available for labour market research. Well-known databases such as the Hungarian Wage Rate Survey or the Labour Force Survey are described in detail in the Statistical Data section.

4 The dynamic approach is similar, yet part of the decision concerns the allocation of labour supply and consumption over time. *In Focus – I.* follows basically the static approach. On the dynamic case, see for instance *Keane* (2011).

The incentive effects of tax systems have two key indicators. *Average tax rates* indicate the fraction of the total income a taxpayer pays as taxes, while *marginal tax rates* measure how much more they would pay in taxes, should they earn a unit more, all levies combined.

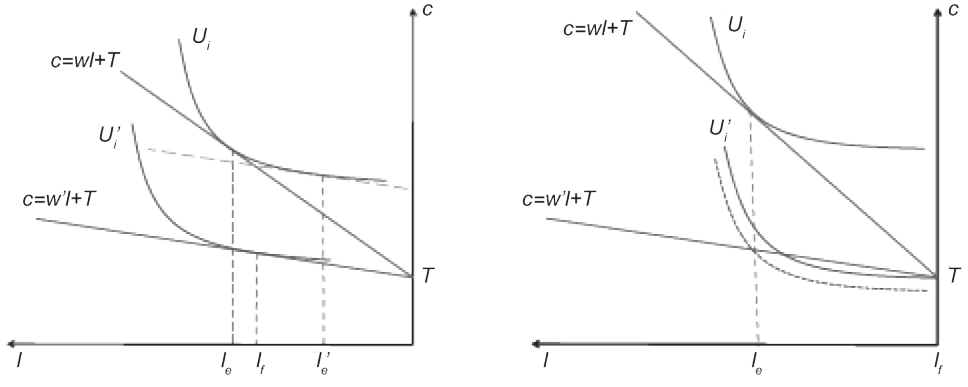
In this regard, it is important to treat taxes together with various, often income-dependent (means-tested) benefits[5] – the real question is how much one can take home from one's income after paying taxes and getting transfers (which is *the effective tax rate*, see *Scharle*, 2005). The take-home share (*net rate*) is also called the *tax price*.[6]

Marginal tax rates have only substitution effects on decisions about hours worked and work intensity (or together: *the effective amount of labour*): a tax rise that affects only the last dollar earned induces a reduction in the effective amount worked. This is illustrated in the left panel of *Figure 1.1:* the decrease of the net wage from $w$ to $w'$ (a rise in the marginal tax rate) with utility kept constant (a rise in the marginal tax rate) decreases hours worked from $l_e$ to $l_e'$. The sign of the substitution effect (for a consistent, "rational" worker) is thus always negative: a higher marginal tax rate decreases the amount of labour supplied.

5 Some transfers are lost with basically the first earned forint, resulting in a discrete, discontinuous jump in the budget set at zero hours of labour. Potential remedies of this effect are discussed in detail *Chapter 3*.

6 Which is thus one *minus* the corresponding tax rate.

**Figure 1.1: Labour supply incentives of average and marginal tax rates**




Legend: *l:* amount of labour, *w:* wage, *T:* non-labour (unearned) income, *c:* consumption, $U_i$, $U_i'$: indifference curves.

Raising average tax rates, in contrast, can even raise the amount of labour supplied, as it also decreases disposable income. This is basically the income effect of a tax change: without changing the (local) slope of the budget constraint (the net wage), this tax rise shifts the line downwards, changing labour from $l_e'$ to $l_f$ (left panel of *Figure 1.1.*).

The magnitudes of the effects are usually measured as *elasticities*, which show the percentage response to a percentage change in the average or marginal net rate of hours worked (the intensive margin) or the propensity to work (the extensive margin). The *uncompensated labour supply elasticity* shows

the total effect of a wage change (the sum of the substitution and the income effects), while the substitution effect itself is measured by the *compensated elasticity*.[7]

For the decision to enter work the fall in the average tax rate is a positive incentive, since this increases the return on entering relative to inactivity. In the simplest case a tax rise can push one into inactivity (i.e. a corner solution: the indifference curve would be tangent to the budget line at some negative amount of labour). The more typical mechanism works through the fact that most jobs have a minimum amount of labour (you cannot work less than a certain threshold – think of part-time or full-time work), which means that in spite of working only for a short period being optimal for the worker, this is impossible in practice.[8] In this case, a tax rise can suddenly make the worker choose inactivity, which of course can mean schooling, child care or retirement too.

This is shown in the right panel of *Figure 1.1*. For the initial net wage $w$, the worker works $l_e$ hours (for instance, full time). By a lower net wage $w'$, having to choose between zero and $l_e$ hours, they choose $l_f = 0$ (the interior solution at the point of tangency is unavailable because of minimal job size). This choice is driven by the average tax rate on the monthly gross wage; i.e. the earnings difference between full-time work and inactivity. For this reason, the average tax rate is also called *the participation tax rate*.

All the various taxes levied on earnings combined constitute the full *tax wedge*. This shows the deviation from a world without intervention, when the marginal product of labour would equal the marginal rate of substitution between leisure and consumption. On top of taxes levied directly on the worker, employer-paid contributions also feature prominently in the full tax wedge, as they also affect the relation between the full labour cost to the employer and the net wage received by the worker. Furthermore, consumption taxes also affect the consumption-labour trade-off, as they also change the amount of goods one can get in exchange for working.[9] Thus the average effective rate of consumption taxes also shows up in the full tax wedge.

In practice, different types of labour income can face different tax rates: for non-employment assignment contracts in Hungary, for instance, only 90% of earnings are taxable. Tax treatment also differs for fringe benefits such as a corporate car, phone or cafeteria. We can weigh these taxes by the fraction of these benefits in the total income to get at the effective average tax rate – for marginal rates the question becomes in what form the worker would receive an extra unit of income. Moreover, various tax benefits, allowances, credits and deductions can change tax rates; average tax rates necessarily, but also marginal tax rates (e.g. if eligibility is phased out above a certain income level). And in case there is a connection between some amount paid and some benefit in return (in Hungary, mainly pension contributions worked this way), the worker's valuation of the extra benefit decreases the net amount taxed away.

7 In the dynamic approach, one version of the compensated elasticity, the so-called *Frisch elasticity*, is one of the most important indicators. This measures the labour supply response under the condition that wealth has constant marginal utility, thus instantaneous labour supply can also change because of intertemporal substitution (taking advantage of a temporary earnings opportunity, without future wages changing).

8 Under such "practical reasons" underlie the general argument that employers have concave costs of employment and thus there is no such labour demand, or some employees face concave costs and thus such individual labour supply is rare (which, through firm-level coordination problems imply that there is no such firm-level labour demand either).

9 Under some conditions (e.g., no savings or capital income) labour income taxes and consumption taxes are equivalent to each other. In general, there is little long-run difference between a tax system taxing purely labour (but not consumption or savings) or one taxing consumption only. For details, see *Scharle et al.* (2010).

### *Labour Demand*

While labour supply is determined by the preferences of the (potential) worker, *labour demand* is a function of labour's productivity – assuming perfect competition in both product and labour markets. This increases with higher levels or lower costs of general technology and development, capital, and other factors of production (e.g. complementary skilled labour). In classical economic models with perfect competition, the employer pays its employees the level of wages which correspond to how much they contribute to its revenues through the production process (the value of the marginal product of their labour). Even with the employer taking wages as given, we can distinguish short-term and long-term labour demand (the latter allows a change in capital and other factors of production, the spread of all relevant information, etc.). It is easy to prove that the long-term elasticity of labour demanded with respect to unit labour costs is equal to the elasticity of substitution between labour and capital.[10]

*Scharle et al.* (2010) briefly survey the empirical literature on labour demand in Hungary. Studies of direct personnel demand using individual-level observations find elasticities close to the international average, between –0.5 and –0.8 (*Kőrösi*, 2005). Estimating the elasticity of labour-capital substitution from an empirical investment equation, *Kátay and Wolf* (2004) find a long-term value of –0.8, close to the estimates from personnel demand equations.

Numerous government programs and interventions aim to change labour demand. *Sections 5.2* and *5.3* analyse the effects of various *wage subsidies* in detail. Though in the long run these are supposed to work through the tax wedge (i.e. when employer and employee contributions are equivalent and they have an effect through labour supply), in the short run they can have a direct effect on labour demand and can be more effective countercyclical incentives (we discuss this in detail in *Section 5.5*).

The other well-known, primarily demand-side intervention on the labour market is the institution of *minimum wages*. This introduces a lower bound for wages, thence firms have no more incentive to employ some workers, since their contribution would be less than the legislated minimum wage. So in this way the minimum wage can decrease employment. Yet if there is no perfect competition in the labour market, or where companies can affect wages for other reasons, raising the minimum wage might even increase employment.

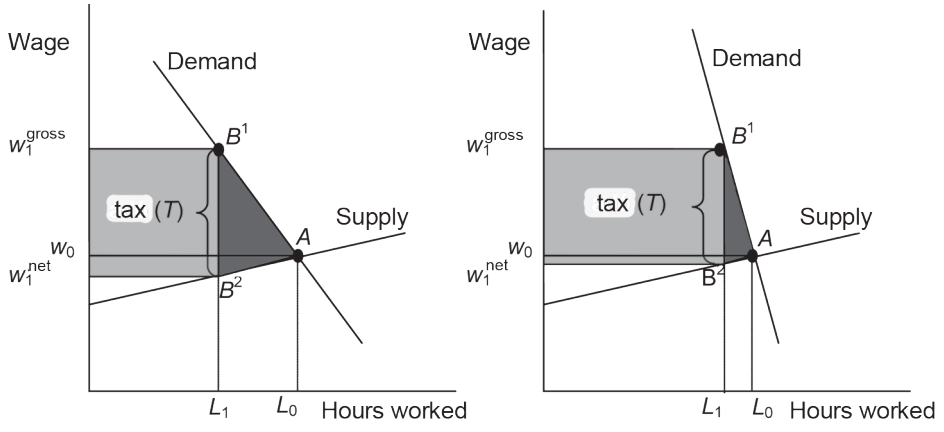
Meanwhile the minimum wage can be socially beneficial because it does not allow wages of subsidized low-income people to fall in line with their increased labour supply. This can reinforce the power of the subsidy and the scope for redistribution – besides which it is necessarily inefficient (even self-contradictory) to levy any taxes on minimum wage earners (*Lee and Saez*, 2012). *Section 5.4* discusses these aspects as well.

10 To be precise, the proposition assumes a constant returns to scale, two-factor, constant elasticity of substitution (CES) production function.

## *Labour market equilibrium*

The equilibrium of labour demand and supply can be seen on *Figure 1.2*. The horizontal axis shows the effective amount of labour, the vertical the wage. The demand curve is downward sloping: firms hire fewer workers amid higher unit labour costs ("super-gross wages"). The supply curve is upward sloping: workers are ready to work more for higher net ("take-home") pay.

**Figure 1.2: Equilibrium of labour demand and supply with a unit tax on labour**




The two panels differ in the wage elasticity of labour demand: the same wage change increases the amount of labour demanded less on the right-hand side (smaller elasticity). The market equilibrium with no taxes is at the wage level where quantity demanded and supplied are equal ($L_0$ of point $A$). Here the full cost of labour equals the net wage ($w_0$).

Let us introduce now a unit tax of $T$ (among labour taxes, such is the health care contribution). The new equilibrium arises at an employment level ($L_1$) where the difference between the gross wage of the labour demand curve and the net wage of the labour supply curve equals the tax. It is important to note that this result does not depend on whom the tax is levied (in the long run). We can check this in the figure by plotting demand and supply in terms of gross and net wages, respectively.

What will happen to tax revenues? With no behavioural response (no change in the quantity demanded or supplied), we could expect revenues $T \times L_0$. The introduction of the tax will decrease employment though, and actual revenues will only equal *the light grey area*, $T \times L_1 < T \times L_0$. What is happening to social welfare in the meantime? As a potential measure, let us look at the sum of *consumer surplus* and *producer surplus*. In *Figure 1.2* the triangle shaped area between the demand curve and the equilibrium wage shows the size of the consumer surplus (in the labour market this goes to the employer), i.e. the sum by which employers value the employed labour above the actual wage. The producer

surplus (in the labour market this belongs to employees) is the area between the supply curve and the horizontal line corresponding to the given wage, which shows how much more employees value their income above their forfeited leisure.

At the introduction of the tax, both surpluses decrease: consumer surplus by the area of the trapezoid between segments $w_0 - A$ and $w_1^{gross} - B^1$, producer surplus by the area of the trapezoid between segments $w_0 - A$ and $w_1^{gross} - B^2$. But not all of this is a loss, as the government also collects revenues – exactly in the amount corresponding to the area of the light grey rectangle. The sum of consumer and producer surplus on the one hand, and government revenue on the other, decreased thus by the area of the darker triangle. Its area is $1/2 \times T \times (L_0 - L_1)$.

Both the missing tax revenue relative to the case without behavioural responses, and the *deadweight loss* of the tax, are a function of how much employment decreased. A comparison of the right and left halves of the figure also reveals that this is larger when supply and demand curves are flatter, or employment changes more for any wage change. In other words, when demand and supply are more elastic.

Finally let us see how the burden of the introduced tax is shared between employees and employers. This is called *tax incidence* in the literature. We again stress that this is not about the legal split but about who is contributing to the tax revenue. It is easy to see in the figure that gross wages go up by $w_1^{gross} - w_0$ while net wages decline by $w_0 - w_1^{net}$. We can easily see that their relative size depends on the *relative* slope of the supply and demand curves.

### *The elasticity of labour supply*

*Are there segments of the labour market which exhibit a significant supply elasticity?* The traditional labour economics literature analysing US data found essentially zero elasticity of hours worked with respect to wages[11] (*Pencavel*, 1986); i.e., wage changes lead to basically no changes in labour supply. Similarly low elasticities were found in Hungarian data by *Galasi and Nagy* (2003) and in Czech data by *Bicakova et al.* (2006). The pioneering studies taking the nonlinearities of the tax system into account could find much higher elasticities (*Hausman*, 1981), yet the methodology applied did not prove reliable enough. Subsequent studies could not show a significant effect of the tax system on the labour supply of primary earners[12] (*Heckman*, 1993, *Blundell and MaCurdy*, 1999). For secondary earners, however, multiple studies found robust and large effects, especially on the extensive margin (*Eissa*, 1995, *Eissa and Liebman*, 1996).

In Hungary, we can expect larger effects among the less educated, lower-income, or otherwise disadvantaged workers. This is reinforced by the fact, as shown by *Scharle* (2005), that effective marginal tax rates are especially high for certain low ranges of earnings.[13] The results of *Benczúr et al.* (2012) on

11 The wage elasticity here is the ratio of the percentage change in hours worked or the propensity to work and the percentage change in the wage.

12 By primary earners the literature basically means prime-age men. Among them, labour market participation is close to complete, so their extensive margin (participation) decision is often ignored.

13 The labour market incentives embedded in the public pension system have been extensively analysed for Hungary. For example, *Cseres-Gergely* (2005) found that the generous text treatment of pensions is a significant disincentive for labour market activity, because net earnings decrease much less after retirement than gross earnings.

Hungarian data also show that taxes affect labour market activity especially in these groups. (We take a closer look at this question in *Chapter 3*.)

### *The elasticity of taxable income*

Empirical studies took a significant turn when they started to look at the effects of income taxes not only on hours worked but on taxable income altogether. The seminal study of *Feldstein* (1995) on US data found very high elasticities, in excess of 1. This decreased with the refinement of the data and methodology used, and the current consensus is around values of between 0.12 and 0.4 (*Gruber and Saez*, 2002, *Saez et al.* 2012). *Chapter 2* covers this literature in detail, adding the corresponding Hungarian estimates, and discussing the policy relevance of the results.

The impact of tax rates on taxable income has been in the focus of recent studies, because it is a *sufficient statistic*[14] for the effects of the taxes: it encompasses the compound effect of all potential responses, be they more overtime, less tax evasion, more work effort, a quick training, or delayed child-bearing. Moreover because tax shocks are exogenous changes in the price of labour – independent of individual choices, demand and supply, and other unobserved factors –, more general studies of labour supply also turned to analyzing tax changes, and this literature is rich in methodological innovations. More and more, the studies use robust, nonparametric methods, extensive databases of all taxpayers over multiple years, with data collected and scrutinized for administrative purposes.

Some types of responses can still be missing from the estimated response of taxable income. In what follows, we discuss two main cases, with two subcases and main examples of each. All this is covered in more detail than above, to introduce the issues and approaches to the Hungarian audience.

*Underestimated elasticities*. First, one rarely observes collective responses, especially for changes that affect only a small fraction of taxpayers. The distortionary costs of taxes could be summarized by the frictionless changes of labour supply, independent from any other constraint or factor – but factors such as labour demand, especially work organization and the labour supply of other colleagues do not allow full adaptation in the short run. The limited response of taxable income could mistakenly lead to an underestimation of the real costs according to true preferences. In the long run, with new collective agreements or job switches one could observe sharper, larger responses reflecting the true valuation of employees. This is shown by *Chetty et al*. (2011) for example, who document collective income movements following the shifts of tax brackets in Denmark. This coordination problem, similarly to the misunderstanding or the ignorance of taxes, is essentially a *friction* (a false rigidity), which can improve over time – or even spreading in space, as *Chetty et al*. (2012b) document for the United States.

14 An excellent review of the significance and widespread use of such measures of composite effects is given by *Chetty* (2009a).

Both studies use the nonparametric methodology allowed by rich, "large datasets", where the concentration of taxpayers around the kinks of their budget constraints (the spike in the density of earnings or taxpayers, *bunching*) helps to measure responses,[15] or in the US case the salience of incentives. *Saez* (2010) derived that such concentrations are larger with more elastic responses: when workers are more sensitive to deviations from their expected effort, more of them would work more on the side of the kink that is taxed less, but less on the other side of the kink taxed more, thus the kink is the optimal choice for more people. The Danish study of *Chetty et al.* (2011) found that earnings concentrate around kinks of the majority of colleagues even for whom the kink would be somewhere else individually. The US study of *Chetty et al.* (2012) meanwhile identifies the local familiarity with the earned income tax credit by the degree of bunching of the self-employed who apparently adapt (or evade) conspicuously well.

Another example of frictions due to employers and co-workers comes from *Saez et al.* (2012), and goes against the theory of tax incidence discussed above. A Greek reform raised contributions only for a fraction of workers. One could expect that employers shifted the burden onto those affected, but this is not what happened: employers kept the burden of higher employer contributions for themselves, but shifted to workers in the case of higher employee contributions. It is a cautionary tale that norms of justice (discrimination at the workplace or different gross wages being unacceptable) can override the most basic economic (incidence) expectations that we derived from individual incentives, even in such a transparent case. In a Hungarian example, this could mean that a subsidy of young mothers will not necessarily be shifted on raising their wages if the differentiation between mothers and their colleagues would prove too controversial or cumbersome.

Second, long-term responses are rarely observable, and on a short timescale of a study, adaptation to transaction costs could prevent responses from reflecting true preferences. This is where *Chetty* (2012) has made progress when he looked at the information content of studies following large tax changes. He assumes that even an ignorant or inert employee, when facing large enough utility losses, would get over the frictions. The size of the tax change affects the cost of an imperfect response. Thus from every study we can infer what the true elasticities are that can correspond to the documented imperfect responses. According to *Chetty* (2012), among the estimates of the most influential studies of the last three decades, various though they may be, there is still an overlap for the underlying structural elasticities they allow: an intensive margin compensated wage elasticity of 0.3 is consistent with most of the important results from the modern empirical literature. This can be seen as the new professional consensus according to the surveys of *Saez et al.* (2012) and *Piketty and Saez* (2013) as well.

15 Nonlinear budget constraints are treated in more detail in the review of *Benczúr* (2007).

Adaptation costs might be the prime remaining reason why one could still expect high social costs of taxation – even in spite of numerous studies finding small responses and thus small costs from precise estimates in rich data, but only in the short run. Convincing measurements of the really long-run responses, like counterfactual careers or school choices, still await even the international literature. Such calculations are only available from macroeconomic calibrations.

That said, long-run expectations about future taxes can have important effects in the short run, which is neglected even by the best available empirical labour supply elasticity estimates – *Kueng* (2012) meanwhile calculates (surprisingly realistic) tax expectations from the spread between taxable and tax-exempt bonds, and documents significant forward-looking consumption responses to them.

The empirical literature of extensive margin elasticities is reviewed by *Chetty et al.* (2012a). The study also tries to reconcile the results with the macroeconomic literature of indivisible labour, which arrives at different elasticities from calibration. Because the extensive margin is more intimately related to decisions over the lifecycle (intertemporal substitution), the dynamic treatment is appealing, hence the connection. Moreover, the substitution between time periods or risk aversion, which are so important for finance or dynamic decisions, are similarly a function of the curvature of utility functions, as is the substitution between consumption and leisure. This determines how quickly the marginal utility of consumption is decreasing. This intimate but somewhat neglected connection has been exposed by *Chetty* (2006).

The long run, steady-state elasticity of labour supply corresponds to the compensated, Hicksian notion, and the empirical results from individual-level studies of 0.3 on the intensive and 0.25 on the extensive margin are consistent with standard macro models. However, microempirical studies are also able to estimate Frisch elasticities, which incorporate intertemporal substitution, and the consensual estimates of 0.5 on the intensive and 0.25 on the extensive margin are definitely smaller than what could explain the employment fluctuations over the business cycle in developed economies in current macro models.

*Elasticities affected by the tax system.* In two important cases, the tax system itself affects the size of elasticities. With precise and unbiased estimates on the latter, the elasticity of taxable income is a correct and sufficient statistic to evaluate the current tax system. It offers less guidance, however, on what effects, distortions and costs we could expect from (thought) experiments of other reforms.

First, the tax system with its too narrowly defined rules can generate new, artificial, and often quite elastic responses: tax evasion, geographic mobility, or shifting income. In these cases, though studies correctly estimate the composite response, it is still not a sufficient statistic for assessing the damaging or distortionary effect of another tax with fewer loopholes or better enforcement. A tax levied on a broader base, with fewer exemptions and deductions, which taxes easily transformable forms of income the same way, might be able to generate the previous levels of government revenue with smaller rates, and distortions would further decrease because the remaining responses show smaller elasticities.[16]

The (international) mobility of the wealthy and thus the amount of mobile income can be significant,[17] though usually the emigration elasticity of the native rich is lower (~0.15) than that of immigrant foreigners (~1). This limits only tax systems with a significant number of wealthy immigrants. *Kleven el*

16 A robust model and an empirical calibration of such *fiscal externalities* of taxes is given by *Piketty et al.* (2011). *Kopczuk* (2005) showed empirically that the 1986 tax reform in the United States with its uniform rates and closing of loopholes led to a decrease of the measured elasticity of taxable income.

17 In this regard, *Keen and Konrad* (2013) give a good review of the literature on international tax competition and coordination.

*al*. (2012) document significant mobility for soccer players in Europe, while *Kleven et al*. (2011b) analyse a Danish immigrant tax exemption, and find very high tax elasticity of moving (1.5).

This phenomenon is similar to the fact that the relevant elasticity can be higher because of potential tax evasion or simple income shifting. This is now the mainstream interpretation of the estimates of *Feldstein* (1995): some of the large effects after the 1986 cut of American income taxes followed from the fact that labour was suddenly taxed less than capital income, which changed the form in which business-owners took value out of their company. Also, *Goolsbee* (2000) showed something similar for the 1993 US tax increase; that its apparent big effect came largely from the corporate executives in question rearranging their remuneration in the short run: they took their money out before the tax rise, which then implied surprisingly large income drops with the higher taxes.

Second, the *salience* of taxes (and benefits) is crucial: a misunderstood tax obviously has different effects than a clearly understood system. It is an important lesson though, that the tax distortions can even decrease this way, and of course the corresponding elasticity estimates may also change accordingly. If labour supply drops less after a tax hike than if gross wages had decreased by the same amount, the distortionary costs of the tax are smaller (*Chetty*, 2009b). The worker would miss the lost income even after an ignored tax, yet the income effect is unavoidable even under an ideal sharing of the burden, and a forgotten tax causes no deadweight loss on top of that. Of course, a misunderstanding can also induce completely pointless responses (high elasticities), when the distortion is an unnecessary cost. A particularly important example for the latter can come from pension contributions. The closer a pension system resembles individual savings, i.e. the more direct is the perceived connection between in-payments and the present value of future benefits, the less there is for the worker to react to. Their performance, their value added can stay what they would choose according to their preferences and their productivity, hence efficient and just.[18] Yet if the taxpayer thinks that their pension contribution is lost – or at least it is unrelated to their future benefits – they would work less, since the (perceived) returns to work decreased.[19]

The previously discussed concentration-bunching method has been advanced in this regard by *Kleven and Waseem* (2012). They measure and quantify ignorance, errors, or frictions from the extent that Pakistani employees reported earnings which no preferences could rationalize, because they could have taken home more pay with less work.

It is an important practical aside that relieving-solving informational problems can be a much cheaper way of guiding agents towards more efficient solutions and choices than ramping up ill-understood incentives. *Chetty and Saez* (2013) conducted a field experiment among Americans eligible for the earned

18 This is also the main argument for a French reform of *Bozio and Piketty* (2008).

19 *Liebman, Luttmer and Seif* (2009) document that incomes change significantly with pension benefit rules. On the contrary, *Friedberg* (2000) found significant effects even where American pensioners would have actually got back their benefits lost due to higher income – which must have been a misunderstood, unnecessary, costly response.

income tax credit, where they find that a cost-effective explanation had as large an effect on the next two years' earnings as if they had increased the subsidy itself to a large extent.

### *Tax evasion*

*Tax evasion* is important for all taxes, including labour income taxes. It is paramount to distinguish *tax evasion*, which breaks the rules explicitly, from *tax avoidance*, which follows the letter of the law, if not its spirit. The problem is not only that they decrease government revenues, but also that they distort the redistributive effects of the tax system in many ways. On the other hand, when the tax system prices out otherwise legitimate economy activity, it might be beneficial for social welfare if the transaction still takes place after some tax evasion.[20]

The canonical deterrence model says that tax evasion is driven by its relative return, i.e. how much one can save on the tax relative to paying it in full (*Slemrod and Yitzhaki*, 2002). The real-world willingness to pay taxes cannot be completely explained by the probability of getting caught and penalties, as many more pay more taxes than what the standard model would predict. In the baseline model, however, the rational comparison of evaded taxes and expected penalties does not take into account social norms and interactions, like some respect for rules, some need for belonging and conformity, learning from others, or fairness.[21] These factors can drive people towards paying more taxes, yet they can also prove a social cost of tax evasion: if the tax system is known to lead to evasion, the knowledge of rules being broken leads to losses of individual utility and thus social welfare.

### *Indicators of redistribution*

One of the main features of tax systems, and income taxes in particular, is their *progressivity*. This means that someone with a higher income contributes more to public funds. *Chapter 2* discusses the connection between the earnings distribution and progressivity in more detail, but we lay down some general aspects here.

It is a general feature that the upper deciles of the income distribution, let it be labour or capital income, accrue a disproportionate share of total income.[22] This is not at all surprising: all members of the top 10% have incomes much larger than the average income, so their total income is bound to be more than the tenth of the population's total income. This also means at the same time that a 1% increase in the economic activity of the top 10% will result in a much larger increase in total income than the same for the bottom 10%.

Measures of this disproportionality, which many say erode social welfare, can describe the entire distribution, like the Gini coefficient, or compare different points of the distribution, like the ratio of the top 10% and the median. A

20 Some elements of tax evasion waste resources (e.g. when we carry around cash needlessly, or we choose a product not really of our fancy), but this loss is captured by taxable income as a sufficient statistic. The latter can still be upwardly biased, towards excessively strong responses, if tax evasion did not fully destroy value added, it only transferred some income. A sufficient statistic for the efficiency loss in this case has been derived by *Chetty* (2009c) and applied to the flat tax reform of Russia by *Gorodnichenko et al.* (2009), finding much smaller welfare gains from the flat tax than what was apparent otherwise. The fiscal externalities of *Piketty et al.* (2011) can be interpreted similarly.

21 The canonical model also ignores the issue of practical methods for tax evasion or hiding income. In this regard, the finding of *Kleven et al.* (2011a) is especially interesting: in Denmark, employer-reported income data is much more reliable than self-reports. According to their explanation, at larger workplaces there is no stable equilibrium of hushing up and letting each other hide some income. *Kumler et al.* (2012) find something else for Mexico: in less developed countries even corporate income reports can be improved by better incentivized reporting. In advanced economies, it was partly the result of technical progress that they could improve the institutional efficiency of the tax system by collecting reported earnings (resulting in smaller fiscal externalities and elasticities).

22 It is important to add that here we talk about the distribution of annual snapshots, and part of the big differences come from the lifecycle, temporary shocks, or the entry of more productive generations. This sheds a different light on these differences and how just they are.

progressive tax system decreases inequality, yet it makes the distribution of tax payments even more disproportionate: in Hungary the top 10% of the income distribution has 35–38% of total income, but 55–59% of all tax receipts come from them (considering only earnings of employees, 2000–2010, see *Table 1.1*).

*Table 1.1* shows the evolution of the distribution of earnings and personal income tax contributions of Hungarian employees', based on individual income tax records from 2000 to 2010.[23] The table confirms the unequal distribution of both income and tax receipts: the bottom three deciles get roughly 7–9% of income and pay 1–3.5% of personal income taxes,[24] the income share of the middle five deciles is 38–42%, with a tax share of 16–19%. The ratio of the top 10% of incomes and the median income stayed roughly constant, between 2.5–3; while ratios involving the bottom 10% are unstable due to the cell size of the database.

23 As we mentioned before and will discuss in more detail in the next section, in the ideal case, the true distribution of goods could only be seen from a holistic, systematic analysis of all income, all taxes, and all benefits. We cannot venture to do so here, yet we still think that this partial information on the income distribution is still interesting news for most readers.

24 2004 and 2005 values are biased downward by the imprecision of income cells in the database.

**Table 1.1: Distribution of income from personal income tax records, 2000–2010 (annual income, in thousand forints)**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bottom three deciles** | | | | | | | | | | | |
| Income cut-off | 405 | 505 | 585 | 595 | 575 | 625 | 775 | 875 | 925 | 925 | 925 |
| Average income | 261 | 349 | 336 | 391 | 341 | 365 | 495 | 541 | 550 | 551 | 539 |
| Income share | 8.01 | 9.15 | 6.99 | 8.31 | 4.97 | 5.03 | 8.58 | 7.81 | 7.67 | 7.98 | 8.01 |
| Tax share | 2.91 | 3.51 | 2.11 | 1.35 | 0.61 | 0.68 | 1.26 | 1.32 | 1.27 | 1.24 | 1.20 |
| **Middle five deciles** | | | | | | | | | | | |
| Income cut-off | 1,150 | 1,350 | 1,550 | 1,850 | 1,925 | 2,125 | 2,275 | 2,475 | 2,625 | 2,575 | 2,575 |
| Average income | 751 | 872 | 950 | 1,109 | 1,088 | 1,184 | 1,359 | 1,498 | 1,582 | 1,572 | 1,588 |
| Income share | 38.84 | 38.33 | 40.04 | 40.44 | 42.53 | 41.89 | 39.24 | 41.05 | 41.36 | 41.01 | 40.29 |
| Tax share | 26.89 | 27.05 | 25.86 | 23.59 | 21.89 | 21.00 | 22.76 | 25.67 | 25.42 | 24.33 | 22.81 |
| **Ninth decile** | | | | | | | | | | | |
| Income cut-off | 1,650 | 1,950 | 2,125 | 2,375 | 2,775 | 3,050 | 3,250 | 3,550 | 3,750 | 3,650 | 3,750 |
| Average income | 1,412 | 1,654 | 1,881 | 2,170 | 2,311 | 2,554 | 2,728 | 2,967 | 3,140 | 3,074 | 3,112 |
| Income share | 15.70 | 15.64 | 15.64 | 12.97 | 16.19 | 16.51 | 15.99 | 15.72 | 15.34 | 15.02 | 16.53 |
| Tax share | 17.33 | 17.29 | 17.85 | 16.00 | 19.71 | 19.63 | 19.29 | 18.85 | 18.66 | 18.13 | 17.11 |
| **Top decile** | | | | | | | | | | | |
| (Ceiling of 99th percentile) | 4,875 | 5,500 | 5,500 | 6,500 | 7,750 | 8,250 | 9,250 | 9,750 | 10,250 | 10,250 | 10,250 |
| Average income | 3,170 | 3,720 | 4,128 | 4,512 | 5,189 | 5,747 | 6,131 | 6,566 | 6,930 | 6,788 | 6,939 |
| Income share | 37.45 | 36.88 | 37.33 | 38.28 | 36.31 | 36.57 | 36.18 | 35.41 | 35.63 | 35.99 | 35.17 |
| Tax share | 52.86 | 52.16 | 54.18 | 59.07 | 57.78 | 58.70 | 56.69 | 54.16 | 54.65 | 56.30 | 58.89 |
| **Inequality measures** | | | | | | | | | | | |
| p90/p50 | 2.48 | 2.55 | 2.59 | 2.73 | 2.85 | 2.98 | 2.89 | 2.78 | 2.83 | 2.75 | 2.83 |
| p50/p10 | 2.96 | 2.59 | 2.88 | 2.95 | 3.55 | 3.73 | 3.46 | 3.00 | 3.53 | 3.53 | 3.53 |
| p90/p10 | 7.33 | 6.61 | 7.46 | 8.05 | 10.09 | 11.09 | 10.00 | 8.35 | 10.00 | 9.73 | 10.00 |

Note: *Thresholds* can only be determined at 50,000 forint resolution for lower incomes, at 100,000 forints for higher incomes, and at 250,000 forints for the highest incomes. This introduces artificial fluctuations in inequality measures involving the bottom decile (p90/p10, p50/p10). In 2004 and 2005 there is particularly large

error in the cutoff for the bottom three deciles in all rows, and the middle five deciles' average income, income share, average tax and tax share. The *income share* shows the fraction of total income the group has. The *tax share* shows how much of the sample's total tax receipts come from the group. The annual average exchange rate was approximately 243–265 Forint per euro in years 2000–2008, 298 in 2009 and 272 in 2010.

Source: The authors' calculations, using *APEH (NAV)* data by income groups, for employees only.

## The theory of optimal income taxation

All the previous concepts describing and evaluating tax systems lead us naturally to the literature on optimal interventions and tax schedules. In what follows, we briefly summarize the theoretical results and guidelines most relevant to subsequent chapters of *In Focus I*.

### *The fundamental problem of income taxation*

Members of a political community finance their public goods (such as public safety or healthier and more educated neighbours) from their tax payments, which can alleviate free-riding problems and lead to higher public good consumption for all.[25] Most citizens probably value this in excess of their individual contribution: the value created benefits all, while its cost can be pooled, spread, shared, and paid only once, so the generated value added is multiple. Because a unit of public funds can be reallocated one-to-one independently from its payer (it is *fungible*), even without direct income transfers (a conspicuous form of redistribution), the question of sharing the burden optimally would still remain.[26]

The fundamental problem of the unequal burden (or just share) is that we have only imperfect observations of the characteristics underlying the ideal redistribution. If we only infer these characteristics from observed behaviour (value creation, consumption), we are bound to distort this behaviour. The canonical case is the following. We would like to put more of the burden on people born of higher ability, but we can only differentiate between people according to the compound effect of ability and effort (i.e. earnings). As a result, we will also distort (hinder) efforts, which is needless and costly. Ideally, taxes would only differ by ability (with the inevitable, even efficient, income effects); all other solutions can be compared to this baseline. On the other hand, the substitution effect, due to the changing returns on effort (viz. marginal tax rates) is a pure loss.[27]

In the basic case, to establish an optimal income tax scheme, we only need a few major statistics. First, the empirical distribution of income,[28] second, the social weighting of citizens of different ability, third, labour supply elasticities at different income levels, which determine distortions (*Diamond*, 1998; *Saez*, 2001; *Diamond and Saez,* 2011).[29] *Chapter 2* discusses these questions in detail.

25 *Besley and Persson* (2013) give an overview of the so-called fiscal capacity of political communities, and the proportionally bigger governments that advanced economies can maintain.

26 The iron logic of fungible tax payments implies that any income tax scheme corresponds to social weights that could rationalize it from the empirical income distribution and preferences (i.e. welfare inferred from elasticity estimates). This is how *Saez and Stancheva* (2012) endogenize social weights, in order to allow us to move forward in tax reform dilemmas even without assuming a social welfare function, or just to describe what social preferences and weighted individual marginal utilities could correspond to existing tax schedules.

27 A magisterial review of the recent literature is given by *Piketty and Saez* (2013), always paying attention to link the theory of optimal (but realistic) tax and benefit schemes to empirics. They also discuss tax evasion and income shifting, international migration, and rent seeking, with special attention to issues of relative incomes, the taxation of couples and children, as well as in-kind benefits. Finally the authors summarize which non-utilitarian alternatives we might move towards from the clashes between utilitarian conclusions and practice, intuition or consensus.

28 It is essential to know how many people would be affected by a tax rate change at a given income level, and how large changes for how many people would be allowed by a revenue-neutral change elsewhere.

29 *Lockwood and Weinzierl* (2012) make a remarkable aside: if some income differentials reflect differences in preferences (e.g. like ingrained drive), which the political community would respect (and not punish those who value material goods more and leisure less than others, e.g.), then the canonical recommendation would yield a too progressive tax schedule. *Werning* (2007) conducts a useful exercise instead of solving the utilitarian optimization program: he derives robust tests of the minimum requirements of Pareto efficiency for tax schedules, with flat taxes as a special case.

### *The tax base*

It is a valid question why an unequal burden (a just split) is practical and common to accomplish by the taxation of income in particular. While incomes are relatively easy to register and aggregate by person, the purchase-by-purchase taxation of consumption would make it really cumbersome to levy different burdens on different transactions. This is why it is recommended to tie the unequal burden to incomes, with income taxes.[30] Because tax law can rarely distinguish goods the way the proposed redistribution (burden sharing) requires to distinguish their consumers, it is usually hopeless to achieve just redistribution with differential taxation of goods and services.[31] All in all, its administrative advantages[32] notwithstanding, value-added or consumption taxes (even with multiple rates) are unable to differentiate to a large extent, let alone aligned with the aims of the political community[33] (see Chapter 6 of *Mirrlees et al*. 2011, and *Scharle et al*. 2010).

The connection between earnings on the one hand and the most important characteristics for redistribution on the other is imperfect but tight and well documented in modern states. In comparison, even the most advanced bureaucracies do not link consumption data to citizens. Even in the realm of incomes, the state makes insufficient effort to link incomes with taxes and benefits, and the political community barely knows how it shares its burden and goods. The *Mirrlees Review* also recommends wholeheartedly the joint treatment of taxes and benefits, not only for administration but also for design and planning (Chapter 5 of *Mirrlees et al*. 2011). The linking should start with the registration of data already collected and opening it up for research (on databases already available in Hungary, see the Appendix of this chapter). Yet it would also be important to document transfers and in-kind benefits throughout the lifecycle.

Another classic question of the tax base concerns *family taxation*. If spouses share resources, including their income, this cannot be neglected by a just and efficient tax system either. Among corresponding optimal tax recommendations, the work of *Kleven et al*. (2009) stands out. It shows that observing the spouse's income on top of one's own improves the inference on ability. The solution also depends on whether two-earner families differ mainly by having lower fixed costs on the second earner's market work. This would justify a higher marginal burden on two-earner families, though to an extent which is declining in the income of the first earner. This actually lines up well with widespread practice of individual taxation, as in the United Kingdom, where joint family income is the basis for (means-tested) benefits, which are then faced out gradually. Since second earners' labour supply elasticity is higher empirically, they should still face lower average tax rates.

On the empirical side, *Gelber* (2012) conducted a thorough study of earnings reacting to a spouse's income and taxes. Investigating a large-scale Swed-

30 It is important to keep in mind that the main difference between the literature of optimal income taxes and optimal commodity taxes lies in the convention that the latter only assumes linear taxes with a single rate, while the problems of the former have always been more general, according to practice.

31 An exception could be the case of categorically distinguished luxury taxes, yet they cannot be expected to significantly change the share of the burden.

32 *Pomeranz* (2011) documents how the self-controlling, enforcing effect of value-added taxes spreads upwards in supply chains.

33 *Kaplow* (2011), in his comments on the *Mirrlees Review*, also uses the example of a uniform value added tax to highlight how right the authors were to argue for efficiency improving reforms in a redistribution-neutral fashion. In a systematic, holistic approach a reshuffling of income taxes and monetary transfers can always implement an arbitrary redistribution of resources.

ish reform, he found that a compensated tax cut would have (substitution) effects increasing both spouses' earnings. Yet he also points out that simpler measurements (not taking compensating changes or simply using total family income) would overestimate these elasticities; it is not true that for a spouse the other's earning would simply count as unearned income.

*Taxes on capital income* (e.g. interest, dividend or corporate taxes) distort choices between time periods, and as taxes on an important intermediate good, they needlessly distort production too (*Diamond and Mirrlees*, 1971a, 1971b).[34] This can be necessary only if higher ability people save more (probably because of self-control or patience) at any income level.[35] The distortion from capital taxes is enormous (*Chamley*, 1986, *Judd*, 1985), since such a tax leaves a compounding burden year over year on the same initial saving, eventually taxing infinitely the creation of this useful factor of production (initially saving and then accumulation).[36] This is why economic theory prefers the taxation of consumption instead of savings-inclusive labour earnings or total income. A tax on consumption (or expenditure) does not need to be linear or proportional though: only a tax collected on purchases (e.g. a VAT) needs to take the same proportion on each unit and consumer for administrative reasons. But a conventional income tax could also be viewed as a consumption tax if savings were tax exempt: then the remaining (spent) income can still be taxed individually, even progressively (see Chapters 13 and 14 of *Mirrlees et al*. 2011).[37]

It is particularly relevant to the labour market effects of the tax system that human capital accumulation is similarly punished by conventional labour income taxes.[38] *Best and Kleven* (2012) also showed that allowing for learning and human capital investment results in a less progressive optimal tax system. Remarkably, they recommend age-dependent tax rates and an easier burden on older workers for the same reason. *Gelber and Weinzierl* (2012), however, derive and calibrate opposite results because of the intergenerational nature of this accumulation: even at the cost of larger redistribution and static distortions it is beneficial to incentivize the investment in the skills of children in low-income families.[39]

### *Distinctions beyond income?*

We can give two main justifications for differential taxation (in addition to income). First, more directly, the political community can deem other types of differential burdens just. For instance, it can support values or preferences on top of ability; like certain consumption bundles (merit goods), rural residence, or childbearing.[40] Nonetheless, the tax authority is just as unlikely to observe the other characteristic perfectly, thus the inference or filtering problems become multidimensional, which can be rather complicated and counterintuitive.

34 More generally, the recommendation is uniform intermediate taxation.

35 The general argument of *Atkinson and Stiglitz* (1976) has been adapted to this case by *Saez* (2002) and recently calibrated by *Golosov et al.* (2012).

36 *Saez* (2013) makes an important clarification though. A progressive capital income tax would only tax large incomes highly until they fall back to the tax-exempt bracket. This implies no infinite burden. Such capital taxes can have a place in an optimal tax system (even without the lump-sum redistribution of initial wealth).

It is still an empirical question whether capital accumulation responds to this distorted price. Long-term measurement is very difficult. *Piketty and Saez* (2012) rationalize capital taxes with expecting small responses in reality.

37 Or a progressive tax system entirely on labour can still be equivalent to such a system, if we can determine the fraction of returns to capital that depended on effort (like the profit of small enterprises being labour income). *Feldstein* (2012) argues against the tax on "consumed income" preferred by *Mirrlees et al.* (2011) with its more complicated accounting.

38 Equally for physical as well as human capital, it would be paramount to separate pure interest from returns to effort, both at times of investment and later. Effort generates original income and should be taxed by labour income taxes.

39 *Kopczuk* (2013) reviews inheritance and related taxes. *Piketty and Saez* (2012) discuss capital taxes justified as annuities on redistributed wealth that would compensate for the good or bad luck of more or less generous forebears.

40 Distinction not by need (e.g. sickness) or resources (e.g. income, wealth) but by some choice is often labeled paternalistic. For in-kind benefits, these are sometimes defensible as corrections of externalities or so-called internalities. It is an internality for example if the citizen, admitting his own frailty and ignorance, wishes to substitute for his self-control with mandatory savings of the pension system or compulsory schooling. For more detail on this, see *Bernheim* (2013) on the applications of behavioral economics to public economics.

Second, some other observable characteristics can simply help with the original inference problem: if other information (gender, age, or height) can make the inference from income to ability more precise, only practical reasons can justify their negligence.[41] The filtering problem can be improved in two different cases. First, if the observable factor drives changes in the ability distribution, e.g. the labour market values the skills of the middle-aged or tall people more highly. Second, if different preferences change how the same skills will be turned into earnings in different groups, e.g. mothers of young children, the elderly, or the disabled are more sensitive to income in giving up their leisure, and thus have a more elastic labour supply. This kind of *tagging* can be so efficient that the main question of this literature is why the state does not use it more.[42] Labour market effects can be seen as the mirror image of the same reasoning: without this optimal tagging, some people work too much, while others work too little.

Abilities also change sharply over one's career. This has been discussed more boldly in the literature, perhaps because most of us visit both the peaks and troughs sooner or later. The canonical model of optimal income taxation (*Mirrlees*, 1971) is static, and can at best correspond to taxing overall lifetime earnings differentially. But for the calibration of such a system, short-term measurements are misleading. Not only are measurements of such responses (thus elasticities, thus preferences) dubious, lifetime incomes are simply rarely collected; so they could not constitute a tax base in practice, nor could their distribution help calibrate an admittedly imperfect annual income tax system. Though it has been know since *Vickrey* (1939) that the current annual income tax system is not neutral in the timing of earned income (e.g. it underincentivizes work over shorter careers), this is a significant distortion even today: a time-neutral tax could have 11% less deadweight loss (*Liebman*, 2003). Moreover, savings can help to game the annual income tax system at older ages – or as a precaution, society is bound to design a weaker filter, a less efficient tax system. Meanwhile, earning abilities genuinely change over one's lifetime, and some insurance against career risks would surely be valuable.[43] Early retirement or disability insurance is already one form of this; its current forms though are ripe with perverse incentives.[44]

Among the most important proposals, *Farhi and Werning* (2011) approximate an optimal earnings history-dependent income tax system with one where labour taxes change with earnings and consumption (saving). Their important finding is that a simple age- (but still not history-) dependent labour and capital income tax scheme can be a fairly good approximation to the optimal system, while still offering significant welfare improvements over the current practice. Even more, the relatively high (optimal) capital taxes they derive have only second-order benefits relative to those of age-dependent correction of labour taxes. The biggest welfare gain relative to a simple tax system would come

41 The line continues with the income or wealth of family members, or age.

42 The moral reasoning for the absence of tagging have been translated into a transparent economic model by *Weinzierl* (2012). Here the political community also puts some weight on the principle of *equal sacrifice* (originating at least from John Stuart Mill), not only on utilitarianism, thence only the obviously informative tags implying significant productivity loss (disability, blindness, old age) will be used, weaker ones (height, gender, skin color) not. Without this, the standard utilitarian social welfare function would yield a so-called inverse Euler equation: all distinguishable groups should have their expected value of the reciprocals of marginal utility of consumption equalized – which is just the cost of increasing the utility of each group.

43 On the reasons and recommendations for dynamic taxes, see the review of *Diamond and Werning* (2013).

44 *Golosov and Tsyvinski* (2006) calculated significant welfare gains from means-tested disability benefits.

from an upward-sloping age profile of personal income tax rates. Though the authors of the *Mirrlees Review* would only tag because of different elasticities, an age-dependent tag is their only recommended complication too: an extra lower rate for the young and those before retirement in an otherwise simple (broad-based, low-rate) tax proposal (Chapters 3 and 4 of *Mirrlees et al*. 2011).

Finally, we need to mention an important spatial effect of taxation, the distortion of *amenity* levels and corresponding mobility rates and house prices (*Albouy*, 2009). Because income taxes are uniform in nominal income within a country, the local price level introduces differences in the real burden, which can be not only unjust, but also represent a costly distortion of real estate prices and residential choice.[45] What is more, uniform taxation of real earnings (some cost indexation) would not be a perfect solution either: it would not overtax productivity differences in space anymore, but undertax regions which are recognised as having lower real wages because of their more pleasant environment. *Albouy* (2009) calculates that the welfare losses of the current system can be as much as 0.23% of incomes; though it is questionable how relevant this calculation is for Hungary.[46]

## APPENDIX

### Hungarian databases used for empirical research

MÓNIKA BÁLINT

The state covers most of its expenses through the collection of taxes. Taxation changes the behaviour of economic actors (it has an impact on labour demand and supply, consumption and saving) and re-allocates income between different groups. The implications of changes in taxation and welfare provisions are complex: they are best quantified by empirical research using micro-level data. This chapter provides a brief overview of the characteristics of databases with individual-level data, their analytical possibilities, limitations and accessibility.

#### *Data from personal income tax returns, National Tax and Customs Administration*

According to the provisions of Act CXVII of 1995 on personal income, in Hungary individuals must declare their income to the tax authorities each year, using the form xx53.[47] The income tax database of the National Tax and Customs Administration (in Hungarian: Nemzeti Adó- és Vámhivatal, NAV, before 2010: Tax and Financial Control Administration, in Hungarian: Adó- és Pénzügyi Ellenőrzési Hivatal, APEH). includes information from tax return forms – in the same format – namely: personal identification (sex, date of birth, place of residence), total income (combined tax base), tax liability on

45 Free choice of residence is a key issue of urban public finance, reviewed by *Glaeser* (2013).

46 Albouy's US results might be hard to extrapolate to Hungary, due to larger mobility in the US. Yet with the wide range of urban and rural final goods and real estate prices, it still seems imaginable that the uniform nominal tax and benefit system generates mobility which significantly rearranges the labour market. And the tax treatment (exemption) of owner-occupied homes (the implicit rent) distorts housing demand, while building regulation affects housing supply: both distort real estate prices and mobility.

47 "xx" indicates the last two digits of the tax year for which the tax return was submitted.

the combined tax base, any deductions and allowances reducing tax liability on the combined tax base, other data, tax liability for the given year, calculation of public contributions (simplified contributions), any overpayment of health care or pension contributions, and special tax payments.[48]

The advantages of the database compared to survey-type databases is that it includes all tax payers – in this case 4.3–4.6 million people[49] – and therefore with the appropriate sampling techniques it is possible to obtain an unbiased sample. Using the tax and the social insurance numbers – which identify each individual tax payer – it is possible to create longitudinal datasets by integrating data from various tax years or even integrating different databases that use the same identification (such as contribution payments, family and other benefits etc.) (*Benedek*, 2008).

*Limitations, disadvantages.* The fact that the database is based on self-reported information and does not have any information on amendments by the taxpayer or amendments following an inspection by the NAV makes data cleaning for the study of behavioural implications more difficult and it might bias results when computing real income. A further limitation is that the tax return forms provide no information about the occupation or the industry of the tax ayer (only the self-employed are required to indicate this), and it is not possible to identify employment that lasted less than a year. Forms prior to 2008 did not include information about gender; the tax authority addressed this by adding a new variable that deducted gender using the first name (however this did not provide complete coverage). Another disadvantage of the database is that it does not show the real income of tax payers: it only includes taxable income that is reported to the authorities. Furthermore it does not provide information about the characteristics of families or households (*Benedek*, 2008).

*Access.* Before Act CI of 2007 (on access to data) personal income tax data was not easily accessible. Although the Ministry of Finance (in Hungarian: Pénzügyminisztérium, PM), as a supervisory body, usually had access to the requested information, nevertheless it was not possible to integrate the information with data from other sources (*Benedek*, 2008). However the Act strengthened the rights of those requesting data and it stipulated that data must be made available for impact assessment and research aimed at facilitating decision-making. In the case of databases covering the whole population, the maximum size of the sample can be one half of the total population and once information has become public data, it must be freely available to anyone. The dataset used by *Kiss and Mosberger* (2011) will soon be available from the National Info-communication Agency (in Hungarian: Nemzeti Infokommunikációs Szolgáltató Zrt., NISZ); however other datasets have not yet been turned into public data.

*Publications using the NAV database. Bakos, Benczúr and Benedek* (2008) examined the impact of average and marginal tax rates on the elasticity of in-

48 Based on the tax return form for 2011.
49 Source in Hungarian: *NAV*.

come – and in the same study – assessed the potential implications of the introduction of a flat-rate tax system. The study used a five per-cent sample of income tax returns submitted for the tax year 2004, and merged this with 2005 tax return information for each individual in the sample. *Kiss and Mosberger* (2011) assessed the impact of the "extraordinary tax" introduced in 2007 on the taxable income of high earners using income tax data from NAV: out of the total population of tax payers in 2005 they selected a 10% sample – excluding the self-employed – and integrated this with data from 2006–2008. *Benedek and Kiss* (2011) integrated a 10% random sample of income tax returns from 2008 with the Household Monitor Survey (in Hungarian: Háztartásmonitor-felvétel) of Tárki and used a microsimulation method to estimate the impact and cost of tax reform measures. *Benedek and Scharle* (2006), *Benedek and Lelkes* (2005) and *Ecostat* (2009) also applied microsimulation methods using income tax databases.

### *Household Budget and Living Conditions Survey, Hungarian Central Statistical Office*

The history of the Hungarian Central Statistical Office's Household Budget and Living Conditions Survey (in Hungarian: KSH Háztartási költségvetési és életkörülmények adatfelvétel, HKÉF)[50] goes back to many decades: until 1983 it was carried out on a yearly basis, then every odd year between 1983–1993, and again yearly since 1993. The HKÉF is a representative survey of Hungarian households and aims to provide information about – financial and in-kind – income and expenditure. Thus the survey provides a wide range of information about work, social and capital income, as well as the amount and value of goods and services consumed by households. However it has limited information about educational attainment, economic activity and even more limited information about savings, indebtedness and wealth. The datasets – depending on the year – contain information about 20–26 thousand individuals living in 7.5–10 thousand households. Data is collected using a retrospective interview and a diary or log method. Since 1993 approximately one third of the households in the sample is replaced each year (however in practice this does not always happen), therefore about one third or one fourth of the households remains in the survey for three years (*Molnár,* 2011).

*Limitations, disadvantages*. The survey does not include marginal groups (the homeless, the poorest and the richest) therefore the database in its "raw" form does not provide a complete and accurate picture of the whole income distribution. Some economic and social changes had negative implications for the validity of HKÉF, both in terms of response rates and underreporting of income and in some cases consumption. When working with the data, it must be taken into account that young people, Budapest residents, people with higher

50 Until recently KSH used the title Household Budget Survey (HBS in Hungarian: KSH Háztartási költségvetési adatfelvétel, HKF).

education, the economically active and the self-employed are under-represented in the sample. People of pension age, pensioners and the unemployed are over-represented (*Molnár,* 2011).

*Access.* Anonymous datasets can be obtained from the KSH for research purposes or accessed in the HCSO's research room[51] following registration and approval of the data request.

*Publications using the HKÉF. Cserháti et al.* (2007, 2009), and then *Benedek, Elek and Szabó* (2009) and *Benczúr et al.* (2011) used the database for microsimulation modelling. *Benczúr et al.* (2012) used it for a structural labour supply model.

### *Integration of databases managed by the Central Administration of National Pension Insurance, National Health Insurance Fund, the Hungarian State Treasury, and the National Labour Office (Ministry for National Economy; Institute of Economics, Research Centre for Economic and Regional Studies, Hungarian Academy of Sciences)*

The relevant data integration was initiated by the Ministry of Finance (in Hungarian: Pénzügyminisztérium; the predecessor of the Ministry for National Economy, in Hungarian: Nemzetgazdasági Minisztérium, NGM): a sample of 200,000 individuals was selected from the 2001 Population Census that included information on gender, age and place of residence, then using these parameters a random sample was selected from the Social Insurance Number database of the National Health Insurance Fund (in Hungarian: Országos Egészségpénztár, OEP). Then using anonymous codes data on the use of health services, sick leave and child care allowance[52] from the databases of the OEP, data on employment history, income and pension from the database of the Central Administration of National Pension Insurance (in Hungarian: Országos Nyugdíjbiztosítási Főigazgatóság, ONYF) and information on child care benefit,[53] maternity allowance[54] and child benefit were linked. The sample includes longitudinal data from 200,000 individuals for the period between 2000–2007 (*Elek et al.* 2008).

The Institute of Economics (the predecessor of the Research Centre for Economic and Regional Studies, in Hungarian: Közgazdaság- és Regionális Tudományi Kutatóközpont, KRTK) proposed the creation of a database that covered less information, however with a larger sample size than the database of the Ministry of Finance for research on labour market forecasting in 2010. The sample was selected by the OEP from the Social Insurance Number database using random sampling: the sample consisted of half of the total population aged between 15–74 years in 2002. The dataset created by the OEP contains demographic information, the code for health insurance status and its duration, duration of any benefits or services and their code for the period of

51 KSH research room.

52 This is a contribution-based maternity pay that can be claimed up to the second birthday of the child.

53 Contribution-based benefit paid for the first six months of the maternity leave.

54 This is a universal benefit that can be claimed up to the third birthday of the child.

2000–2009. The dataset from ONYF includes, in addition to demographic information, pension qualifying service (code and duration), any periods without contribution payment and occupation groups (in Hungarian: FEOR). Information from the job seekers' register of the National Labour Office (in Hungarian: Nemzeti Munkaügyi Hivatal, NMH) as well as data on unemployment assistance and information on family benefits (child care allowance etc.) and the number of children from the Hungarian State Treasury (in Hungarian: Magyar Államkincstár, MÁK) were integrated in the database.

*Limitations, disadvantages*. Research possibilities are limited by the fact that information on educational attainment is only available for the unemployed and the FEOR code (from which information on education could be inferred to some extent) is missing for people with certain status codes. The reliability of the databases is somewhat compromised by the fact that different datasets – or sometimes even the same dataset – provide inconsistent information about individuals, and these problems cannot always be resolved. A further uncertainty in the analysis is that the dataset of the OEP contains information about many insurance relationships that have already ended, but without information concerning their end date. Finally, the usability of the KRTK dataset is also limited by the fact that the sample has not been supplemented since its creation and it has no information about those aged under 15 or over 75 years.

A disadvantage of the KRTK dataset compared to the dataset of the Ministry of Finance is that while the latter had information about the children for whom family benefits were claimed, the KRTK dataset computed the number of children from eligibility for child benefit at a given time point that is not reliable due to the algorithm used. The OEP databases have only included all people claiming contribution-based maternity allowances since after 2006.

Finally, the possibility of the renewal of datasets is limited by the law: it is not possible to link additional data to anonymous dataset, therefore to extend data longitudinally sampling and the resource-intensive data cleaning must be repeated.

*Access*. The Ministry of Finance's database can be accessed through the Ministry for National Economy, the successor of the Ministry of Finance. In order to access the database approval must be obtained from the head of the Department for Macroeconomy in the State Secretariat for Taxation and Financial Policy Affairs. The "raw" KRTK database can be accessed by anyone through the National Info-communication Agency. The cleaned version is available from the Data Bank of KRTK – as a general rule for collaborative research projects with KRTK staff and upon approval by the director of the Data Bank.

*Publications using institutional databases and areas for future research*. The aim of the creation of the Ministry of Finance's database was to assess the targeting of social insurance assistance. Moreover – due to its panel structure

which provides longitudinal information about individuals over a period of 6–8 years – it is also suitable for the analysis of the flow between different labour market statuses, eligibility for different assistance and their relationship (*Scharle,* 2008). Furthermore, information about the total taxable income also makes it suitable for the analysis of income distribution and trends in individuals' wages. Compared to other administrative databases, the main advantage of the ONYF database is that it not only provides information about people who have worked for at least one day regardless of the duration of the total employment period; however, information about the duration of employment also allows the computation of the average number of people in employment on any given day.

Comparing the data of those employed lawfully with population surveys – using a discrepancy method – it is possible to estimate the prevalence and characteristics of grey and black employment (see for example: *Augusztinovics and Köllő,* 2007, and *Chapter 6*). In addition the KRTK database, due to its large size, is especially suitable for the selection and analysis of smaller sub-samples (for example to study the impact of the duration of labour market statuses on income/transfers).

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## 2. THE ELASTICITY OF TAXABLE INCOME

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The goal of this chapter is threefold. First, it surveys the relevant international literature, focusing on its most policy relevant aspects. Second, it reviews the results of two previous estimations of the elasticity of taxable income using Hungarian data (*Bakos et al.* 2008, *Kiss and Mosberger,* 2011). Finally, it investigates how the estimated elasticities can be used in simulations of the "optimal tax system".

### The state of the international literature

#### *The original literature*

The literature on the elasticity of taxable income was initiated by the seminal paper of *Feldstein* (1995) analyzing the 1986 US tax reform. *Saez et al.* (2012) provide a review of the development of the literature. The elasticity of taxable income is the parameter that quantifies by how much an individual's taxable income increases if their marginal net-of-tax rate (their "tax price" or 1 *minus* the marginal tax rate) increases by one percent. While Feldstein's results suggested that this parameter can exceed one, later works like that by *Gruber and Saez* (2002) suggest that the elasticity is most likely to be around 0.4 for the United States. It is worth noting that calculations by *Kiss and Mosberger* (2011) suggest that an elasticity of 0.4 in Hungary would imply that an increase in the actual top personal income tax rate in 2010 would have resulted in decreased tax revenue, that is, Hungary would have been on the "wrong side" of the Laffer curve.

The major part of the literature, following *Feldstein* (1995), uses variants of the "difference-in-differences" method to estimate the elasticity of taxable income. His study was the first to use anonymous individual income tax returns to analyse whether the taxable income of groups who experienced the most significant tax cut grew at the highest rate. The methodology saw improvements in proportion to the quantity and quality of available data: *Auten and Carroll* (1999), and *Gruber and Saez* (2002) conducted a regression analysis comparing individuals rather than raw group means, and were able to control for demographic characteristics of individual taxpayers. Still, their method, like Feldstein's, is based on the difference-in-differences methodology focused on whether taxpayers who are affected differently by the tax reform also show a differential response.

The difference-in-differences method would work ideally in an experimental setup: in that case, the researcher would divide the sample randomly into a treated group and a control group in a way that the two groups are perfectly indistinguishable from each other before treatment. When assessing tax reforms we can almost never reach this ideal setup because the tax system always differentiates between taxpayers based on observable criteria.

When, for instance, the researcher estimates the effects of the introduction of a new tax bracket by comparing the change of the behaviour of taxpayers above and below the relevant income threshold, one can raise the criticism that taxpayers in both groups behave differently simply due to their original income differences: the group above the threshold behaves differently because they had a higher income in the first place. The literature formulates this criticism in terms of two econometric issues. The first issue is "regression to the mean", which is thought to affect mostly taxpayers with very high (or very low) income. In every year, some of the high-income individuals are just experiencing a one-time windfall, which is most likely be followed by a decrease in income in the following year. It is possible that the income growth of two income groups differ only because of this phenomenon and not because of the different tax changes affecting them. The second econometric issue (having the opposite effect) occurs if the income distribution becomes more dispersed due to the nature of economic-technological developments and we wrongly attribute this development to a tax reform. The literature, following *Auten and Carroll* (1999) and *Gruber and Saez* (2002), deals with this problem by including (log) initial income (i.e., taxable income in the period before the tax change) as a control variable in the regression explaining income growth. This method, at least in principle, properly deals with gradual changes in the income distribution as well as gradual differences between groups related to the phenomenon of regression to the mean.

There is another reason why the analysis of tax reforms does not conform to the ideal experimental setup: individuals can switch from the control group to the treated group, and vice versa, as a consequence of their decisions or chance. This happens if a low-income tax payer becomes a high-income taxpayer (or the other way round) independently from the changes in the tax code. Such events are common as taxpayers get promoted, switch jobs, move, or experience other changes in their work conditions due to reasons unrelated to tax reforms. These switches between the treated and control groups introduce a bias into the estimation procedure. If an individual's income increases and, due to this fact, a higher tax rate applies to them, then we may wrongly conclude that their income increased *as a consequence* of the higher tax rate. The literature solves this so-called "reverse-causality problem" by using the instrumental-variable (IV) estimation procedure. The instruments are constructed by applying the after-change tax rules to the individual's original income (inflated by the av-

erage wage growth). This tax rate, based on the so called "synthetic income", is only dependent on the changes of the tax system and not on the taxpayers' random income fluctuations or decisions.

Although the literature – including the two studies on Hungary we present in detail – typically uses the difference-in-differences estimation method, it is worth breafly summarizing a second method that employs a different strategy. (A third type of strategy which uses "kink points" and "notches" of the tax function to identify the elasticity will be discussed later on in the chapter.) This second estimation methodology is based on the simple statistic of the share of total income earned by the top one (or five) percent of taxpayers. If this statistic is available for a long time period then it can be related to the marginal tax rate of top earners during this period. In the United States, for example, the top one percent earned an almost constant 8 percent of total income during the period before 1980. The income share of the top one percent started to increase during the period of two tax reforms that decreased the marginal tax rates for top earners during the Reagan administration to reach 12 percent of total income by 1990. This, as *Saez et al.* (2012, p. 19) highlight, is an indirect, but quite persuasive argument for the existence and significance of the taxable income elasticity.

Studies using this methodology cannot ignore the question of how the top income share would have evolved if the tax system had remained unchanged. The importance of this question can be well illustrated with an example from the US: top marginal tax rates were increased during the Clinton administration but top income shares continued to climb in the 1990's following a temporary drop, reaching 16 percent in 2000. *Saez et al.* (2012) show that the method of controlling for the time trend significantly affects the estimated elasticity: the time-series method, without controlling for the trend, gives a parameter estimate of 1.7 while the estimate is only 0.6–0.8 when the trend is controlled for.

*Saez and Veall* (2005) obtain a high elasticity parameter (0.8–1) by applying the same time series method to eight decades of Canadian data. The interesting result of the paper is that they obtain a much lower elasticity (approx. 0.3–0.5) when they include as an explanatory variable the top income share in the United States. According to the authors it is possible that the surge in top incomes in Canada in the last decades of the 20$^{th}$ century was influenced by similar developments in the US, due to the threat of the brain drain: firms may have had to offer higher wages in some specific occupations in Canada to prevent workers from taking up work in the US.

Another version of the top income share method gives a different answer to the question of what benchmark the growth in the top income share can be compared to. *Brewer et al.* (2008) analyse the development of top income shares and its relationship with tax changes on four decades of British data. Their study compares the income share of the top one percent to the income

share of the next four percent (taxpayers belonging to the 95th to 99th percentiles) taking into account the respective tax rates of both groups. The estimated elasticity is 0.46 (approximately one-third lower than estimated without a control group). This method is accurate only if we can assume that the income share of the top one percent and the next four would have increased at an equal rate absent any tax changes. If technological change favoured the top one percent compared to the other high earners, then the estimation will be biased upwards *(Saez et al.* 2012).

*Other countries*

Following the seminal papers analyzing US data, a large number of estimations have been conducted on other countries. In most countries the estimated elasticity of taxable income is lower compared to the parameter estimated for the United States. Most economists think this is due to differences between the tax systems rather than differences in preferences or behaviour between countries.

The argument that the elasticity of taxable income is a function of the tax system and, in particular, the definition of the tax base, has been theoretically established by *Slemrod and Kopczuk* (2002), and was empirically supported by *Kopczuk* (2005) in his analysis of US tax reforms. If there are many types of deductions in the tax system, then taxpayers have many opportunities to influence their tax base – either through an adjustment in real activities or through relabeling unchanged activities. In this case we will find a high estimated taxable-income elasticity parameter. As *Slemrod and Kopczuk* (2002) highlight, this manipulation of the tax base is a social waste since it is unproductive. This means that, in general terms, a tax system with fewer deductions and exceptions to its tax base (i.e., a tax system with a "broader" tax base) is less distortive and is therefore better for social welfare.

International studies give support to this assumed relationship between the tax system and the elasticity of taxable income. There are relatively many types of deductions in the German tax system. The only existing estimate of the elasticity of taxable income on German data (*Gottfried and Witczak,* 2009) finds a relatively high taxable income elasticity (between 0.4 and 1, depending on the specification). But most studies on other countries obtain an estimated elasticity parameter between 0 and 0.3. For example in a recent study on Danish data, *Kleven and Schultz* (2012) estimate an elasticity of 0.05 for wage income and 0.01 for the income of the self-employed. In Denmark the tax base is very broad, the possibility of tax base allowances and deductions is restricted, and double income reporting is widespread (both employers and banks report the individuals' income to tax authorities). This interpretation is supported by the fact that US studies find that broader definitions of income (e.g., before deductions) react less sensitively to tax rates than taxable income. *Gruber and Saez*

(2002), for example, estimated the elasticity of taxable income to be about 0.4, while they found an elasticity of about 0.1 for a broader concept of income.

Further patterns can be deduced from the international literature. The estimated elasticities may, for example, differ between different groups. According to a few studies the income elasticity is higher for those groups who have more possibilities to shift their income either between time periods or income sources (entrepreneurs, high income individuals). This is supported by estimations of *Sillamaa and Veall* (2001) on Canadian data, *Pirttilä and Selin* (2011) on Finnish data and *Ljunge and Ragan* (2004) on Swedish data. Another study on Swedish data, *Blomquist and Selin* (2010) provides estimates separately for men and women. They can observe not only the taxpayers' annual income, but also their hourly wage. According to their estimates the hourly wage elasticity of males is around 0.15, while it is around 0.5 for women. When the authors analyse the elasticity of wage income, the income elasticity of males is around 0.2, while it is above 1 for women.

The estimated elasticity may also depend on the time horizon of the analysis. On the one hand it is possible that the adjustment of taxpayers takes time. On the other hand, it is also possible that taxpayers merely shift the timing of some of their activities: in this case there is a short-run elasticity but the real long-run effect is zero. *Holmlund and Söderström* (2007) use Swedish tax rate changes from 1995 and 1999 to differentiate between the short and long run elasticities by including the tax rate changes of the current year and the previous year as control variables. While the estimated coefficient of the current tax change is not significantly different from zero, the effect of the previous year's changes is between 0.22–0.32, suggesting that the long run elasticity is higher than the immediate one. *Giertz* (2010) obtained similar results, while *Heim* (2009) found only short run elasticities. However, the results should be interpreted with caution, because – mainly due to the way of controlling for the initial income – they are typically sensitive to the specification (*Saez et al.* 2012).

Finally, the magnitude of the estimated elasticity may depend on the extent of the tax reform. According to *Kleven and Schultz* (2012) the estimated elasticity is larger in the case of larger tax reforms, probably because smaller tax changes go unnoticed by many taxpayers, and also because there is more to be gained by adjusting optimally to a larger tax change. Taxpayers' inattention or adjustment costs may thus create frictions in the adjustment process. The availability of tax return data encompassing a quarter of a century makes it possible for Kleven and Schultz to compare the effects of large and small tax reforms. The estimated elasticities support the theoretical predictions: the estimated elasticity of wage income is 0.12 for the 1980's, while for the 1990's – the period of smaller tax changes – the same elasticity parameter is only 0.02. If the decision-friction assumption is correct, then the effect of the larger tax reforms is closer to the actual long-run taxable-income elasticity.

### *Decision frictions and mistakes*

A recent strand of the literature devotes special attention taxpayers' (either rational or irrational) inattention and mistakes. This line of research promises to reconcile two conflicting notions, both of which are persuasive in their own right: on the one hand, economists think that taxpayers in general do react to material incentives, while on the other hand most taxpayers do not make time-consuming calculations in order to re-optimize their taxable income to new tax regulations each year. This may have two reasons: lack of information and lack of control. On the one hand, not all taxpayers know important details of the tax system (most people probably do not know even their marginal or average tax rate). But even if all taxpayers had all the information, the majority would not have total control over their taxable income and its composition.

The so called kinks and notches of the tax function provide a great opportunity to analyse the behavioural patterns behind the estimated elasticities. Kinks of the tax function – and the taxpayer's budget line – appear when the taxpayer's marginal tax rate changes at a given income level. Rarer in modern tax systems are notches: income levels at which there are discrete jumps in the tax payable. *Saez* (2010) made an early attempt to identify the taxable-income elasticity from the "bunching" of taxpayers at kink points of the tax function. The more taxpayers bunch at kink points, the more optimizing taxpayers there are and the higher is the elasticity. The results show a relatively limited bunching behaviour of taxpayers, suggesting a lower elasticity than that which researchers find when analyzing tax reforms. The result is consistent with the concept that taxpayers do not consider the kinks of the tax function as important enough to pay attention to them.

Probably *Kleven and Waseem* (2013) are the first to have analysed taxpayer behaviour at notches of the income tax function. They exploit a rare feature of the tax system of Pakistan: when an individual passes the threshold of a higher tax bracket, their new tax rate is not only applied to income above the threshold but to their total income. This means that at each bracket threshold the *average* tax rate of taxpayers increases; thus at each threshold, the net income of an individual is reduced. Notches create a strong incentive for taxpayers to remain just below the next bracket threshold. Accordingly, tax return data from Pakistan reveals more significant bunching below the thresholds than is observed below kink points in other countries. At the same time the proportion of taxpayers who could increase their net income by reducing their gross income is not negligible. Their presence suggests that there are several taxpayers who are not, or at least not in every year, able to optimize their taxable income according to the tax system.

There are several factors that may hamper the adjustment of taxpayers. According to *Chetty et al.* (2010), optimal behavioural responses to tax changes are hampered, among other things, by the costs related to switching jobs, and restrictions on working time set by employers. They find support for this hypothesis on Danish data. Besides these factors, lack of information may also induce frictions as not all taxpayers are aware of the opportunities offered by the tax system. Based on an experiment involving tens of thousands of individuals in the US, *Chetty and Saez* (2012) showed that those who received advice from consultants on their tax declaration took advantage of more deductions than their counterparts who received no such advice. *Chetty et al.* (2012) find that even the location of residence of taxpayers might affect the extent of their tax optimization behaviour. The authors detected significant territorial differences in the bunching density at the kink points of the tax function which appears to be related to how well-informed taxpayers are in different geographic areas about the details of the US Earned Income Tax Credit (EITC). The authors find that the tax deductions of those people who moved from a "less informed" area to a "more informed" one increase, while in the reverse case the claimed amount of deductions does not decrease. This lends further support to the explanation that the effects are generated by the changes in the taxpayers' knowledge.

The study of decision frictions and mistakes is a relatively new area in the analysis of the effects of taxation which makes it difficult to draw final conclusions. The field promises to help us understand what kind of behavioural patterns are really behind the estimated aggregate elasticities. This can help us give better forecasts about the effects of tax reforms (better understanding the difference between short-run and long-run effects), but also to learn more about the welfare effects of taxation.

### *What is behind the elasticity?*

One of the most important questions in the study of the taxable-income elasticity is what behavioural responses are behind the estimated elasticities: to what extent can the results be explained by real labour supply adjustment, and to what extent can they be explained by tax optimization or tax avoidance? Here we review the literature of other countries; we will revisit the question in the next section which discusses existing estimation results for Hungary.

Before the appearance of the literature on the taxable-income elasticity the focus of researchers was on whether tax changes affect the working hours of individuals. These studies found that men's working hours do not react very sensitively to tax changes, while women's labour market participation and working hours react slightly more sensitively (*Feldstein,* 2002, *Meghir and Phillips,* 2010). *Moffitt and Wilhelm* (1998) found that even though high-income men's working hours are inelastic, their total earnings do react to tax reforms, suggest-

ing that real labour supply changes may have occurred either in non-reported overtime, or in other aspects of work effort that are even harder to measure.

Another strand of the literature showed that dramatic changes in reported income were specifically due to tax optimization. *Goolsbee* (2000), for example, showed that the behavioural effect of the 1993 US tax increase on high incomes was mainly due to the fact that executives exercised more of their stock options right before the tax rate increase. In this case, a significant part of the behavioural response did not have to do with the adjustment of labour supply.

Taking into consideration the results from other countries we may conclude that, although tax optimization does play an important role in some cases, the overall evidence does not support a view that labour supply adjustment does not play a part in the estimated elasticities. On the contrary, the more moderate estimates of the taxable income elasticity are not much higher than estimates of the elasticity of working hours to tax changes. These in turn may underestimate labour supply adjustment as they do not take into account the changes in work effort.

## Results from estimations for Hungary

This section presents re-estimated results of the study of Péter Bakos, Péter Benczúr and Dóra Benedek (*Bakos et al.* 2008; henceforth BBB) and the results of the study by Áron Kiss and Pálma Mosberger (*Kiss and Mosberger,* 2011; henceforth KM). First, we briefly review the data and tax reforms used by both studies. We also investigate in detail how the studies identify the estimated effects. Then we survey the results in three respects. First, we discuss what control variables should be included in the regressions. Here we will focus on initial income (to treat the mean-reversion problem), the average tax rate (to control for the income effect) and demographic characteristics (to control for the different income trends of specific taxpayer groups). Second, we discuss how the elasticity of taxable income depends on the income level. Finally, we turn to the question of to what extent we may consider the estimated elasticities as reflections of labour supply adjustment.

### *Data and tax reform episodes*

Both studies use samples of individual tax return panel data compiled by the tax authority (APEH at the time of the research, NAV today). The data set was originally prepared for the Ministry of Finance, but was also used by the Office of the Fiscal Council. The database contains data from the tax return form xx53 for the respective years (as before inspection). The anonymous random samples were selected by the tax authority as follows. For the BBB study a sample of 250,000 individuals was selected from 2004 data (approximately 5 percent of all taxpayers), and then the 2005 data was added for the same individuals. For the KM study a 10 percent sample was selected from 2005 data

and tax files for the same individuals for three subsequent years were added. Sample attrition is a common phenomenon in similar analyses. In our case it is not significant because a significant part of the inactive population files a tax return either because they work for some months or because some of the social benefits they receive are taxable (e.g., some unemployment and maternity benefits).

The 2004–2005 tax reform reduced the number of tax brackets from three to two, increased the employee tax credit, raised the pension contribution ceiling, and introduced income dependent phase-out regions for some tax credits, raising marginal tax rates for those in the phase-out regions. These generated significant changes at all income levels both in the marginal and in the average tax rates; this allowed the authors of the BBB paper to obtain relatively precise estimates for a wide range of income.

The difference-in-differences estimation strategy identifies the effect of the marginal tax rate based on tax changes that affect the tax rates of similar taxpayers differently; in the language of econometrics, this difference in the "treatment" of different individuals is called exogenous variation. Changes in the income of individuals that are unexplained by observables also result in the change of tax rates, but this constitutes endogenous variation. Tax reform episodes, in turn, induce changes in the tax rates of individuals that are not due to their behaviour, thus providing exogenous variation.

In 2005, such exogenous variation at lower income levels (up to 2.5 times the annual minimum wage – thus including about 60 percent of income earners) was provided by the elimination of the middle tax bracket and the phenomenon of bracket creep.[1] In the top 40 percent of the income distribution the main source of exogenous variation is the bracket creep; but the changes regarding the phase-out rules of tax credits also caused variation in the tax rates.[2] The phase-out of various tax credits introduce a variation in the tax rates across individuals which is independent of initial income, thus allowing a separate identification of the effect of the marginal and average tax rate as well as that of initial income. Additionally, both the employee tax credit and other tax credits were phased out as a function of "total annual income", an income definition that is broader than "taxable income" by also including (among others) capital income. This provides further variation in the change of tax rates that is not perfectly correlated with initial taxable income.

Focusing on the top 20 percent of the income distribution (annual taxable income of HUF 2 million and above), the only tax changes causing exogenous variation in the tax rates in 2005 were the increase of the pension contribution ceiling (from HUF 5.307 million to 6.6 million), the introduction of a phase-out range for the child tax credit starting at HUF 8 million, and the introduction of a phase-out range for a number of other tax credits at HUF 6 million. The fact that tax credits were phased out as a function of total income

1 Failing to index bracket thresholds by inflation pushes taxpayers into higher tax brackets.

2 Tax credits can be fully taken advantage of up to a given income threshold, above which they are gradually withdrawn. The effective marginal tax rate increases typically by 10–20 percentage points for individuals in the phase-out range.

(i.e., taxable income plus capital income) does not seem to have a big impact on tax rates. At the same time, if these phase-out ranges are not indexed to inflation, they also affect marginal tax rates in a similar way as the bracket creep; and it is precisely this phenomenon that contributes the most to the identifying variation in tax rates. It should be noted that a more precise accounting for these phase-out regions (mostly in the income range HUF 2–3 million) made a re-estimation of the BBB results necessary.

KM analyse the effects of tax changes between 2005 and 2008 (and, as a robustness check, between 2005 and 2007). The paper does not analyse the whole income distribution, but rather focuses on high income earners, estimating the effects of the so called "extraordinary tax" of individuals, introduced in 2007. The extraordinary tax increased marginal tax rates of the top five percent of earners by four percentage points. In this income range most income-dependent phase-outs are not relevant; most of the identifying variation comes from the change of the extraordinary tax.

*Results*

In the following we review the main results of the BBB and KM studies, first focusing on how robust the results are to controlling for initial income and other control variables, then on the sign and magnitude of the parameter of the average net-of-tax rate (1 minus the average tax rate). The first issue is relevant primarily from a theoretical point of view, while the second has direct tax policy relevance. A negative and statistically significant effect suggests the presence of the income effect: an increase of the average tax rate would lead to a higher activity of income generation as taxpayers seek to restore their previous (net) income position. This means that the total effect of a tax reform that simultaneously decreases the average and marginal tax rates does not necessarily stimulate the generation of income. If however the sign of the parameter is positive, it may be a symptom of a labour market participation effect (some individuals may work more months in a year, or switch from part time to full time employment as a response to a cut in the average tax rate) or an improvement in tax compliance.

We present the estimated parameters of three variables: the marginal tax rate, the average tax rate and log initial income. The regression diagnostics are in all cases "perfect", therefore we will not present them in the tables (F-statistics of the first stage, under-identification and week identification tests, etc.).

*Table 2.1* presents the original and the re-estimated BBB results for the whole sample of individuals earning more than the minimum wage. The tax price coefficient (i.e., the coefficient of the change in 1 *minus* the marginal tax rate) is in all specifications significant and, depending on the control variables included, between 0.0494–0.0744 (original results), and between 0.0301–0.0567 (re-estimated). This estimation range is lower than most estimates in other coun-

tries. The coefficient of initial income is very significant, and including it in the estimation decreases the tax-price elasticity by one third, while including the income effect and further control variables only affects the tax-price elasticity to a small degree. The income effect is positive (and mostly significant) in columns (2) and (3), while it becomes negative (and insignificant in the original results) in the specification treating income changes in the most flexible way – see in column (4).

**Table 2.1: Results of BBB (2008) for the whole sample with income above the minimum wage (HUF 636,000)**

| Δlog(taxable income) | (1) | | (2) | | (3) | | (4) | |
|---|---|---|---|---|---|---|---|---|
| | original | re-estimate | original | re-estimate | original | re-estimate | original | re-estimate |
| Δlog(1 – MTR) | 0.0744** | 0.0567** | 0.0501** | 0.0305** | 0.0494** | 0.0301** | 0.0648** | 0.0362** |
| | (0.0113) | (0.0111) | (0.0113) | (0.0111) | (0.0115) | (0.0113) | (0.0162) | (0.0159) |
| Δlog(1 – ATR) | -0.0187 | -0.0761 | 0.145** | 0.0773 | 0.340** | 0.266** | -0.0673 | -0.140** |
| | (0.0570) | (0.0551) | (0.0637) | (0.0612) | (0.0670) | (0.0642) | (0.0646) | (0.0613) |
| log(initial income) | | | -0.0252** | -0.0245** | -0.0311** | -0.0300** | | |
| | | | (0.00248) | (0.00245) | (0.00276) | (0.00272) | | |
| N | 146,676 | | | | | | | |

Note: The regressions contain the following control variables: Column (1): only the marginal (MTR) and average (ATR) tax rates; in column (2) log initial income is added; in column (3) other individual characteristics are added; the specification reported in column (4) allows the constant and the coefficient of initial income to vary across income deciles. Standard errors are reported in parentheses.
*** Significant at the 1% level; ** 5% level * 10% level.
Source: *Bakos et al.* (2008) and own calculations on the *BBB* data.

*Table 2.2* presents the results of the same specifications on a sample restricted to higher-income taxpayers (HUF 2 million and above in the original BBB analysis, while the threshold is HUF 1.95 million in the re-estimated results because this is the income level where tax credits are fully phased out).

The originally high estimated coefficient of the marginal tax rate in the BBB analysis has been revised downward substantially by the re-estimation, with the level of significance also decreasing. As presented below, still for a sample earning HUF 3–5 million the estimated elasticity is about 0.1 and statistically significant, although it would be even higher in the original BBB estimation. This is not surprising in light of the discussion of the exogenous variation in the data above: there is minimal variation in the tax rates in the income range of HUF 2–3 million. At the same time, the mortgage tax cut is phased out in the income range of HUF 3–5 million, allowing for a more precise identification (this income range was most affected by the recalculation of tax rates as compared to the original estimations).

Controlling for initial income proves to be crucial: it reduces the coefficient of the marginal tax rate substantially, while the coefficient of the average tax

rate changes its sign. The other control variables did not significantly affect the results. Based on the re-estimated results the uncompensated elasticity appears to be negative rather than positive, though the estimate of the income effect is relatively imprecise.

**Table 2.2: Results of BBB (2008) for a higher income sample (HUF 1.95 million and above)**

| Δlog(taxable income) | (1) | | (2) | | (3) | | (4) | |
|---|---|---|---|---|---|---|---|---|
| | original | re-estimate | original | re-estimate | original | re-estimate | original | re-estimate |
| Δlog(1 – MTR) | 0.434** | 0.104* | 0.267** | 0.0491 | 0.288** | 0.0600 | 0.341** | 0.0739 |
| | (0.0567) | (0.0539) | (0.0466) | (0.0439) | (0.0499) | (0.0463) | (0.0572) | (0.0500) |
| Δlog(1 – ATR) | 0.377** | 0.214** | -0.649** | -0.803** | -0.392** | -0.586** | -0.285** | -0.520** |
| | (0.118) | (0.103) | (0.100) | (0.0871) | (0.113) | (0.0958) | (0.115) | (0.0941) |
| log(initial income) | | | -0.0864** | -0.0893** | -0.0801** | -0.0838** | | |
| | | | (0.00620) | (0.00603) | (0.00656) | (0.00634) | | |
| N | 43,733 | | | | | | | |

Note: The regressions contain the following control variables: Column (1): only the marginal (MTR) and average (ATR) tax rates; in column (2) log initial income is added; in column (3) other individual characteristics are added; the specification reported in column (4) allows the constant and the coefficient of initial income to vary across income deciles. Standard errors are reported in parentheses.
*** Significant at the 1% level; ** 5% level * 10% level.
Source: *Bakos et al.* (2008) and own calculations on the *BBB* data.

Initial income and other control variables play a less relevant role in the KM estimation *(Table 2.3)*. The coefficient of the marginal tax rate is robustly around 0.15–0.2; the statistical significance of the average tax rate however is not robust to the specification (for details see KM).

**Table 2.3: Results of KM (2011) for individuals with initial income of HUF 5–8 million**

| Δlog(taxable income) | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Δlog(1 – MTR) | 0.159** | 0.155** | 0.165** | 0.198** |
| | (0.066) | (0.069) | (0.063) | (0.063) |
| Δlog(1 – ATR) | | | -0.545* | -0.557* |
| | | | (0.313) | (0.328) |
| log(initial income) | | -0.027 | -0.023 | -0.009 |
| | | (0.054) | (0.050) | (0.050) |
| N | 6900 | | | |

Note: The regressions contain the following control variables: Column (1): only the marginal (MTR) tax rate; in column (2) log initial income is added; in column (3) the average tax rate is added; the specification reported in column (4) includes further individual characteristics. Standard errors are reported in parentheses.
*** Significant at the 1% level; ** 5% level * 10% level.
Source: *Kiss and Mosberger* (2011).

*How does the elasticity of taxable income depend on income?*

*Table 2.4* reports the elasticities estimated on the whole sample above the minimum wage (Column 1–2), and separately for two subgroups comprising the bottom 80 percent of the sample (Column 3–6). On the full sample the coefficient of the marginal tax rate is relatively low, but significant; while the coefficient of the average tax rate is negative, and is weakly statistically significant in the re-estimated results. In the sample including individuals with income between the minimum wage and the start of the phase-out range of the employee tax credit (columns 3 and 4), the effect of the marginal tax rate is virtually zero, while the coefficient of the average tax rate is positive.

**Table 2.4: Estimated elasticities for various income groups, I**

| Δlog(taxable income) | HUF 636,000 and above | | HUF 636,000–1.5 million | | HUF 1.5–1.95 million | |
|---|---|---|---|---|---|---|
| | original | re-estimate | original | re-estimate | original | re-estimate |
| Δlog(1 – MTR) | 0.0648** | 0.0362* | 0.00715 | 0.00828 | 0.128** | 0.124** |
| | (0.0162) | (0.0159) | (0.0223) | (0.0223) | (0.0536) | (0.0531) |
| Δlog(1 – ATR) | –0.0673 | –0.140* | 0.236** | 0.225** | –0.231* | –0.235** |
| | (0.0646) | (0.0613) | (0.103) | (0.102) | (0.119) | (0.118) |
| N | 146,676 | 146,676 | 80,639 | 80,639 | 22,304 | 22,304 |

Note: Regressions include all individual control variables. Columns report estimations for different samples based on initial annual income. Standard errors are reported in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

Source: *Bakos et al.* (2008) and own calculations on the *BBB* data.

A positive coefficient on the average tax rate could be a symptom of labour supply adjustment at the extensive margin (see *Chapter 3* of this *In Focus – I*) or an improvement in tax compliance. In columns 5–6, where we report estimates for taxpayers in an income range that corresponds to the phase out of the employee tax credit, we can see a significantly positive coefficient of the marginal tax rate of 0.12, and a significantly negative estimated coefficient of the average tax rate (income effect), larger in absolute value, although estimated with less precision. This result is important in the assessment of the employee tax credit: moving the phase-out region to a lower income range could have a smaller marginal disincentive effect and could even stimulate activity through the income effect. (A full-fledged welfare analysis would have to take into account the reduced leisure of those affected, which would make the welfare assessment less clear-cut).

Results for higher income levels (approximately the top 20 percent of the income distribution) are reported in *Table 2.5*. Compared to the original BBB results the re-estimation suggests a lower (and therefore usually statistically less significant) coefficient of the marginal tax rate, and a more negative (but not always statistically significant) coefficient of the average tax rate. The es-

timation in the sample above HUF 1.95 million is imprecise, but we find a significant elasticity of around 0.1 for the sample including taxpayers with an initial income of HUF 3–5 million. There is not enough variation in the tax rate changes of the full sample above HUF 3 million to precisely estimate the coefficients of the marginal and the average tax rate simultaneously. Finally, the elasticity of taxable income is estimated to be about 0.2 for individuals with an income of HUF 5–8 million in the study by KM. They also find a negative, significant, but unstable income effect.

**Table 2.5: Estimated elasticities for various income groups, II**

| Δlog(taxable income) | HUF 1.95 and above | | HUF 3–5 million | | HUF 3 million and above | | HUF 5 million and above | | KM (5–8) |
|---|---|---|---|---|---|---|---|---|---|
| | original | re-estimate | original | re-estimate | original | re-estimate | original | re-estimate | |
| Δlog(1 – MTR) | 0.341** | 0.0739 | 0.741** | 0.0969* | 0.447** | 0.446 | –0.108 | –0.108 | 0.198** |
| | (0.0572) | (0.0500) | (0.153) | (0.0577) | (0.0855) | (0.321) | (0.428) | (0.428) | (0.063) |
| Δlog(1 – ATR) | –0.285* | –0.520** | 1.802* | –0.0760 | 0.123 | –1.268** | –1.932** | –1.932** | –0.557* |
| | (0.115) | (0.0941) | (0.813) | (0.317) | (0.391) | (0.423) | (0.408) | (0.408) | (0.328) |
| N | 43,733 | 43,733 | 12,753 | 12,753 | 19,080 | 19,080 | 6,327 | 6,327 | 6,900 |

Note: Regressions include all individual control variables. Columns report estimations for different samples based on initial annual income. Standard errors are reported in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

Source: *Bakos et al.* (2008) and own calculations on the *BBB* data (columns 1–8); Kiss and Mosberger (2011) for column 9.

### *Do estimated elasticities reflect adjustment in labour supply?*

In the following we review the results of three exercises aiming to reveal more about the adjustment channels behind the estimated elasticities. *Table 2.6* presents the results of the first analysis, where we split the BBB database into groups based on whether the taxpayer claimed cost deductions or not.

**Table 2.6: Estimated elasticities for taxpayers with and without cost deductions**

| Δlog(taxable income) | HUF 636,000–1.95 million | | | HUF 1.95 million and above | | | HUF 3–5 million | | |
|---|---|---|---|---|---|---|---|---|---|
| | all | no | yes | all | no | yes | all | no | yes |
| Δlog(1 – MTR) | 0.047** | 0.0495* | 0.0320 | 0.0739 | 0.0256 | 0.151* | 0.0969* | –0.00639 | 0.208** |
| | (0.018) | (0.0196) | (0.0497) | (0.0500) | (0.0679) | (0.070) | (0.0577) | (0.0844) | (0.0726) |
| Δlog(1 – ATR) | 0.064 | 0.0272 | 0.255 | –0.520** | –0.460** | –0.630** | –0.0760 | 0.261 | –0.562 |
| | (0.079) | (0.0821) | (0.240) | (0.0941) | (0.112) | (0.173) | (0.317) | (0.462) | (0.398) |
| N | 102,943 | 91,288 | 11,655 | 43,733 | 30,346 | 13,387 | 12,753 | 8,254 | 4,499 |

Note: Regressions include all individual control variables. Columns report estimations for different samples based on initial annual income. Columns marked "no" include taxpayers with no cost deductions, columns marked "yes" in turn include taxpayers who did claim cost deductions. Columns marked "all" include both. Standard errors are reported in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

Source: Own calculations on *BBB* data.

Cost deductions are not very frequent or significant in the Hungarian tax system, though they can be claimed against some types of income, especially contract work (wage income also has components against which cost deductions can be claimed, e.g., wage income from foreign assignments). At lower income levels (columns 1–3) the effect of differentiation is negligible, while for higher incomes we find much higher elasticity for those taxpayers who do claim cost deductions than for others (for whom the results are not significant, although the standard errors are large). This result is similar to the result found in the United States (see for example *Gruber and Saez,* 2002), but it is important to note that cost deductions are typically a fixed percent of income in the Hungarian tax system. So it is possible that the adjustment does not take place through cost deductions (i.e., through tax optimization), but rather through the magnitude (or the existence) of the given income type. Even then the question can be asked whether tax changes affect the generation or merely the reporting of these incomes. Based on these results it appears that we cannot take an obvious stand as to what extent estimated elasticities reflect the adjustment of labour supply.

*Table 2.7* reports results separately for men and women as estimated by BBB and KM: although the results are not clear-cut, in most cases the elasticity is higher for women. This certainly weakens the case for tax evasion as the explanation: according to *Meghir and Phillips* (2010), tax evasion should be more widespread among men, a notion that finds support in Hungarian survey results (*Semjén et al.* 2009).

**Table 2.7: Estimated elasticities for genders separately**

| Δlog(taxable income) | HUF 636,000–1.95 million | | HUF 3–5 million | | HUF 5–8 million | |
|---|---|---|---|---|---|---|
| | women | men | women | men | women | men |
| Δlog(1 – MTR) | 0.0716** | 0.0172 | 0.0892 | 0.117 | 0.232** | 0.185** |
| | (0.0245) | (0.0276) | (0.0878) | (0.0757) | (0.103) | (0.084) |
| Δlog(1 – ATR) | –0.0957 | 0.340* | –0.176 | 0.0569 | –1.194** | –0.246 |
| | (0.0954) | (0.136) | (0.491) | (0.424) | (0.487) | (0.431) |
| N | 56,979 | 45,964 | 5,550 | 7,203 | 2,144 | 4,219 |

Note: Regressions include all individual control variables. Columns report estimations for different samples based on initial annual income. Standard errors are reported in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

Source: Own calculations on *BBB* data (columns 1–4) and *KM* (columns 5–6).

Finally, *Table 2.8* reports estimates on samples restricted to include individuals with wage income only. We suppose that individuals earning solely wage income have the least opportunity of tax optimization. The restriction does not appear to matter for the results, save for the coefficient of the average tax rate. In our interpretation this suggests that income shifting (tax optimization) is

not a dominant factor in the reaction to tax changes. This is also supported by a separate exercise reported by KM, showing no differential effect on the capital income reported by those affected by the extraordinary tax (thus finding no signs of income shifting). All in all it is likely that the elasticities estimated in both studies – which are not very large in international comparison – reflect labour supply adjustment.

Table 2.8: Estimated elasticities for individuals earning wage income only

| Δlog(initial income) | HUF 636,000–1.95 million | | HUF 3–5 million | | HUHF 5–8 million | |
|---|---|---|---|---|---|---|
| | all | wage only | all | wage only | all | wage only |
| Δlog(1 – MTR) | 0.0474** | 0.072** | 0.097* | 0.091* | 0.198** | 0.212** |
| | (0.183) | (0.020) | (0.058) | (0.055) | (0.063) | (0.104) |
| Δlog(1 – ATR) | 0.064 | 0.219* | –0.076 | –0.631* | –0.557* | –0.743** |
| | (0.079) | (0.091) | (0.317) | (0.287) | (0.328) | (0.325) |
| N | 102,943 | 73,477 | 12,753 | 6,373 | 6,900 | 4,240 |

Note: Regressions include all individual control variables. Columns report estimations for different samples based on initial annual income. Standard errors are reported in parentheses.

*** Significant at the 1% level; ** 5% level * 10% level.

Source: Own calculations on *BBB* data (columns 1–4) and *KM* (columns 5–6).

We may conclude that Hungarian results are overall consistent with international estimations: the elasticities are not very large, but in the case of specific groups they are notable. Re-estimation suggests lower elasticities than originally reported by BBB (2008). Estimations for high-income taxpayers show larger tax price elasticities. While the international literature rarely finds a significant income effect, in the Hungarian estimations the coefficient of the average tax rate is often statistically significant; its sign is typically negative but sometimes positive. As *Chapter 4* of this *In Focus – I* shows, this uncertainty has important consequences for economic policy. Although it cannot be ruled out that the results are partly due to tax optimization or tax avoidance, it is very likely that labour supply adjustment causes a significant part of the estimated elasticities.

## The elasticity of taxable income and the "optimal income tax system"

How can we use estimates of the taxable income elasticity in the impact assessment of tax changes? The simplest type of impact assessment estimates the direct fiscal impact of a tax change: while a "static" assessment is based on the assumption that the behaviour of economic agents remains unchanged, "dynamic" fiscal effects can be predicted with the help of the elasticity. Calculations of dynamic fiscal effects were performed by *Benczúr* (2007) in an ex-ante assessment of the 2007 extraordinary tax of individuals, but also in the studies of *Bakos et al.* (2008) and *Kiss and Mosberger* (2011).

Second, the elasticity can be used as a parameter in more complex models. An example is given in *Chapter 4* of this *In Focus – I*, presenting a microsimulation model that uses this elasticity to take into account the behavioural adjustment of taxpayers.

Finally, the estimated elasticity is an important parameter of models that are used to characterize, and simulate, the "optimal income tax system".

### *The theory of optimal taxation*

The theory of optimal income taxation is an important field in public economics. The theory views the tax system from the point of view of an ideal "social planner". Taxes change the incentives of economic agents, and distort their decisions; thus taxes are more costly for economic agents than the revenue that is collected by the government. At the same time, the government needs revenues to provide important public goods (national defence, rule of law, environmental protection) and support vulnerable groups in society. The optimal tax system is one that can raise the revenue needed to finance the public activities desirable for society with the least social cost.

The theory of optimal taxation does not provide simple answers as to what the optimal tax system looks like. One reason for this is that the optimal tax system – as is clear from the introduction above – always depends on the preferences of society. In other words, the theory can provide only conditional answers: what kind of tax system corresponds to a certain set of social goals and values.[3] Another reason is that, for the sake of transparency and tractability, theoretical analysis usually concentrates on one aspect of the tax system at a time. Thus the theory of optimal consumption taxation can be separated from the theory of optimal income or capital taxation. The aggregation of partial results and the assessment of their applicability are therefore separate important tasks of the students and practitioners of the field. Finally, the results are generally sensitive to modelling assumptions and the value of some parameters that are hard to measure, raising a further barrier to policy applications.

The foundational work of the theory of optimal income taxation is by *Mirrlees* (1971). The work of *Mirrlees* is based on two main assumptions. The first assumption is that the incentive effect of taxation is mainly effective at the intensive margin, that is, individuals may respond to taxation by increasing or decreasing their working hours (but his formulation of the theory abstracts from entry to and exit from the labour market).[4] The other main assumption is that an individual's gross wage depends on their time-invariant productivity; the government is unable to tell the productivity of individuals, it can only levy taxes based on their income.

The type of results directly following from the logical structure of the theory describe how the optimal tax rates depend on the behaviour of taxpayers, the redistributive preferences of society and the shape of the income distribution.

3 Exceptions are cases where a tax system can be changed in a way that no-one is made worse off. Such cases are however rare: even if winners gain more than the damage of the disadvantaged, it is not easy to find the way to compensate the latter.

4 The theory was later reformulated by others (*Piketty,* 1996, *Saez,* 2002) to allow for adjustment at the extensive margin, i.e., entry to and exit from the labour market.

At a given income level, the marginal tax rate should be high if taxpayer behaviour in that income range is not very sensitive to the tax rate, if redistribution is not very important for society, and if the number of taxpayers in that income range is small relative to the number of taxpayers with a higher income. This latter relationship connects the optimal income tax system to the distribution of income (or more precisely productivity). Regarding an increase of the marginal tax rate in a narrow income range, the more taxpayers there are *above* the affected income range, the more revenue is generated by the tax increase; the more taxpayers there are *in* the affected income range, the more their behavioural reaction will impair the aggregate revenue effect.

### *The optimal top marginal tax rate: theoretical framework*

In the following we describe a result of the theory of optimal income taxation and apply it to the case of Hungary: the formula of the optimal top marginal income tax. The result was first derived by *Saez* (2001), and later applied by *Brewer et al.* (2010) and *Diamond and Saez* (2011) for the UK and the US. Our treatment, and the application to Hungary, is based on their approach following the paper by *Kiss* (2012).

The derivation, not reproduced here in full detail, is based on a theoretical framework in which individuals choose their labour supply (effort) optimally trading off consumption against leisure. The marginal tax rate affects this trade-off, directly affecting optimal effort and the income thus produced.

The optimal taxation problem is viewed from the view point of an ideal "social planner", ignoring the political process that converts society's preferences into a tax system. The goal of the social planner is to maximize social welfare; that in turn is but an aggregate of all individuals' welfare. The optimum is calculated conditional on some level of government revenue needed to finance unmodeled government activity.

The marginal weight in the social welfare function of an individual with a gross income of $z$ is $g(z)$: this expresses how much government revenue society is willing to forgo to leave that individual with one extra monetary unit of consumption. If society values redistribution, this social marginal weight will be $g(z) > 1$ for individuals with low income (society will value an additional dollar of a low-income individual's consumption more than one dollar of government revenue); while it will be $g(z) < 1$ for individuals with high income (society will value an additional dollar of a high-income individual's consumption less than one dollar of government revenue).

A society desiring to support low-income individuals faces the problem that redistribution dampens the work incentives faced by both high-income and low-income individuals. If the tax system induces people to work less, government revenue falls and less redistribution can be financed. This trade-off between equity and efficiency is at the core of optimal income tax theory.

The optimal top marginal tax rate can be derived from the effects of a hypothetical tax change, in which the tax rate increases on income above a threshold $\bar{z}$, leaving the tax system otherwise unchanged. Such a tax change affects social welfare in three ways. 1) Government revenue increases mechanically which is a social benefit (by allowing more to be spent on things valued by society). 2) Raising the tax burden affects the welfare of those taxed which is a social cost. 3) Those affected may decrease their working hours, reducing government revenue which again is a social cost.

At the optimal top marginal tax rate $\tau^*$ the sum of these three effects must be zero. If the sum of these three effects were positive, social welfare could be increased by a further tax increase (or by a tax cut if the sum were negative), meaning that the tax rate was not optimal in the first place. This condition implicitly determines the optimal top tax rate.

The result is a simple formula for the optimal top marginal tax rate, depending on only three parameters. The first parameter is the elasticity of taxable income of the highest earners: $e$. The second parameter $a$, characterizes the shape of the income distribution at high incomes. Its definition is $a = z^m/(z^m - \bar{z})$, where $z^m$ is the average income of individuals with income higher than $\bar{z}$. It has been observed in many countries that this ratio is fairly constant in the top range of the income distribution or, in other words, that it does not depend on the exact value of threshold $\bar{z}$. The third parameter, $g$ is the average social marginal weight of taxpayers with an income above $\bar{z}$. The formula of the optimal top marginal tax rate is then given as:

$$\tau^* = \frac{1-g}{1-g+e \cdot a} \cdot \tag{1}$$

The tax rate thus depends on just three parameters, two of which can be empirically estimated: parameters $e$ and $a$. Since the third parameter, parameter g, depends on the redistributive preferences of society, it is not straightforward to assign a value to it that is plausible for everyone. We get an upper bound for the optimal top marginal tax rate by assuming $g = 0$ above the threshold. In this case the value society assigns to an additional unit of consumption of the individuals with the highest income is negligible. The only force keeping down the tax rates of high-income taxpayers is the behavioural effect; and the optimal top marginal tax rate is equal to the tax rate maximizing government revenue. The formula of the optimal top marginal tax rate simplifies then to the formula of the revenue-maximizing top marginal tax rate:

$$\tau^* = \frac{1}{1+e \cdot a} \cdot \tag{2}$$

### *The optimal top marginal tax rate – application for Hungary*

We have thus presented the formula of the optimal top marginal tax rate in a simple theoretical framework. To apply this formula to Hungary, we first need to assign values to the parameters. The value of parameter $a$ can be obtained from tax return data: it is about 2.5 at high levels of income and is not sensitive to the exact choice of $\tilde{z}$ (*Kiss*, 2012). Based on the estimations of *Kiss and Mosberger* (2011) we choose a value of $e = 0.2$ for the elasticity of taxable income of high earners. Because of the statistical uncertainty about the parameter, it makes sense to also evaluate the formula at higher and lower levels of the parameters.[5]

*Table 2.9* shows the value of the optimal top marginal tax rate as a function of the parameters. Of course, these values should not be compared to actual PIT rates. From a theoretical point of view social security contributions and consumption taxes are similar to the income tax, as they also reduce the amount of consumption goods that can be bought from one additional hour of work. (We describe below the actual tax rates that are comparable with the theoretical standards.)

**Table 2.9: The value of the optimal top marginal tax rate as a function of parameters *g* and e, with $a = 2.5$ (percent)**

| | e | | | |
|---|---|---|---|---|
| g | 0.1 | 0.2 | 0.3 | 0.4 |
| 0 | 80 | 67 | 57 | 50 |
| 0.1 | 78 | 64 | 55 | 47 |
| 0.2 | 76 | 62 | 52 | 44 |
| 0.3 | 74 | 58 | 48 | 41 |
| 0.4 | 71 | 55 | 44 | 38 |
| 0.5 | 67 | 50 | 40 | 33 |

Source: *Kiss* (2012).

As can be seen in *Table 2.9*, the more sensitive the reaction of taxpayers to changes in the marginal tax rate (parameter *e*), and the more socially valuable the marginal consumption of high-income earners (parameter *g*), the lower the optimal top marginal tax rate. Our best estimate of the elasticity of taxable income ($e = 0.2$) is reflected in column 2. With this elasticity parameter, the revenue-maximizing top marginal tax rate is 67 per cent. The optimal top marginal tax rate changes very little if parameter *g* increases from zero to 0.1; but it decreases to 50 per cent if the value of parameter *g* is 0.5.

If we would like to compare the theoretically optimal tax rates to actual marginal tax rates of high earners, we must calculate effective tax rates that express how much net consumption an individual can buy by increasing their

5 *Kiss and Mosberger* (2011) do not find robust evidence for the income effect. The presence of the income effect is equivalent to a case where parameter *e* has a lower value. Thus robustness checks with respect to parameter *e* allow one to get a sense of how the income effect would affect results.

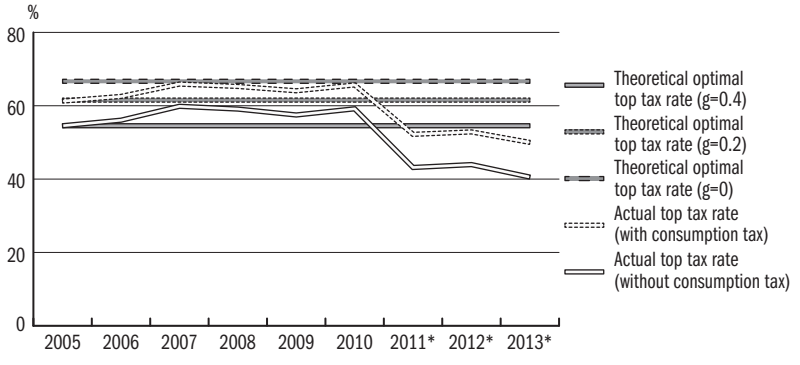
total wage cost by one unit. The formula of this effective marginal tax rate is calculated based on equation (3).

$$\tau_{top} = 1 - (1 - \tau_{cons}) \frac{1 - \tau_{\text{PIT}} - \tau_{\text{EE}}}{1 + \tau_{\text{ER}}} \cdot \qquad (3)$$

In this formula $\tau_{PIT}$ represents the actual top PIT rate, $\tau_{EE}$ and $\tau_{ER}$ represent the contribution rates payed by the employee and the employer, while $\tau_{cons}$ represents the effective consumption tax rate.[6]

*Figure 2.1* shows the actual effective top marginal tax rate in Hungary for the years 2005–2013. The calculation reflects the marginal tax burden of taxpayers with income above the pension contribution ceiling. Employee-side pension contributions are not levied on income above the ceiling. The employee-side pension contribution rate is 10 per cent in 2012, while the contribution ceiling is at just below HUF 8 million; about 2 per cent of tax payers have an income above this level.

Figure 2.1: The actual top marginal tax rate in Hungary, 2005–2013




* Calculations for 2013 are based on information available in June 2012. The effective consumption tax rate for the years 2011–2013 was taken to be equal to its level in 2010, the last year for which data were available.

Source: *Kiss* (2012) based on public data on the tax rates, government budgets, and *National Accounts* for the respective years.

Based on *Figure 2.1* we can make the following statements about the actual top marginal tax rates of the last decade.[7] The effective top marginal tax rate was close to the revenue maximizing rate until 2010; starting in 2011, the actual effective rate is significantly below the revenue maximizing rate. *Figure 2.1* also suggests that if there had been no pension contribution ceiling in Hungary in these years, the actual effective rate would have been over the revenue maximizing rate until 2010 and below that rate starting from 2011.

The 2011 change in personal income taxation can be translated to the language of the model with the help of two parameters. Effective top rates up un-

6 The effective tax rate on consumption is calculated as government revenue from consumption taxes divided by household consumption. The tax rate is calculated similarly by *Brewer et al.* (2010).

7 Here we keep the discussion to make positive statements; some normative issues are raised in the subsection on the discussion of the results. For a more detailed normative analysis, see *Kiss* (2012), or *Brewer et al.* (2010), and *Diamond and Saez* (2011) from an international point of view.

til 2010 were consistent with revenue maximisation for an elasticity of taxable income of $e = 0.2$, and an average social marginal weight of $g = 0$ assigned to high-income earners. The tax system effective from 2011 is consistent, given parameter $e = 0.2$, with a significant increase of the average social marginal weight of high-income earners ($g = 0.5$; see *Table 2.9*) or, with an unchanged $g = 0$ parameter, with the notion that high earners react much more sensitively to tax changes than shown by existing estimations ($e = 0.4$; see *Table 2.9*). Estimations for Hungary presented in this chapter contradict this notion, although the long-term elasticity (in which longer-term decisions on one's career path, like the decision to study, may factor significantly) may be higher than the short-term elasticity.

### *Discussion of the results*

The discussion is divided into two parts. First we discuss considerations that may affect the results but were ignored so far; then we briefly reflect on the normative issue of redistributive preferences. We raise five considerations that may affect the optimal top marginal tax rate. Though there is considerable uncertainty around their significance, the direction of their effect is clear in each case.

*Income effect.* If our estimate of the tax price elasticity is correct but we wrongly ignore the income effect, then the optimal top marginal tax rate is higher than suggested by the above calculations. The reason is that the income effect dampens the behavioural effect of tax changes or, in other words, the correct optimal top rate corresponds to the case where the taxable-income-elasticity parameter is lower. On Hungarian data the income effect is estimated by *Bakos et al.* (2008) to be statistically significant and relatively robust, while it is estimated by *Kiss and Mosberger* (2011) to be only marginally statistically significant and not very robust. The international literature rarely finds significant income effects. Thus there is considerable uncertainty around this issue.

*Income shifting, tax externalities.* If the elasticity of taxable income is a result of taxpayers shifting income between different tax bases (profits or dividends as opposed to wage, for example) or between different time periods, then the real fiscal effects of the behavioural adjustment to a tax change are smaller than if the effect is fully the result of reduced economic activity. In this case we overestimate the behavioural response, and consequently the optimal top marginal tax rate is higher than in our calculations above. Although this issue is not (and perhaps can never be) settled for good, indirect evidence found by *Kiss and Mosberger* (2011) suggests that the behavioural response in their policy episode is not a result of income shifting.

*Tax avoidance.* If there is considerable tax avoidance among some taxpayer groups, this means that taxable income is an inaccurate measure of productivity. If the extent of tax avoidance is affected by changes in tax rates, this means that real economic activity is less responsive to tax changes than our estimations

of the taxable income elasticity suggest. This, similarly to the case of tax externalities, raises the optimal top marginal tax rate (a tax increase induces a shift of income out of the personal income tax base into undeclared income sources that are taxed when they are converted into consumption, even though at a lower rate). Another effect of tax avoidance is that the tax system will burden taxpayers with a similar productivity (and similar total income) differently as a function of their ability to avoid taxes. This impairs the horizontal and vertical equity of the tax system. As the effectiveness of achievable redistribution is lower, society's desire for redistribution may suffer as a result.

*Actuarial considerations.* We assumed in our calculations that taxes and social security contributions have the same effect on taxpayer behaviour. This may be wrong if taxpayers expect that the benefits they receive from the social insurance system have a close link to their payments into the system. There is however great uncertainty both regarding the actual link between contributions and benefits and taxpayers' perceptions about it.

*International tax competition for talent.* We assumed in our analysis that the behavioural adjustment of high-income individuals occurs solely at the intensive margin. In the short to medium run it is a plausible assumption that changes in the marginal tax rates do not induce high-income individuals to exit the labour force. At the same time, any long-run relationship (whether a positive or a negative one) is hard to establish based on the experience of developed countries. One particular aspect of the extensive-margin adjustment of high earners came into the focus of recent investigations: the behaviour of certain specialized professional groups whose services are highly sought after on international labour markets (see, e.g., the studies of *Kleven et al.* 2012a, 2012b). Such groups include stars in spectator sports (like football players playing for major European clubs) or the most successful strata in other internationalized professions. A fierce international competition for high-income individuals is equivalent to a higher elasticity parameter, which implies a lower optimal top marginal tax rate.

*On the redistributive preferences of society.* One of the most important questions when thinking about the optimal tax system is how important redistribution is for society. Parameter *g* in the formula of the optimal top marginal tax rate expresses how much tax revenue society would be willing to forgo to allow a high-income individual to increase their consumption by one monetary unit. Since the parameter expresses value judgment, it has no scientifically correct or incorrect value. But as regarding any value-laden question affecting the whole of society, the question must be reflected on and debated. *Peter A. Diamond* and *Emmanuel Saez* – two researchers who made crucial contributions to the field – recently argued that the value of the parameter should be close to zero in the case of the top one per cent of the income distribution and, consequently, that the revenue maximizing top rate is an important benchmark for public

policy (*Diamond and Saez,* 2011).[8] The most important argument in favour of this view is that it does not rely on a very egalitarian economic philosophy. Parameter $g$ can be approximately zero not only if the welfare of low-income individuals is more important than that of high-income individuals (as in the Rawlsian theory of justice). Such a result can be obtained even if society values the welfare of each of its members equally (that is, even on a utilitarian basis) if consumption has decreasing marginal utility.

## Concluding remarks

This chapter reviewed Hungarian estimations of the elasticity of taxable income, placing these in the context of the international literature, and presenting an application of the estimated elasticity in the field of optimal taxation theory. In the first part of the chapter we surveyed the international literature in more detail than had previous Hungarian studies. Our survey concentrated on questions interesting for economic policy, rather than on technical details. We found that European studies generally found lower elasticities than the US literature, which is probably a reflection of the fact that in the US the personal income tax base can be influenced by a large number of deductions. We noted that the general view is that a good tax system leaves little opportunity to manipulate the tax base (in this case the tax base is "broad"). In such a tax system taxpayers have no strong incentives to pursue non-productive activities in order to reduce their tax base.

In the second part of this chapter we reviewed the two existing studies estimating the elasticity of taxable income in Hungary. In the process we re-estimated the results of *Bakos et al.* (2008). The results of both studies are in line with the findings of the international literature: the elasticities are not large but they are economically significant for some taxpayer groups. The re-estimation suggests lower elasticities than reported in the original BBB results. Higher-income groups generally show a higher elasticity of taxable income; the parameter of the average tax rate is sometimes positive and sometimes negative, unlike in most international studies.

Finally we illustrated the economic significance of the taxable-income elasticity by applying a result of the theory of optimal income taxation to Hungary. The theory suggests that the optimal top marginal tax rate is the function of solely three parameters: the elasticity of taxable income of high-income earners, a parameter describing the shape of the income distribution, and a parameter summarizing society's redistributive preferences (expressing how much tax revenue society would be willing to forgo in order to allow a high-income individual to increase their net income by one monetary unit). We showed that the actual top marginal tax rates until 2010 were optimal if society has a strong taste for redistribution ($g \approx 0$), while actual top marginal tax rates effective from 2011 are optimal if either social preferences for redistribution are

8 For lower values of $\bar{z}$ – thinking about the top 5 or 10 per cent of taxpayers – the assumption of $g = 0$ is less evidently plausible; this is why we present a sensitivity analysis in *Table 2.9.*

low ($g \approx 0.5$), or if the elasticity of taxable income of high earners is about twice as high as in our estimations ($e \approx 0.4$).

Such a high elasticity is not supported by empirical evidence in Hungary, and other considerations such as a potentially significant income effect point toward even higher optimal rates. A taxable income elasticity of high earners of about 0.1–0.2 is a robust result and appears to be mostly driven by the adjustment of labour supply. The long-term effect may be larger (e.g., through the adjustment of investments into human capital) but this notion is not proven empirically.

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## 3. LABOUR SUPPLY AT THE EXTENSIVE MARGIN

GÁBOR KÁTAY & ÁGOTA SCHARLE

The previous chapter of *In Focus – I* analyses how taxes affect the number of hours worked, among those employed. The labour supply decision can be considered at the extreme as well, when working hours are reduced to zero. In the literature this is referred to as adjustment at the extensive margin. Extensive adjustment occurs when a change in their wage or non-labour income induces the individual to enter (or start looking for) or exit employment. While the previous chapter discusses how individuals decide about their work intensity, this chapter examines the decision to enter into employment, or more precisely, the participation decision of individuals.[1]

The primary function of taxes and transfers is to generate funding for public expenditures and to redistribute earned incomes.[2] Although their impact on labour supply is unintended, it deserves special attention, as it can jeopardise the sustainability of the economy. A detailed understanding of these supply side effects is a precondition to maintaining a sustainable welfare system. The next step is to reduce the disincentives by improving the targeting of provisions (entitlement), tightening the eligibility criteria, decreasing the cost of entering employment or cutting benefit amounts.[3] In the following we do not consider welfare effects or measures to reduce supply disincentives.

### The decision-making process

#### *The decision on participation*

According to the basic framework of mainstream economics, individuals compare levels of utility when deciding on their labour market participation: they either choose to work and give up leisure for wages (and consumption) or not work but have more leisure at their disposal, while giving up the wages (and consumption). Accordingly, individuals only wish to enter employment if labour (valued in itself) and their expected wages yield a higher level of utility than leisure would.

The decision clearly depends on preferences, which may vary across individuals: some may choose to work, while others may choose leisure (or unpaid domestic labour). Still, there are a number of factors affecting this simplified decision, other than individual preferences.

The first major factor is the expected net wage. It is quite evident that a person who can earn higher net wages while giving up the same amount of leisure

1 Participating workers either work or are looking for work (while being unemployed). In contrast, non-participating (inactive) individuals do not work and are not looking for work.

2 The redistribution of incomes may be justified on the basis of values (solidarity, reducing poverty) or market failures (e.g. related to credit market constraints, asymmetric information, or myopia) as well.

3 The measures listed here (except for cutting the benefit amount) can improve labour supply incentives, while leaving the original welfare purpose intact.

is more likely to want to work. On the one hand, the expected net wage depends on factors of labour demand, such as the individual's level of education, or their previous professional work experience; on the other hand, it depends on taxation of labour. Our analysis mainly focuses on the latter: how does a change in the tax burden on labour affect individuals' willingness to work? For instance, if there is a decrease in the average rate of personal income tax, the wage of the (potential) worker increases while employer costs remain unchanged, and the higher potential net wage can encourage people to give up more of their leisure in order to work.

Another similarly important factor is the accessibility and size of welfare transfers, since modern welfare states provide many benefits in order to compensate for the lost wages. The common primary aim of unemployment benefits and parental and family benefits is to compensate for the lost labour income.[4] We do not discuss this primary function of transfers here. We only analyse their financial (dis)incentive effect in the simplified framework of this chapter. This effect comes from the fact that individuals receiving a disposable income while staying out of work face a loss of these transfers as well as having to give up leisure for wages when entering employment. Therefore, when making their decision, individuals do not simply consider the net wage, but the gains to work, which equals the difference between the net wage and the transfers lost upon entering employment.[5]

Non-labour incomes may have a substantial role in the participation decision. These incomes discourage entering employment, because they increase disposable income and thus, the demand for leisure (as long as it is a normal good). For instance, if the capital income (e.g. dividends) of an individual was high enough, they would be less likely to enter employment. Certain welfare provisions (e.g. family benefits) are also income-independent, that is, their amounts do not decrease with the earned wages. Thus, these must be added to non-labour incomes. Also, the per capita incomes of other workers in the same household are to be regarded as non-labour incomes. For instance, as is often the case, one adult in the family works (the husband, typically) and the other remains inactive, but her disposable income is not zero.

The other non-financial factors that affect labour supply mostly depend on individual preferences mentioned above. There are a number of factors beyond disposable income that can influence the level of utility obtained by working or staying out of work. First, the decisions of people in the same household as the given individual may affect individual preferences: married couples often coordinate their decisions, e.g. because of the sharing of domestic labour and related preferences, or the fact that they wish to spend their leisure time together. Second, the well-being of children is also important to their parents, which alters preferences yet again. Third, working does not necessarily decrease utility; it can even yield pleasure in the form of self-realization and social contacts,

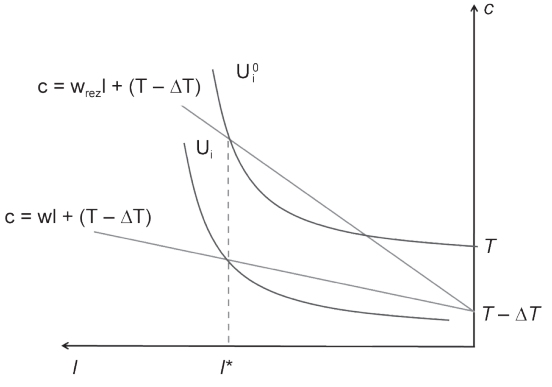
4 Besides decreasing income inequality and reducing and preventing poverty, transfers can help achieve other social outcomes, e.g. equal opportunity, the exploitation of certain positive externalities (through the means of subsidizing e.g. further education or a healthy diet), or the prevention of population decline.

5 Although their quantification is problematic and therefore, empirical studies typically omit them, the cost of claiming the various transfers and that of further related obligations should also be considered.

which alters the shape of the preference curves of the basic model. It is clear from the above that preferences can change over time: a young person still in education, a middle-aged family man, a woman with children to be raised, or an older person approaching retirement age may all have different degrees of willingness to work.

*Figure 3.1* shows the dilemma of the decision.

Figure 3.1: Labour supply decision at the extensive margin




Source: *Benczúr et al.* (2012).

*Figure 3.1* shows the relationship between the potential consumption of an individual ($c$) and their time spent working ($l$). If they do not work at all ($l = 0$), their disposable income is $T$, which is the sum of available transfers, non-labour incomes, and the share of the incomes of others in the household. As the individual begins to work, they lose some of their welfare benefits ($\Delta T$) immediately, while their disposable income increases by the earned net wage ($wl$). Furthermore, it is reasonable to assume that workers do not have absolute control over how much they want to work: for instance, they may only want to work one day of the week, but such positions are available only to a very limited extent. For the sake of simplicity, let us assume that workers may only accept full-time positions. Thus, we restrict their decision to two possibilities: accept a full time position ($l = l^*$), or stay out of work ($l = 0$).

It follows from the above that the budget constraint is nonlinear even in the case of a simple flat tax system: in the case of nonzero hours worked, the equation describing the disposable income of an individual is $c = wl + (T - \Delta T)$; in the case of zero hours worked, the labour income of the person in question is $wl = 0$, and their welfare benefits and other non-labour incomes are $T$.

$U_i$ denotes the indifference curve in the figure: this is the set of points which yield the same level of utility to the individual. Note the indifference curve which intercepts the budget constraint at $l^*$ working hours: this shows the level of utility of a potential worker who decides to work. Should the person in question decide to stay out of work, curve $U_i^0$ which passes through point $T$

applies. It is clear that in this simplified, stylised framework that a potential worker decides about their participation by comparing which of the above two indifference curves yields them the higher level of utility. *Figure 3.1* shows two scenarios: in the case of $wl$ labour-related income, the worker remains inactive because curve $U_i^0$ is higher than $U_i$, while at $w_{rez}l$, he is indifferent about entering employment, since the two indifference curves are identical in this case. A person's net wage obtained by working in this case is called the reservation wage $w_{rez}$, in other words, it is the lowest expected wage which makes them enter employment.

It is clear that the person in the above example would clearly prefer inactivity in case of an increase in the tax burden on labour (or consumption). Since the slope of the budget constraint decreases in this case (from $w_{rez}$ to $w$), at $l^*$ labour the new budget constraint intercepts indifference curve $U_i$, which is lower, therefore, consuming the gains to work yields a smaller utility surplus than leisure, which the individual has to give up upon entering employment.

In reality, the tax and transfer system is more complex of course; the budget constraint can take up many forms due to the various tax rates, credits, and benefits. For instance, if a welfare transfer is available for the working poor as well but its amount depends on the level of income, the budget constraint is broken into two segments.[6]

Thus, similarly to preferences, budget constraints and accessible transfers (or in the case of entering employment, lost transfers) can also greatly vary across individuals. Consequently, there are those who are working or looking for work (active population) and those who choose to remain inactive. It is mostly seen in the case of low-skilled, low-income individuals that the average effective tax rate at point $l^*$ is quite high due to the transfers (gradually) lost upon entering employment, and their potential labour-related income is barely above the allowance. Clearly, in such a situation, the recipient of the benefit continues to stay out of work until they can surpass the level of utility granted by the allowance.

Despite its simplicity, the above framework illustrates the decision mechanism well, and allows us to draw a number of simple, universal conclusions at this point:

1) The higher the non-labour income of a person, *ceteris paribus* the less probable it is that they are looking for work. In this case, point $T$ in the figure is high enough to grant the individual the suitable level of consumption and thus utility, and the consumption surplus brought about by working yields them a relatively smaller utility surplus.

2) The bigger the lost transfer ($\Delta T$), the less the individual wants to work. The straight segment of the budget constraint starts at a lower level if $\Delta T$ is high, therefore, it intercepts an indifference curve which is lower at point $l^*$ – that is, working yields a lower level of utility than that indicated by the indifference curve passing through point $T$.

6 The current social assistance scheme in Hungary works in a similar fashion for those living in the household of the claimant: the claimant themself cannot work, or else they lose the provision, and the family members can work, but if their income is too high, the family loses the provision.

3) The higher the net hourly wage of an individual (e.g. due to a higher level of educational attainment), the steeper the slope of the budget constraint, and the higher the possibility that an individual chooses to work.

### *The duration of job search*

We borrowed the above simple model from neoclassical theory. The model tells us if a person with given preferences wants to work or not. There is either no involuntary unemployment in this simplified framework, or it is explained by exogenous frictions in the labour market.[7] In reality, those who want to work cannot get a job instantly: they are to become unemployed for a certain period of time. Labour market frictions which cause unemployment can be interpreted in the so-called search and matching models (see *Mortensen and Pissarides,* 1999, and *Morvay,* 2012). Search and matching models supplement the neoclassical model of labour supply on the extensive margin by making explicit the labour market frictions which cause unemployment.[8] The probability of finding a job is determined by the intensity of job search, the number of positions offered by firms, and the efficiency of the search. Although the possibility of modelling the participation decision is not excluded in them, most search and matching models do not consider inactivity (but assume that all who are out of work want to work), and mostly focus on explaining frictional unemployment. That is, despite their shared theoretical roots, the two literatures aim to explain different labour market phenomena.

## Labour market activity, taxes, and transfers in Hungary

Manipulating labour supply is not the primary function of taxes and transfers – but their side effects on it may turn out to be substantial. In Hungary, nearly one third of the working-age population receives some sort of a benefit, while barely two thirds participate in the labour market: this suggests that analysing the relationship between the participation decision and transfers is especially justified in the case of Hungary.

The consistently low level of employment can be traced to several causes: the economic structure inherited from the socialist era, the regime change, demographic processes, and the misguided policy choices of successive governments all played a role in it.[9] Due to the generous welfare policies aimed at relieving the social tension which followed the regime change, nearly one third of the working-age population make their living from some sort of a welfare benefit – unemployment, maternity, disability, or early retirement benefits (see *Table 3.1*).[10] Their proportion quickly increased in the first few years after the regime change, and has only begun to show a slow decline in recent years. This was partly due to the tightening of the conditions for retirement, and partly to the increase in the average level of educational attainment.

7 This assumption can give an "employed versus unemployed" nature to the participation decision of the individual. Later, a number of attempts to explain involuntary unemployment appear in neoclassical theory, such as sticky wages, or the efficiency wage.

8 In a nutshell, the model analyses the optimal search strategy from the jobseekers' aspect, with job offers of varying quality coming up at random points in time, and assuming that postponing the participation decision is costly.

9 See a detailed analysis by *Köllő* (2009) on the social structure inherited from the socialist era (more specifically, the share and skill level of the unskilled population) and the role of the policy measures taken in the first years following the regime change, and an assessment of the policy decisions by *Váradi* (2012). *Fazekas and Scharle* (2012) review the processes of the period following the regime change.

10 See *Tables 11.1–11.5* in *Section 11* (Welfare benefits) in the present volume of The Hungarian Labour Market (Statistical Data) – Review and Analysis on the per capita amount of the various provisions.

**Table 3.1: Share of various welfare recipients in the 15–64 year old population, 1990–2010**

| Year | Unemployment benefit | Social assistance | Pension (under 65 years) | Disability benefit | Maternity benefit | Total | Receives benefit and works* |
|---|---|---|---|---|---|---|---|
| 1990 | 0.4 | 0.7 | 15.9 | 1.8 | 3.6 | 22.5 | n. a. |
| 1995 | 2.3 | 3.7 | 17.5 | 3.2 | 4.4 | 31.3 | 6.6 |
| 2000 | 1.8 | 2.4 | 19.7 | 3.5 | 4.4 | 31.8 | 8.3 |
| 2005 | 1.5 | 2.3 | 18.1 | 3.6 | 4.3 | 30.0 | 9.6 |
| 2010 | 2.8 | 2.5 | 15.9 | 2.8 | 4.0 | 28.0 | 10.2 |

* Per cent of the 15–64 year old population receiving benefits.

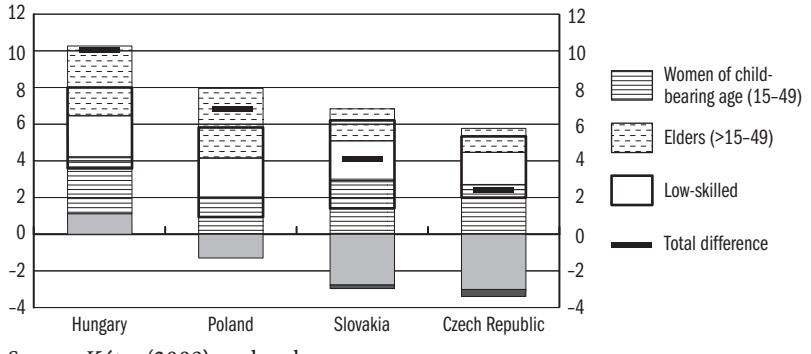
Note: The unemployment benefit covers the insurance-based provision, while the social assistance includes means tested provisions for the working aged. It includes the school leavers' allowance and provisions for the long term unemployed (depending on the year: jövedelempótló támogatás, rendszeres szociális segély, rendelkezésre állási támogatás, bérpótló juttatás). Pension includes disability pension as well, disability benefit includes recipients of other such non-pension provisions, and maternity benefits include insurance based and flat rate benefits (GYED, GYES, and GYET).

Source: Calculation by *Duman–Scharle* (2011) based on data from *Hungarian Central Statistical Office* (KSH), the *Employment Office* (FH), and the *Central Administration of National Pension Insurance* (ONYF). Last column: calculation by Árpád Földessy, based on the Labour Force Survey conducted by *KSH*.

The role of disability pensions and maternity benefits (GYES-GYED-GYET) in providing a livelihood for those who do not work is far greater than that of unemployment provisions (in every age group for women, and for those above the age of 35 for men, see *Köllő,* 2009). All things considered, the system is dominated by provisions that encourage exit from the labour market.

The majority of welfare recipients are inactive, and most of them exit from the labour market either for a prolonged period, or for good. *Figure 3.2* shows that in Hungary, the low willingness to work is mainly explained by the inactivity of "transfer dependent" groups: the difference between the average participation rate in the EU and that in Hungary is mostly due to the low-skilled, the older workers, and women of childbearing age.

**Figure 3.2: The contribution of certain social groups to Hungary's participation rate deficit relative to the EU average (percentage points, in 2011)**




Source: *Kátay* (2009), updated.

## Empirical research on adjustment at the extensive margin

Most countries have quite complex tax and transfer systems in place; average tax rates (e.g. applicable at the average wage or the minimum wage) cannot adequately capture the variety of components of these systems. Therefore, it is not only the heterogeneity of individual preferences which justifies the use of individual (micro-level) data, but also the complexity of the tax system.

Thus, the empirical (international) literature on adjustment at the extensive margin is mainly based on micro-level analyses. Three main approaches are used. The first one includes the reduced-form approach and the program evaluation methodology. Instead of aiming for a general picture of the labour supply of individuals, studies of this approach analyse the effects of particular measures that have already run their course. Consequently, most of them only consider a small portion of the population (the affected group), so that the general effects of comprehensive changes in the tax and transfer system cannot be inferred from it. Such is the paper of *Dickert et al*. (1995) which analyses the effects of the expansion of tax credits in the United States, on data from the Survey of Income and Program Participation (SIPP). *Eissa and Liebman* (1996) wrote a similar paper using the Current Population Survey.[11]

The estimation of structural equation(s) is another well-known approach used in *Kimmel and Kniesner* (1998), *Aaberge et al*. (1999), and *Meyer and Rosenbaum* (2001), among others. Generally, results show that it is secondary earners (married women, for the most part) and the low-skilled who respond to changes in the tax and transfer system at the extensive margin. However, the empirical literature of the structural approach is incomplete in a number of ways. First, methodological differences make the comparison between estimations problematic. Thus, elasticities vary across quite a broad range. Second, also owing to the methodological simplifications, the net wage elasticities are also unquantifiable in a number of cases and therefore these estimations cannot be used for policy simulations or even welfare analyses. Third, most estimations mainly focus on the tax system and either exclude the social welfare system altogether, or include it only in a very simplified form.

The third strand of the empirical literature uses life cycle models (see e.g. the summary by *Keane,* 2011). In contrast with the above, life cycle models do not simply consider the static decisions of individuals, but their dynamic decisions – made with expected future income and situation in mind – on their activity paths, which cover their whole lifespan. The advantage of this approach is that it can treat decisions on education or retirement in their full dynamics. To its disadvantage, however, the identification of its estimation parameters is less clear. In addition, due to its complexity, the estimation procedure requires considerable processing power. Because of these reasons, most papers only consider a small portion of the population (married women, for the most

11 See *Moffitt* (2002) for a more detailed review.

part), and similarly to the second approach, do not present an overall picture on the differences between the various groups.

### *Detailed analysis of the adjustment at the extensive margin in Hungary*

The first Hungarian studies which examine the extensive adjustment of labour supply for the total working-age population are descriptive in nature, therefore do not quantify the effects of the various factors – such as taxes and transfers – and address them only indirectly (*Galasi*, 2003; *Nagy*, 2000). The first empirical findings which include transfers as well were published by *Kátay and Nobilis* (2009): the authors used a simple decomposition method to analyse the effects of demographic composition and recipient ratios for various transfers on the aggregate participation rate. Their results suggest that the consistent increase of the participation rate beginning in 1997 was primarily due to the tightening of the access to transfers (more specifically, the gradual increase in the statutory pension age and, later, the tightening of conditions for disability pensions), and secondly due to a steady increase in the average level of educational attainment. Although smaller in magnitude, the temporary tightening of the child care system in 1996 and the change in the demographic composition (caused by the "Ratkó-grandchildren", a wave of baby boomers entering the labour market) also had a significant effect.

*Benczúr et al*. (2012) is considered the first Hungarian attempt at the structural approach and the simultaneous handling of taxes and transfers. Similarly to previous studies, the authors find that the response to changes in the tax and transfer system is significant only in a number of well-defined groups: the low-skilled, those approaching retirement age, and married women of childbearing age. As shown above, these are precisely the groups that can explain the difference between the participation rate in the EU and that in Hungary.

*Table 3.2*. shows the most important results of the estimations made by *Benczúr et al*. (2012).[12] The figures denote marginal effects and their standard errors, pertaining to a given group (i.e. computed from the average values for the given group). They show how the probability to participate changes for an individual of a given group in percentage points, if their net wage or available welfare provisions were to increase by 1%. "Whole sample" in part *A* means those aged between 15 and 74, while the full sample for part *B* contains only those aged between 25 and 54 (prime-age population). The first row clearly shows that the average worker is sensitive to changes both in net the wage (0.395) and in transfers (–0.1367).[13] However, the effect weakens considerably (to 0.127 and –0.054, respectively) for the prime age (25–54 year old) population.

The three subsequent rows show that educational attainment has a significant effect on individuals' responses to changes in the tax and transfer system. The difference between the groups of various attainment levels is even stronger if we only consider the differences among the 25–54 year old population.

12 The three-step procedure used in the paper yields a probit model, in which the left-hand side variable is a dummy for participation (employment or unemployment vs inactivity), and the right-hand side contains the net surplus income of the individual obtained through work (gains-to-work), the non-labour net income which includes welfare transfers as well, and other control variables. The first two steps serve to correct for the bias introduced by the fact that the wages of the unemployed is unknown. The estimations were run on a pooled cross section database constructed from the Household Budget Survey of KSH for the years 1998–2008. The table shows marginal effects computed on the sample averages of the respective groups.

13 This means that a 1 per cent increase in the net wage is associated with a 0.395 percentage point increase in the probability of participation, while a 1 per cent increase in welfare transfers reduces this probability by 0.136 percentage points.

Marginal elasticity is the highest for low-skilled workers, while the prime-aged with higher education are practically insensitive to changes.

**Table 3.2: Conditional marginal effects for various subgroups of the working age population**

| | Working-age population (*A*) | | Prime-age population (25–54) *(B)* | |
|---|---|---|---|---|
| | Net wage | Transfer | Net wage | Transfer |
| Whole sample | 0.395 | –0.136 | 0.127 | –0.054 |
| | (0.038) | (0.013) | (0.014) | (0.006) |
| Educational attainment: Primary school or less | 0.294 | –0.093 | 0.409 | –0.194 |
| | (0.089) | (0.028) | (0.040) | (0.019) |
| Educational attainment: Secondary school | 0.310 | –0.118 | 0.122 | –0.054 |
| | (0.031) | (0.012) | (0.012) | (0.005) |
| Educational attainment: Higher education | 0.139 | –0.045 | 0.050 | –0.019 |
| | (0.015) | (0.005) | (0.004) | (0.001) |
| Older workers (older than 50 years) | 0.392 | –0.103 | | |
| | (0.065) | (0.017) | | |
| Women of childbearing age (25–49) | | | 0.231 | –0.108 |
| | | | (0.021) | (0.010) |
| Prime-age, single men | | | 0.096 | –0.038 |
| | | | (0.012) | (0.005) |
| Prime-age, single women | | | 0.168 | –0.076 |
| | | | (0.019) | (0.008) |
| Prime-age, married men | | | 0.039 | –0.016 |
| | | | (0.005) | (0.002) |
| Prime-age, married women | | | 0.290 | –0.133 |
| | | | (0.025) | (0.012) |

Note: Standard errors are in parentheses.
Source: *Benczúr et al*. (2012).

The last rows present the responsiveness of selected subgroups. These show that one of the most sensitive groups is that of older workers, who most likely decide about the timing of their retirement depending on the available provisions and expected wages. Moreover, the estimations confirm that married women of childbearing age are also sensitive to taxes and available transfers.

### *The effect of various transfers on adjustment at the extensive margin*

The shortcoming of *Benczúr et al*. (2012) is that it treats the various transfer elements (such as unemployment provisions or child care benefits) as a whole, thus it does not differentiate between these elements in terms of labour supply incentives. In reality, changes in the various transfers can have varied effects. We address these issues in the present section.

Existing Hungarian studies which analyse the labour market effects of pensions and maternity benefits have not measured labour supply adjustment by participation but by the employment or entry rates of various groups. Never-

theless, in the long run, participation can be approximated by employment, if 1. wages are perfectly elastic in the long run, and 2. the state of unemployment is solely explained by temporary frictions.

The first indirect findings on the child care system in Hungary are from the cross-section estimation of *Galasi* (2003), who attempts to decompose the difference between the employment of men and women into components.[14] It is shown that 64 per cent of the observed employment gap is accountable to the parameter effects of the number of children, i.e. the fact that the negative effect of having children on the probability of entering employment was stronger for women. *Köllő* (2009) and *Szabó-Morvai* (2011) analyse the consequences of the 1996 abolition and eventual reintroduction of the insurance based maternity benefit (GYED),[15] using the Labour Force Survey of KSH and the Turning Points of Life-Course survey. Their results show an increase in the re-employment probability for skilled mothers (who were most likely entitled to GYED before the change in regulations), but this effect was not significant (except for the year of 1997). The reintroduction of GYED did not affect the probability of finding employment in the first two years after childbirth, but in the third and fourth years there was a substantial decrease (*Szabó-Morvai*, 2011).[16]

Studies examining the labour supply effects of old-age and disability pensions show a consistently substantial and negative effect. *Köllő and Nacsa* (2005) reveal the interrelationship between expected wages, disability pensions, and labour supply. They estimate the effects of various factors on the likelihood of a man aged between 44 and 62 and that of a woman aged between 44 and 58 to be retired at the end of 2000. The parameters suggest very strong regional differences. For example, the likelihood of a man 5 years short of the age for retirement was 37 per cent across the whole sample, but the same value was only 18 for the most developed micro-region and 56 for the most disadvantaged one. In the case of women, the differences were somewhat smaller. All else being equal, the low-skilled and those living in micro regions with low wages were more likely to be retired, and those in rural regions were less so. A coordinated decision between husbands and wives seems more common within families than substitution: willingness to retire is lower, not higher for those with a working spouse.

Finally, *Cseres-Gergely* (2008) estimates how present wages and expected pensions affect retirement, using individual panel data from the Household Budget Survey of KSH for the 1993–2000 period. His results indicate that a 1 per cent increase in the expected income of staying in employment is associated with a 0.11–0.13 percentage point decrease in the likelihood of retirement, while the same increase in expected pensions increases the same likelihood by 0.16–0.18 percentage points.

An earlier paper by *Cseres-Gergely* (2005) suggests that this effect is to a large extent accounted for by the tax regulations for pensions. A pensioner living in

14 Estimated in a logistic regression, on a dataset constructed from the first quarter waves of years 1993–2000 of the Labour Force Survey of KSH.

15 GYED is available to those who worked before the birth of their child, and its sum depends on their previous wages.

16 The fact that the insured maternity leave is relatively generous may be an explanation in that it provides savings for the period after its depletion (that is, it has a certain delayed income effect), but it is also possible that the decreased willingness to re-enter employment in the third and fourth years among those entitled to GYED is because they want another child (*Köllő*, 2012).

a typical family loses up to one quarter of their net income upon retirement, which is partly compensated for by the pension itself and partly by the fact that it is tax-free. The shift in individual incomes is almost exclusively determined by the previous two sources of income: other sources or casual work is rare. This shift does not influence the income of the spouse: the level and structure of their income is the same after the retirement of their spouses as it was before. Accordingly (and since other household incomes, e.g. from petty farming remain unchanged as well), per capita household income decreases by even less: 13 per cent on average.

### *The effect of transfers on the timing of entering employment and the probability of finding a job*

Individuals who choose to work do not become employed automatically. As we mentioned before regarding the duration of the job search, the timing of entering employment and job search cannot be analysed within the traditional model of labour supply; these decisions can be interpreted within the aforementioned search and matching models instead. These models consider a number of effects – the duration of job search and the quality of matching between jobs and workers – in a unified framework. Transfers have opposing effects on these two outcomes: they increase the unemployment period but at the same time increase the quality of the match. In this subchapter we only consider the former, negative effect, see box on the latter.

Empirical estimations based on search and matching models are not directly comparable to extensive supply estimations which analyse the participation decision, because their subjects are different. However, effective policy responses can only be designed considering the results of both areas, since the current level of employment is affected by both the rate of participation (and supply) and the probability of finding a job. Therefore, we present a short review of the existing results of estimations on the probability of finding a job and the timing of accepting job offers.

Most existing Hungarian studies are based on reduced-form estimations which measure the probability of entering employment among the registered unemployed, and the timing of exits. They exploit the quasi-experimental situations created by the successive reforms starting in the 1990s, and the detailed and relatively easily accessible database of the Employment Office. In theory, estimations based on the search and matching model can capture demand constraints (such as the quantity of vacancies) and the effectiveness of the search as well as the factors which affect supply (the intensity of the job search). However, the estimations in Hungarian studies compare the behaviour of groups of the same productivity (which expect wage and job offers of the same distribution) who only differ in terms of the amount or duration of the unemployment benefit they are entitled to.

### The positive effect of transfers on the labour market

Unemployment benefits may keep the reservation wage higher than optimal, and thus can increase the period of unemployment, but at the same time they help job seekers find the position most suited to their abilities, thus making the worker–employer match more effective. Besides solidarity, this is the strongest argument for mandatory state unemployment insurance. This is because such an insurance would not work on a market basis, while it is the only way to ensure that workers who lack the savings to support a family and themselves can still search for a new job with the appropriate care. Benefit payments also make sense even if the problem could be tackled by taking out a loan, because many people cannot realistically assess their future opportunities or are unable to secure an adequate loan due to a dysfunction in the capital markets.

*Chetty and Looney* (2006) estimated that in both the United States and Indonesia, food consumption is reduced by 10 per cent if the main earner becomes unemployed. This shows that households can compensate for the most part of the income loss resulting from unemployment: this finding suggests that the welfare gain resulting from the implementation of a formal unemployment insurance system should be low. However, in the case of Indonesia, it should also be taken into account that people use inefficient methods to avoid their consumption declining with their income (in technical terms: they smooth their consumption). Generally, if consumption does not closely follow the changes in income because people are highly risk averse, then public insurance would provide significant welfare gains by eliminating inefficient adaptation strategies, such as reducing human capital investments (*Chetty and Looney* 2005).

So far there is only one Hungarian study on the positive effect of unemployment insurance: *Galasi* (1996) analyses the effect of the amount of the unemployment benefit on the intensity of job search, using data for 1992–1995 of the household panel of TÁRKI. His estimates reveal that a larger benefit amount is associated with greater intensity in searching for a job, in the case of men. Thus, a larger benefit improves the chances of finding a job, since more intensive job search is likely to increase the frequency of job offers.

In the past twenty years, five papers have been published on the insurance-based unemployment benefit and four on the allowance for the long-term unemployed, and neither of them revealed a substantial negative effect on labour supply. For instance, in a study of those who exhausted their entitlement to the unemployment benefit, *Micklewright and Nagy* (1998) find a sudden increase in the re-employment rate of claimants immediately after they exhausted the benefit – suggesting that some of them found a job earlier, but delayed the entry –, but the affected group is only 2–3 per cent of the cohort under analysis. *Wolff* (2001), the most prudent of the three studies dealing with the reform of 1993, finds no effect of a combined decrease in the replacement rate (the benefit divided by the previous wage) and in the benefit duration in the case of men, and only a minor positive effect in the case of women.[17] *Köllő* (2001) estimated the effects of the benefit amount using data from the Unemployment Register of the Employment Office and survey data gathered in the spring of 2001.[18] According to his results, the replacement rate does not affect re-employment, but there is a slight increase in the probability of entry at the end of the entitlement period. However, the effect is only substantial for a minor fraction of the unemployed (those with a high school degree or higher). *Micklewright and Nagy*

17 This result somewhat refined the previous estimation by *Micklewright and Nagy* (1998) in which they did not control for the effect of recalled workers. This is due to the fact that the effect of the tightening was measured by a comparison to the employment probabilities of two groups of benefit recipients: those who became unemployed just before and immediately after the reform. This introduced a bias because the share of workers recalled to their previous job (for seasonal work) was higher among new entrants, and these recalled workers have a higher chance of entering employment. See a more detailed review of the analyses on the effect of this and similar reforms in *Wolff* (2001) and *Cseres-Gergely* and *Scharle* (2012).

18 Also controlling for the effect of the higher re-entry rate of recalled workers.

(1998), pertaining to the spring of 1994, estimated the largest disincentive effect out of the four papers which analyse the benefit for the long-term unemployed: they find that entitlement to the benefit is associated with a 0.144 decrease in the probability of entering employment in the case of men (0.157 in the case of women). Further estimations show smaller effects, but the differences are minor, and can be explained by changes in either the willingness to work (a shift in preferences) or in the entitlement conditions for the benefit, or by small differences in the estimation procedures.

## Conclusion

The primary function of taxes and transfers is to provide funding for public expenditure, redistribute earned incomes on value-based terms, and compensate for labour income loss. Although their effect on labour supply is unintended, it deserves special attention, since it can jeopardise the sustainability of the economy. A detailed understanding of these supply side effects is a precondition to maintaining a sustainable welfare system.

This chapter explored how the tax and transfer system affects the participation decision of individuals, and how it enhances or reduces the intensity of job search and the entry into employment.

Hungarian empirical studies reveal that the labour supply effect of the tax and transfer system can be significant among certain groups: *Benczúr et al*. (2012) find that mainly the low-skilled, the older workers, and married women are sensitive to taxes as well as transfers, as opposed to prime-age workers with higher education who are practically insensitive to such changes. Due to the all-inclusive nature of the estimation method, this result cannot ascertain whether the entitlement (access) to the various transfers or the amount of the transfer (compared to expected wages) has the stronger effect on participation. Thus, it remains unclear whether a tightening of entitlement conditions or a reduction in the benefit amount is better suited for increasing participation.

Estimations on the various transfers seem to confirm the former: there was no substantial increase in the re-entry rate of mothers resulting from the abolition of the insured maternity leave in 1996 (which meant a reduction in the amount, since everyone remained entitled to the flat rate leave), while studies on old-age retirement and the increase in retirement age (which tightened access) found a significant labour supply effect.

Results on the timing of entering employment and the probability of finding a job add further support: the papers which analyse the timing of entering employment following a cut in unemployment provisions find no significant positive effect on labour supply.

Finally, though it is not discussed in this volume, we must note that the primary function of transfers is not the creation of incentives for labour supply, but the redistribution of incomes. Therefore, reducing their disincentive

effects requires measures which are not in contrast with this primary function (that is as long as decision makers do not want to alter the scope of redistribution as well). Such measures may include the tightening of the access or of behaviouralconditions, or a more consistent enforcement of existing job search conditions.

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# 4. MICROSIMULATION AS A TOOL FOR ASSESSING THE IMPACT OF TAX CHANGES

DÓRA BENEDEK, GÁBOR KÁTAY & ÁRON KISS

Microsimulation makes it possible to take into account differences across households in the impact assessment of government measures. Heterogeneity may be important for two reasons. First, measures may affect different households differently (e.g., high and low-income households, families with and without children, etc.). Second, different households may respond differently to the same policy measure. Microsimulation modelling makes it possible to quantify the effect of heterogeneity. Using the results of the previous two chapters on labour supply, this chapter analyses how changes in the tax and transfer system affect labour supply and macroeconomic performance.

## Microsimulation as a tool

### *What is microsimulation?*

Microsimulation is a modelling tool that can be applied in the analysis of the effects of economic policy measures at the level of economic units (individuals, firms, households).[1] The modelling is based on a database providing detailed information on a sample of economic units such as the age, gender, and earnings of an employee; or the number of employees and annual revenue of a firm, etc. The first step in the impact assessment of an actual or hypothetical government measure is to calculate how the changes affect the individual economic units. For example, in the analysis of personal income taxation, microsimulation modelling begins with calculating the tax liability for each taxpayer before and after the changes. The total tax revenue is then calculated by aggregating the tax payable by individuals, weighted by population weights. Given that the unit of analysis is the individual, the simulation can take into account the interactions between various elements of the tax system, for example how a taxpayer's child tax credit is affected by changes in the rules of another tax credit. Such exercises cannot be conducted – or only less accurately – without microsimulation. This is why microsimulation is important in the *ex ante* impact assessment of government measures.

The use of microsimulation models has become increasingly widespread in policy making and policy analysis in the last two decades. They allow policy analysts to assess the redistributive impact of planned reforms, i.e., the analysis of which social groups win and which ones lose as a result of a policy change.

1 This paper only discusses models used for the analysis of tax and transfer systems, although microsimulation modelling is also used in other areas.

Microsimulation models allow one to study the effects of complex reforms (for example the overhaul of the whole family support system) as well as changes affecting only one element of the system [such as a targeted increase in the child tax credit or the introduction of a 0% tax rate as a substitute to the employee tax credit (ETC)].

The two key elements of a microsimulation model are thus a database representing the population and a set of rules decsribing the tax and benefit system. These two determine the accuracy of the model. The database can be of two types: it may be a survey or an administrative database. The Household Budget and Living Conditions Survey (in Hungarian: *Háztartási költségvetési és életkörülmény-adatfelvétel, HKÉF*) of the Hungarian Central Statistical Office (in Hungarian: *Központi Statisztikai Hivatal, KSH*) is an example for the first, while the representative sample of individual tax returns from the National Tax and Customs Administration (in Hungarian: *Nemzeti Adó- és Vámhivatal, NAV*) is an example for the second. Both types of data have advantages and disadvantages. Surveys typically have a smaller sample size which makes estimation errors larger; also, sample selection and misreporting may cause systematic measurement errors. On the other hand, the advantage of surveys is that they provide information about the household, as opposed to just the individual. Administrative databases in turn are larger but they often provide information only about the individual and no information on other members of the household (at least this is the case in Hungary). Furthermore, administrative data sources only have information that is strictly related to the purpose of the public data collection at hand. It is possible, although far from sure due to the nature of the issue, that survey data include information on undeclared income and work. As a consequence, the decision which type of data to use should be made in the light of the research question. If the focus is on changes in taxation then the administrative database is usually the better choice. However, if the analysis focuses on taxation and transfers simultaneously, then information about the family is probably necessary, therefore the appropriate data source will be a survey such as the HKÉF.

Microsimulation models can be divided into static and dynamic models. The former are based on the simplifying assumption that economic actors do not change their behaviour in response to reforms, while the latter takes such behavioural reactions into account.[2] Although in reality economic agents may change their behaviour in response to measures, static models can still be useful. Firstly, they are sometimes the only tool we have in the absence of reliable empirical estimates for the behavioural response. Secondly, even if there are empirical estimates of the parameters describing behavioural responses, it is not always easy to assess the estimation error and its impact on the simulation results. The assumptions underlying static simulation are simpler, and its weaknesses more transparent, which can be an advantage when interpreting the results.

2 This type of dynamic microsimulation is also often referred to as *behavioural* microsimulation. Some of the literature uses the term *dynamic* microsimulation in a more specific sense: it is used to describe long-term models, typically used for the long-term analysis of social security systems, that take into account the aging of generations.

## *The development of microsimulation modelling*

One of the first microsimulation models (TAXSIM) was developed by the National Bureau of Economic Research (NBER) in the USA at the end of the 1970s (*Feenberg and Coutts*, 1993). Currently, most developed countries use microsimulation models both in public administration and in research institutes[3] particularly for the impact assessment of policy proposals. In the United Kingdom, for example, various microsimulation models are used: PenSim2 is used for the analysis of the pension system (*Emmerson et al.* 2004), the Policy Simulation Model is used for the analysis of proposed changes in the tax and benefit system, and a number of universities and research centres, such as the Institute for Fiscal Studies (IFS), have their own models. The Netherlands Bureau for Economic Policy Analysis (Centraal Planbureau, CPB), which plays the role of a fiscal council, has a multi-purpose microsimulation model, MIMOSI (*Romijn et al.* 2008). Microsimulation has been used in the US to analyse the potential impact of different health care reform proposals on the proportion of the uninsured (*Gruber,* 2005, 2008, and *Gruber and Levitt*, 2000), the employment incentives of family taxation in Germany (*Steiner and Wrohlich,* 2004), and different scenarios of pension reform in Belgium (*Desmet et al.* 2007). Most of these models take into account behavioural effects. Finally, the EUROMOD model should be mentioned: a model that covers EU Member States and makes it possible to carry out static microsimulation and comparative analysis of countries. There is also an extension for a limited group of Member States for dynamic analysis.

Microsimulation modelling has developed in two important directions in recent years (see for example *Bourguignon and Spadaro,* 2005, and the overview by *Williamson et al.,* 2009). On the one hand behavioural effects, particularly labour market behaviour is increasingly incorporated into the simulation (see for example *Aaberge et al.,* 2000, *Blundell et al.,* 2000, *Creedy and Duncan,* 2002, and *Immervoll et al.,* 2007), in parallel with the increasing emphasis on economic incentives in economic policy. While these models have mostly concentrated on the adjustment of labour supply at the intensive margin, i.e., adjustment of working hours, more recent research tries to take into account the extensive margin as well, i.e., entry to and exit from the labour market.

Another important development in recent years has been the integration of micro- and macro approaches in economic policy modelling by the combination of microsimulation and "computable general equilibrium" (CGE) models. By linking microsimulation to macro models it is possible to take into account indirect macroeconomic feedback effects and thus quantify the overall economic effects of policy changes. The microsimulation module ensures that the analysis also takes into account household heterogeneity. Therefore, as opposed to traditional macro models, the analysis is not based on the assumption

3 Some models, mainly used in Anglo-saxon countries are available at microsimulation.org.

of one, or a few, representative households. Although commonly this approach was applied to developing economies, various studies used it in the analysis of taxation in developed countries, such as *Aaberge et al.* (2004) to explore the effect of ageing on the sustainability of public finances in Norway; *Arntz et al.* (2008) to analyse the hypothetical reform of the German welfare system; and *Fuest et al.* (2008) and *Peichl* (2009) to analyse the hypothetical introduction of a flat income tax in Germany. *Davies* (2009) provides a survey of the linked microsimulation-CGE approach, while the topic is also picked up by the special issue of an international journal focusing on microsimulation (*Bourguignon et al.* 2010).

*Microsimulation analyses in Hungary*

The history of microsimulation in Hungary dates back to around 15 years ago; the method has however gained ground in recent years. The first tax and benefit microsimulation model was developed by the research institute Tárki for the Ministry of Finance in 1997 (*Szivós et al.* 1998). Later, Tárki and the Ministry of Finance cooperated to develop the microsimulation model "TÁRSZIM" in the first half of the 2000s. This model is based on a database that links data from tax returns to the HKÉF. This model was used by *Benedek and Lelkes* (2005) to analyse the effect of the introduction of a hypothetical flat tax in Hungary. The Ministry of Finance also developed its own model, HKFSZIM (*Benedek et al.* 2009), based solely on the HKÉF. At the same time, Ecostat also created microsimulation models to analyse the Hungarian tax and benefit system (*Ecostat,* 2009, *Cserháti et al.,* 2007, 2009). The "HKFSZIM" model was developed further by the Office of the Fiscal Council by incorporating the adjustment of labour supply at the intensive margin, and by an attempt to link microsimulation to the macro model of the Fiscal Council (the two models were linked by manual iteration). The extended HKFSZIM model was used by the Fiscal Council to analyse the effect of proposals regarding the tax system (*Fiscal Council,* 2010, *Benedek and Kiss,* 2011) and for own research projects. One of these projects, by *Gáspár and Varga* (2011), analysed the incidence of non-performing mortgage loans during the economic crises, assessing the relative importance of contributing factors such as job losses and the depreciation of the currency. The analysis conducted simulations to estimate the ratio of non-performing loans under different economic scenarios.

Four other Hungarian studies used microsimulation to analyse the effect of tax changes, however these did not develop a full-fledged model. One of these is the study by *Bakos, Benczúr and Benedek* (2008) that estimated the elasticity of taxable income and simulated, using the elasticity, the effects of the introduction of a flat income tax. *Kiss and Mosberger* (2011) used a simulation of a tax increase on high earners to illustrate the economic significance of their

estimated taxable-income elasticity. More complex microsimulation calculations were presented by *Benedek and Kiss* (2011) using partly static, partly dynamic microsimulation methods. Finally, *Benedek and Lelkes* (2011) used a microsimulation approach to estimate the impact of tax evasion on income redistribution (see *Chapter 6* of *In Focus – I*).

## A microsimulation tool

The rest of this chapter uses a microsimulation model created by Péter Benczúr, Gábor Kátay and Áron Kiss in Magyar Nemzeti Bank (MNB, the central bank of Hungary) to analyse hypothetical and actual economic policy measures (for a detailed description of the model see *Benczúr et al.* 2012a; the first results of the model were published in a non-technical paper in the MNB Bulletin, *Benczúr et al.* 2011).

The model has two important differences compared to microsimulation models used previously in Hungary. First, it takes into account labour supply adjustment both at the intensive and extensive margin; second, the microsimulation module is embedded in a small macro model, which means that long-term, general-equilibrium effects of government measures can be analysed. Two elements of the modelling strategy can be viewed as contributions to the international literature: 1) the way adjustment on the extensive margin is taken into account, 2) the full integration of the macro model and microsimulation that is made possible by the simplicity of the macro model.

Before moving on to the analysis, the main characteristics of the model are described. The model is based on the 2008 wave of the HKÉF. The use of the household survey is necessary because the model aims to analyse the effects of the whole tax and benefit system. Although it would be possible to use a more recent wave (the 2009 and 2010 waves are available at the time of the writing of this chapter), these are snapshots of an economy in recession. Considering that the dynamic effects calculated by the model are long-term, representing a hypothetical transition "from equilibrium to equilibrium", data from the last year prior to the crisis appeared to be a better choice.

The income distribution observed in HKÉF data – particularly at high income levels – does not correspond to that observed in administrative data; therefore an income correction step has been carried out before the simulation. Income reported by taxpayers in the HKÉF was multiplied by a percentile-specific correction factor at high income levels.

The model explicitly simulates labour supply adjustment at both the intensive and extensive margin. Labour supply adjustment on the intensive margin is identified with the elasticity of taxable income, as estimated by *Bakos et al.* (2008) and *Kiss and Mosberger* (2011) (see *Chapter 2* of *In Focus – I*). We calculate the marginal and average tax rates for each tax payer before and after the tax changes; the adjustment at the intensive margin occurs by allowing

the taxpayers to increase or decrease their reported income to the extent corresponding to the estimated elasticities.

Identifying the labour supply adjustment at the intensive margin with the elasticity of taxable income is a natural choice from the perspective of a fiscal analysis, but may be questioned from a macroeconomic perspective. It is an error to equate these two concepts if the taxable income elasticity is not caused by any real economic adjustment (changes in the number of hours worked or work intensity) but rather simply by tax optimisation such as "relabeling" of income. There are two reasons why we assume that the elasticity parameters largely represent real labour supply adjustment. First, the estimated parameters are considerably lower in Hungary than in other countries where the taxable income can be significantly reduced by applying deductions (such as the United States), and it does not differ significantly from estimates of the taxable-income elasticity on broader definitions of income in the US that are harder to manipulate by the taxpayer. Our estimated parameters are also consistent with earlier international studies that estimated the elasticity of labour supply (number of hours worked) directly (see for example *Meghir and Phillips,* 2010). Second, as discussed in *Chapter 2* of *In Focus – I*, the taxable income elasticity of individuals with wage income only is not lower than that of other groups in our estimations, whereas these individuals are probably the least likely to engage in tax optimisation practices.

The modelling of adjustment at the extensive margin is based on estimates by *Benczúr et al.* (2012b). The approach and the results are presented in detail in *Chapter 3* of *In Focus – I*, therefore only a brief overview is provided here. Apart from individual characteristics, willingness to work is influenced by the amount of income an individual can expect to receive when working or out of a job. The difference between these two is the *"gains-to-work"*: this is lower than the wage income for those who lose eligibility for certain benefits when they take up work [an example is the child care benefit (*"gyed"*)]. For those who are in employment the simulation determines, based on the relevant rules, what transfers they would be eligible for if they were not working. For those who are out of work the wage they would be offered on the market is estimated. Then the model computes the gains-to-work for each individual and it calculates, based on the relationship estimated by *Benczúr et al.* (2012b), the probability of being active, given each individual's age, gender and other characteristics. The microsimulation model thus calculates the labour supply shock resulting from a change of the tax and transfer system as a sum of two components: adjustment at the intensive and the extensive margin.

The labour supply shock thus calculated serves as an input into a small macroeconomic model that calculates how changes in labour supply affect real wages, the capital stock and output in the economy. The macro model is a long-run, neoclassical model of a small, open economy. In the long run capital is nearly

perfectly mobile internationally, or put differently, differences in the (risk-adjusted) returns between countries are nearly completely equalised. Therefore the supply of capital is highly elastic in the model. In addition to the capital supply equation, another element of the macroeconomic model – based partly on micro-based estimates and partly on calibration – is a production function of the economy. In equilibrium, wages are equal to the marginal product of labour, as derived from the production function. The production function also influences the long-term substitutability of capital and labour.

Long-run equilibrium wages, as determined in the macro model, influence the long-term supply of labour: thus the behavioural microsimulation is repeated based on the output of the macro model; then, using the resulting labour supply shock, the macro model is re-run. This iterative process is continued until equilibrium is reached, that is, until the wage development on which the microsimulation is based corresponds to the macroeconomic consequences of the labour supply shock that is the result of the microsimulation.

The microsimulation model can, with relatively few components, assess the long-run labour supply and fiscal implications of changes in taxes and transfers. The main components are the labour supply elasticities (themselves based on empirical estimates) and the small macroeconomic model assuming a very elastic adjustment of capital supply. However, there are a number of important considerations that the model does not take into account. These should be kept in mind when interpreting the results. The most important limitations are the following:

1) The macroeconomic model is suitable for comparative statics exercises; the dynamics of the transition path to the new equilibrium cannot be analysed.

2) Also following from the static character of the macro model, it does not explicitly model the consumption-savings decision of households (and the level of consumption does not feed back into other relationships of the model). Consumption (and VAT revenue) is thus calculated by the model based on a simplifying assumption that households spend their total disposable income. On the short run this means that we overestimate consumption and VAT revenue; in the long run, however, it may be a more acceptable approximation.

3) The model is not closed from the side of the state; thus budget deficit (and debt) does not affect the sustainability of government finances via interest rates. This is less of a problem for a static macro model than it would be for a dynamic model; nevertheless, when interpreting the results it must be kept in mind that the model does not take into account the implications for fiscal sustainability of various sets of measures.

4) Calculations of the employment effects are based on the assumption that group-specific unemployment rates observed in 2008 represent equilibrium unemployment levels; the micro-mechanisms of search-and-matching in the job market are not, however, modelled in detail. This may be a relevant ommis-

sion if some labour market reforms affect the mechanisms of job search-and-matching. For instance, if the duration of unemployment assistance is too short, job seekers might be less likely to find suitable job opportunities. A less effective labour-market matching has a negative effect on economic efficiency. The model does not take these considerations into account; it focuses exclusively on the incentive effect of transfers, that is, that transfer cuts induce individuals to search more intensively for a job. This means that the model may overestimate the positive long-term effect of transfer cuts on employment.

5) The model treats different types of labour (skilled and unskilled, for instance) as "perfect substitutes". This means that the model assumes that all job seekers will eventually find employment at the equilibrium wage rate (subject to a group-specific equilibrium unemployment level). It also follows that relative labour costs are assumed to correspond to relative productivity levels. The model ignores the possibility of a structural mismatch between labour supply and demand in terms of education, experience, or regional distribution. Although this assumption makes sense in the very long run, it may result in overestimating the employment effect of transfer cuts because it is uncertain that individuals – even if they want to find a job – have the same likelihood of finding employment as seemingly similar workers already employed.

6) Point 4 and 5 highlighted factors that might lead to the model overestimating the long-run employment effects of transfer cuts. It should be added that the long-run approach of the model hides the fact that transfer cuts reduce aggregate demand and therefore slow down growth in the short run (particularly in a weak cyclical position). We also note that transfer cuts increase the inequality of income distribution; this effect can be evaluated by the model (for detailed calculations see *Benczúr et al.* 2011, 2012a).

7) The model is based on the assumption that real wages are perfectly flexible over the long term. This assumption guarantees that all labour supply shocks increase employment. If wages cannot adjust for some reason, the excess labour supply leads to an increase in unemployment rather than the expansion of employment. The assumption of perfectly flexible wages means that the effects of a minimum wage policy cannot be evaluated in the model. The minimum wage puts a legal limit on downward wage adjustment, reducing the employability of low-productivity workers (its effect can however be eroded in the long run if it is increased at a slower pace than the rate of general wage inflation).

8) Our framework does not explicitly model the behaviour of the self-employed and the informal sector (for more on the informal sector see *Chapter 6* of *In Focus – I*). The labour supply elasticities that are used in the model (particularly in the case of adjustment at the intensive margin) are mainly related to employees (rather than entrepreneurs). This means that in the simulations we make the implicit assumption of unchanged behaviour on the part of the self-employed. With regard to the informal sector, the main issue is that it

is unclear whether undeclared work is at least partly observed in the survey data of the HKÉF. If only legal employment is observed in our data, than our simulation results are valid for declared employment, while the fiscal effects are estimated without distortions. If, however, respondents in the HKÉF also report undeclared work, then the results concerning employment will reflect both declared and undeclared work, while our estimated fiscal effects will be less accurate. The simulated employment effects may be accurate even in this case because the estimation of adjustment on the extensive margins is based on the HKÉF data (see *Benczúr et al.* 2012b); that is, the estimation and the simulation relate to the same indicator of employment, itself probably close to the official employment statistic calculated based onKSH's Labour Force Survey.

## Analysis of changes in the tax and transfer system

This section aims to answer three questions with the help of the microsimulation model. 1) First, a flat-rate income tax system is compared to three alternative tax systems in which groups of low-income earners face lower tax rates. 2) Second, revenue-neutral reform packages are compared to see which one is more friendly to economic growth and employment. 3) Finally, the long-term effects of actual measures introduced since 2010 are simulated.

There is some overlap between the analyses presented here and our previous analyses published in the *MNB Bulletin* (*Benczúr et al.* 2011); however, the analysis has been updated to reflect policy measures adopted or proposed since the publication of that article. While both this paper and the *MNB Bulletin* article focus on specific actual reform packages, *Benczúr et al.* (2012a) aims to provide a detailed, and more technical, description of the model rather than a detailed analysis of hypothetical or actual reform packages. Only the simulations of revenue-neutral scenarios (i.e., point 2) above) and the results reported in *Table 4.4* are taken from that paper, without substantial changes.

### *The employee tax credit and its alternatives*

*Table 4.1* displays the results of three scenarios. In all three the benchmark is a hypothetical, pure, flat income tax system (with a tax rate of 16%) without any employee tax credit or child tax credit, in which taxable social transfers and benefits are taxed as "independent" income (non-wage income). All other aspects of the tax system are based on rules that were in force in 2010. This benchmark is chosen for three reasons. First, apart from the child tax credit, it is close to the ideal tax system as envisaged by the current Hungarian government. Second, the simplicity of the benchmark makes it very easy to analyse the partial effects of single policy measures without the interference of confounding elements. Finally, since the social transfers are taxed as independent income, as opposed to wage income, the employee tax credit does not decrease

the tax payable after them. Therefore, the employee tax credit only reduces the taxes payable after wages. As will be shown this is an important difference compared to the tax credit system that had been in force until 2011.

The first pair of columns present the effects of a simple employee tax credit as compared to the benchmark tax system. The employee tax credit makes wage income tax exempt up to the minimum wage – a monthly income of HUF 73,500 (approximately EUR 270) in 2010. With a tax rate of 16% the maximum amount of the employee tax credit becomes HUF 11,760. The employee tax credit is phased out at a rate of 10% starting right at the minimum wage. The static fiscal effect of the employee tax credit thus specified – considerably less generous than the actual tax credit between 2003 and 2011 – is approximately HUF 180 billion, roughly equivalent to the cost of job protection measures being introduced in 2013 (see below). While its employment effect is considerable – two per cent – it increases effective labour and GDP to a lesser extent suggesting that those newly entering employment are mainly low-skilled, low-productivity workers. The large employment effect is mainly due to the fact that the tax credit can only be used on wages, thus the financial gains to employment increases substantially for low earners, which creates incentives to take up employment.

The scenario in the second pair of columns achieves the tax exemption of incomes up to the minimum wage through the introduction of a zero-per-cent lower tax rate. The difference between the zero-rate version and the tax credit is that all tax-payers (even the high earners) benefit from the zero rate since it is not phased out. This also means that this scenario is considerably more expensive for the government budget than the employee tax credit. To correct this, the upper tax rate must be set in a way that the cost of this reform package is roughly equal to the first scenario: in this case, the marginal tax rate on income above the minimum wage is 24 per cent instead of 16 per cent.

*Table 4.1* shows that the zero-rate version performs worse in every aspect than the tax credit: in addition to a significantly lower employment effect, it has a negative impact on effective labour, capital and GDP. The reason for this is that the higher, 24% marginal tax rate has a negative impact on higher earners' labour supply at the intensive margin.

The third pair of columns show the estimated impact of the targeted employer-contribution relief included in the government's "Job Protection Program" as effective in 2013. As part of these measures, workers aged under 25 or over 55 or those in manual occupations ("category 9" of the Hungarian occupation classification system FEOR, based on the international system ISCO) are eligible for a 14.5 percentage point employer-contribution relief after wages up to HUF 100,000 for two years; women returning to work after receiving child care benefits are entitled to a 27 percentage point employer-contribution relief on wages up to HUF 100,000 forints for two years (and a relief of 14.5 percentage points

for an additional year). As argued in *Chapter 3* of *In Focus – I*, the contribution relief actually targets groups with a low employment rate whose labour supply probably responds sensitively to incentives at the extensive margin. The previous two scenarios have been calibrated to have a similar static fiscal impact to the "Job Protection" measures. The results indicate that although employer contribution relief has a considerable impact on employment, it is still lower than the effect of the employee tax credit presented in the first two columns. At the same time, its dynamic effect on the government budget balance is more favourable.

**Table 4.1: Tax credit and its alternatives**

| | Employee tax credit[a,b] | | Zero lower rate with a higher regular rate[a] | | "Job Protection" measures[a,c] | |
|---|---|---|---|---|---|---|
| | static | dynamic | static | dynamic | static | dynamic |
| **Macroeconomic effects (difference from the benchmark in per-cent, levels)** | | | | | | |
| Effective labour | | 0.9 | | –0.6 | | 0.6 |
| Employment | | 2.0 | | 1.3 | | 1.0 |
| Capital stock | | 0.7 | | –0.5 | | 0.5 |
| GDP | | 0.8 | | –0.6 | | 0.6 |
| Gross average wage | | –0.1 | | 0.1 | | 1.6 |
| Disposable income | | 2.4 | | 1.5 | | 1.4 |
| **Fiscal effects (HUF billion, 2010 prices)** | | | | | | |
| Personal income tax | –185 | –185 | –177 | –199 | 0 | 30 |
| Employee contributions | 0 | 9 | 0 | –8 | 0 | 35 |
| Employer contributions | 0 | 19 | 0 | –16 | –185 | –142 |
| Taxes on consumption | 35 | 44 | 32 | 27 | 0 | 26 |
| Taxes on corporations | 0 | 5 | 0 | –4 | 0 | 4 |
| Taxes on sales | 0 | 4 | 0 | –3 | 0 | 3 |
| Transfers | 1 | 25 | 1 | 8 | 0 | 9 |
| Change of budget balance | –150 | –79 | –144 | –194 | –185 | –37 |

[a] Compared to a flat tax of 16% without any type of tax credits.
[b] Social transfers are not eligible for the employee tax credit.
[c] The following groups are eligible for an employer-contribution relief. Workers aged under 25 or over 55 and those in occupations of "category 9" in the Hungarian occupation classification system (FEOR, based on the international system ISCO): 14.5 percentage points after a gross monthly wage of up to HUF 100,000 for two years; women returning to work after receiving child care benefits: 27 percentage points after a gross monthly wage of up to HUF 100,000.
Note: Positive changes of budget balance indicate an improvement and negative figures a deterioration of the balance. The estimate of the VAT revenue is based on a simplified assumption.

This should not be taken to mean that any type of employee tax credit must do better than any set of targeted incentives. One of the most important arguments in favour of targeted incentives is that they may help to filter out workers whose earnings are underreported (officially earning the minimum wage but receiving payments in cash), and thus may help reduce tax avoidance. Anoth-

er argument for targeted incentives may be that they are not phased out, thus they do not increase marginal tax rates in the phase-out region – even though the hypothetical employee tax credit in our simulations is phased out at lower-to-middle income levels and (as argued in *Chapter 2* of *In Focus – I*) marginal tax rates have minimal or no effect on the labour supply at those income levels. An argument in favour of tax credits, in turn, may be that low market wages define sufficiently well which groups need incentives: it is likely that many people who are out of employment would earn relatively low wages: not enough to compensate for lost transfers and other non-labour income. Increasing their gains-to-work may target the incentives just right.

In this comparison the difference between the employee tax credit and the "Job Protection" measures is due to two main reasons: On the one hand, the tax credit affects a larger number of low-paid workers and exactly those to whom it matters most in terms of relative income. On the other hand the "Job Protection" measures provide contribution relief to other workers for whom the incentive effect is not relevant (such as higher-paid women returning after maternity leave or the highly skilled and highly paid employees under 25 or over 55).

### *Revenue-neutral reform packages*

The three scenarios presented in *Table 4.2* describe policy packages that have a nearly neutral fiscal effect. The simulations were taken from the working paper by *Benczúr et al.* (2012a). The benchmark in this case is the tax system of 2008. The first pair of columns present an across-the-board Personal Income Tax (PIT) cut financed by an increase of the Corporate Income Tax (CIT). The second scenario assumes that the PIT cut is financed by transfer cuts, more specifically the elimination of the possibility of early retirement. In the third pair of columns a similar transfer cut is combined with a cut in the CIT.

The first pair of columns indicate that a revenue-neutral package consisting of an across-the-board PIT cut and a CIT increase has a negative impact on the GDP. The reason is that capital supply is almost perfectly elastic in our model, whereas the reaction of labour supply to changes in taxation is a lot less elastic. Therefore, increases in labour supply that result from lower personal income taxation cannot counterbalance the decline in capital supply brought about by the increase of capital taxation, and therefore total production declines. However, the manner in which the PIT cut is implemented is important. Increased revenues from a higher CIT tax might make it possible to cut the PIT in a targeted way so as to achieve a positive overall GDP-effect.[4]

In the scenarios presented in the second and third pair of columns income and capital tax cuts are financed by cuts to social transfers. For the model, transfer cuts mean savings for the government budget *and* increasing labour incentives at the same time. Other, potentially counterveiling effects of transfer cuts are not taken into account in the model (see our discussion of the model's limita-

4 If the PIT cut is concentrated at high incomes, there might be cases when the GDP impact of the increased labour supply resulting from adjustment at the intensive margin is greater than the decline in output caused by the increase in the CIT.

tions above for more detail). Therefore in this simple framework transfer cuts have a clear and positive effect on both the labour market and the budget. The results suggest that employment increases more if the budget savings from transfer cuts are spent on PIT relief, while the capital stock and GDP increase more if they are spent on CIT relief.

**Table 4.2: Revenue-neutral policy packages**

| | CIT increase[a] and PIT cut[b] | | Elimination of early retirement[c] and PIT cut[b] | | Elimination of early retirement[c] and CIT cut[a] | |
|---|---|---|---|---|---|---|
| | static | dynamic | static | dynamic | static | dynamic |
| **Macroeconomic effects (difference from the benchmark in per-cent, levels)** | | | | | | |
| Effective labour | | 0.7 | | 4.4 | | 3.7 |
| Employment | | 0.1 | | 4.1 | | 3.9 |
| Capital stock | | –6.7 | | 3.6 | | 10.1 |
| GDP | | –1.9 | | 4.1 | | 5.9 |
| Gross average wage | | –3.2 | | –0.3 | | 2.8 |
| Disposable income | | 1.3 | | 2.8 | | 1.4 |
| **Fiscal effects (HUF billion, 2010 prices)** | | | | | | |
| Personal income tax | –253 | –318 | –260 | –195 | –7 | 146 |
| Employee contributions | 0 | –30 | 1 | 53 | 1 | 84 |
| Employer contributions | 0 | –70 | 0 | 103 | 0 | 173 |
| Taxes on consumption | 46 | 21 | 3 | 46 | –42 | 22 |
| Taxes on corporations | 234 | 204 | 0 | 26 | –234 | –178 |
| Taxes on sales | 0 | –9 | 0 | 19 | 0 | 28 |
| Transfers | 0 | 1 | 241 | 255 | 238 | 249 |
| Change of budget balance | 27 | –201 | –14 | 307 | –44 | 523 |

[a] The CIT increase was calibrated as an increase of the effective tax rate on capital from 0.073 to 0.098; a CIT cut is calibrated as the effective tax rate decreasing to 0.048.

[b] The lower PIT rate (up to HUF 1.7 million) is reduced from 18% to 14.5%, while the upper PIT rate is reduced from 36% to 32.5%; the "extraordinary" top PIT rate (from HUF 7.137 million) decreases from 40% to 36.5%. The ETC makes the minimum wage PIT-exempt: its rate remains equal to the lower PIT rate thus its maximum monthly amount is reduced to HUF 10,005.

[c] In the scenario where the possibility of early retirement is eliminated, retired people under the pension age in our sample lose their entitlement to old age pension in our simulations. In this case static numbers should be interpreted as long-term effects without behavioural reactions.

Note: Positive changes of budget balance indicate an improvement and negative figures a deterioration of the balance. The estimate of the VAT revenue is based on a simplified assumption.

### *The long-term macro-economic impact of measures introduced since 2010*

The next set of simulations assesses the long-term impact of policy measures introduced in the past two years (2013 measures are taken into account as of August 2012, the closing of the Hungarian version of *In Focus – I*). Some of

these measures affect indirect taxes (on consumption, transactions or corporate income) that do not have a direct effect on labour market incentives; the intentional simplicity of the macro module should be taken into account when interpreting the simulated effects of these measures.

**Table 4.3: The impact of measures introduced between 2010 and 2013**

| | Changes in PIT and contributions[a] | | Changes in transfers[b] | | Other tax changes[c] | |
|---|---|---|---|---|---|---|
| | static | dynamic | static | dynamic | static | dynamic |
| **Macroeconomic effects (difference from the benchmark in per-cent, levels)** | | | | | | |
| Effective labour | | 5.0 | | 1.5 | | 0.0 |
| Employment | | 0.6 | | 2.6 | | 0.3 |
| Capital stock | | 4.1 | | 1.2 | | –0.1 |
| GDP | | 4.7 | | 1.4 | | 0.0 |
| Gross average wage | | 1.2 | | –0.1 | | 1.3 |
| Disposable income | | 7.3 | | –0.1 | | –4.2 |
| **Fiscal effects (HUF billion, 2010 prices)** | | | | | | |
| Personal income tax | –420 | –340 | 0 | 8 | 0 | 30 |
| Employee contributions | 131 | 226 | –22 | –5 | 0 | 17 |
| Employer contributions | –184 | –48 | 0 | 31 | –139 | –124 |
| Taxes on consumption | 57 | 132 | –18 | –2 | 361 | 377 |
| Taxes on corporations | 0 | 30 | 0 | 9 | –104 | –105 |
| Taxes on sales | 0 | 21 | 0 | 6 | 171 | 171 |
| Transfers | 0 | 7 | 115 | 132 | 0 | 4 |
| Change of budget balance | –416 | 28 | 75 | 180 | 289 | 370 |

[a] Elimination of "super-grossing" and the employer tax credit tax credit, abolition of non-taxable transfers, introduction of a flat income tax at a 16 per cent rate, expanded child tax credit, introduction in 2013 of the "Job Protection Program", increase of employee contributions.

[b] Cuts to the amount and maximum duration of the unemployment benefit, extended duration of the less generous type of child care benefit ("GYES") to up to the third birthday of the child.

[c] The simulation was calibrated based on information available in August 2012. Consistently with the government's publicly communicated intentions it was assumed that only one-third of the 2011–2012 bank tax would be made permanent. As of January 2013, this no longer reflects the government's official policy. Other tax changes in the period of 2010–2013 include cuts in the CIT, increases in the VAT and excise duties, the introduction of a tax on phone calls and text messages, the introduction of a tax on financial transactions, increases in the tax on company cars and the tax on insurance policies, the estimated extra revenue from the planned introduction in mid-2013 of an electronic road toll system, and the introduction of an optional new tax regime for small businesses.

Note: Positive changes of budget balance indicate an improvement and negative figures a deterioration of the balance. The estimate of the VAT revenue is based on a simplified assumption.

The first pair of columns in *Table 4.3* present the impact of changes to wage taxes and social security contributions (both on the employee and the employ-

er side). Overall, the measures appear to have the biggest effect by improving incentives for high earners, and to a lesser extent by promoting employment through the general PIT rate cuts, the extention of the child tax credit and the "Job Protection" measures.

The flat, 16 per-cent rate PIT significantly reduced the effective marginal tax rate for high income earners leading to considerable adjustment at the intensive margin in the simulation. Additional labour supply is gradually absorbed by labour demand through the adjustment of the wage rate, resulting in an increased level of effective labour (only a small part of which is new employment, while most is the reflection of adjustment at the intensive margin), capital and output. The elimination of the employee tax credit would, on its own, lead to a 2 per cent decline in employment, but other measures like the general PIT cut, the "Job Protection" program and the expanded child tax credit turn the overall effect into modestly positive territory. The balance of the elimination of the employee tax credit and the "Job Protection" program in terms of employment is simulated to be around minus one per cent, consistent with the results presented in the first sub-chapter, although it should be kept in mind that savings from the abolition of the ETC considerably surpass the cost of the "Job Protection" program. One reason why the ETC was relatively less efficient is that it could be credited against some government transfers (transfers taxed as wage income are typically insurance-type transfers like the unemployment benefit and some maternity benefits), thus its elimination was a tax increase and a transfer cut at the same time. In contrast, the targeted employer contribution relief affects only income from actual work.

Moving to the second pair of columns, the cuts in the amount and duration of the unemployment benefit significantly increase employment in our simulation; as we noted above, this result should be considered as an upper estimate and treated with great caution. The model takes into account only the financial incentive effect of transfers and ignores all other, potentially relevant effects. These might be particularly relevant in the case of the unemployment benefit: while reducing the duration of the assistance creates a stronger incentive for job search, and thus might reduce the reservation wage of job seekers, the matching of employees and employers might be affected negatively if the duration of the assistance is too short.[5]

The last pair of columns indicate the cumulative effect of other changes that are not directly related to labour taxation and transfers. The reduction of labour taxation (first pair of columns) and the CIT of businesses with revenue lower than HUF 500 million (approximately EUR 1.85 million) were offset mainly by increases in taxes on consumption (including the VAT, excise duties, the part of the new taxes on financial transactions and telecommunication services that falls on household consumption) and to a lesser extent by taxes paid by businesses on their inputs which we interpreted as taxes on sales (the

5 Most of the structural unemployment is the result of such labour market frictions and inefficiencies.

part of the new taxes on financial transactions and telecommunication services paid by businesses as well as additional charges related to the introduction of the electronic road toll system).[6] Despite the positive budget balance, the overall impact on the real economy is almost neutral because value-added type consumption taxes have a more limited impact on the real economy than labour and capital taxes. The moderate positive employment effect is due to the new options introduced in the taxation of small businesses. However, due to technical limitations, this was modelled in a very simplified way, as the reduction of the effective employer contribution rate from 27% to 16% to a specific group of businesses.

The cumulative effect of all measures assessed is displayed in the first pair of columns of *Table 4.4*. Individual measures may strengthen or weaken each other's effect, therefore the cumulative effect may be different from the sum of effects in *Table 4.3* (for example, the elimination of the ETC *after* the transfer cus has a lower impact on the transfer side and will thus have a greater negative effect on employment). The balance of effective labour, capital and GDP is clearly positive, the employment effect largely caused by the simulated effect of the unemployment benefit cuts: in a simulation without these measures employment would decline by 0.13 per cent.

**Table 4.4: The full 2010–2013 package and hypothetical risk-premium shocks**

| | Measures between 2010–2013 | | Risk premium of +50 basis points | Risk premium of +100 basis points |
|---|---|---|---|---|
| | static | dynamic | dynamic | dynamic |
| **Macroeconomic effects (difference from the benchmark in per-cent, levels)** | | | | |
| Effective labour | | 4.6 | 4.3 | 3.0 |
| Employment | | 2.6 | 1.5 | 0.9 |
| Capital stock | | 3.7 | -5.5 | -15.4 |
| GDP | | 4.3 | 0.9 | -3.5 |
| Gross average wage | | 2.3 | -1.6 | -5.4 |
| Disposable income | | 1.7 | -1.1 | -4.5 |
| **Fiscal effects (HUF billion, 2010 prices)** | | | | |
| Personal income tax | -405 | -319 | -374 | -440 |
| Employee contributions | 105 | 205 | 141 | 67 |
| Employer contributions | -293 | -164 | -257 | -368 |
| Taxes on consumption | 404 | 504 | 441 | 366 |
| Taxes on corporations | -103 | -76 | -120 | -170 |
| Taxes on sales | 169 | 195 | 174 | 147 |
| Transfers | 103 | 119 | 113 | 109 |
| Change of budget balance | -20 | 463 | 117 | -290 |

Note: Positive changes of budget balance indicate an improvement and negative figures a deterioration of the balance. The estimate of the VAT revenue is based on a simplified assumption.

6 In the calibration of the model we calculated an effective tax rate on consumption, including both value-added and transaction-type taxes. While the first influences only real labour incomes, the latter influences both real labour and capital incomes.

The third and fourth columns of *Table 4.4* present scenarios where, in addition to the effects of the complete set of economic policy measures, the required return on capital invested in Hungary goes up by 50 or 100 basis points. The required return can increase as a result of a riskier economic environment or if investors consider sectoral surtaxes, the effective nationalisation of private pension funds or retroactive taxation as signs of a permanent increase in uncertainty. It is not surprising that in a small open economy capital is very responsive to increases in the required return on capital, and a downward adjustment of the capital stock results in the decline of output and wages. The increase of the required returns has a more moderate impact on the labour market: an increase of 100 basis points reduces effective labour supply by just over 1.5 percentage points, while changes in the capital stock and GDP are much greater. According to these admittedly simplified calculations, an increase of 80 basis points in the required return wipes out the potential growth-enhancing effect of all other measures within the last two years.

## Concluding remarks

This chapter has provided an overview of the international and Hungarian applications of microsimulation methods and briefly presented the microsimulation model created by Péter Benczúr, Gábor Kátay and Áron Kiss at MNB. This model has been used to analyse the employment and macroeconomic effects of hypothetical and actual changes to the Hungarian taxes and transfer system.

Summarising the findings of the different impact assessments, the first part compared three alternative ways of promoting the employment of low-income groups that are characterised by a low employment rate. It has been shown that the introduction of a zero per cent tax rate up to the minimum wage performs less well than if the minimnum wage is made tax exempt by an employee tax credit. Using a simple parametric example it has been shown that a limited employee tax credit that can be credited only against wage income (and not against government transfers) and is phased out rapidly above the minimum wage (two aspects in which this particular variant is more restrictive than the actual ETC in Hungary between 2003 and 2011) would probably have a higher employment impact with a similar static fiscal cost than the "Job Protection Program" entering into force in 2013. In terms of employment level, the balance of the elimination of the ETC and the introduction of the "Job Protection Program" is approximately minus one per cent, although the fiscal balance of both measures is positive. The relatively small employment effect of the ETC compared to its cost is mainly due to the fact that until 2011 it could be credited against some government transfers, thus its elimination meant a PIT increase and a transfer cut at the same time.

The second set of simulations analysed the impact of revenue-neutral policy packages. The simulations have shown that the increase of capital taxes in

a small open economy (where capital supply is nearly perfectly elastic in the long run) has a significant negative impact on both the capital stock and output. Therefore, while financing labour tax cuts by capital tax hikes increases effective labour, it has a negative impact on GDP. Transfer cuts always have a positive impact in our model because they mean savings for the government budget and improved work incentives for the groups affected at the same time. As we have discussed in detail, this is due to the fact that the model only takes into account the role of transfers as financial incentives and ignores potential negative countervailing effects.

Finally, we have attempted to assess the potential long-term macroeconomic effects of the most important tax and transfer measures introduced in the period of 2010–2013. In the simulations the strongest effect of the policy package is to improve incentives for high earners and thereby increase the effective labour supply at the intensive margin. The employment impact of the whole policy package is moderate: the effect of tax changes is somewhat negative; the only substantial positive effect in the simulations appears to come from the cuts of the unemployment benefit. A permanent increase of the expected return on capital investments could easily turn negative the growth-enhancing effects of all other measures combined.

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## 5. LABOUR DEMAND EFFECTS OF TAXES AND TRANSFERS

### 5.1 A theoretical framework for measuring labour demand effects

ÁRPÁD FÖLDESSY & ÁGOTA SCHARLE

In the standard model of economics, the wage elasticity of labour demand depends on the elasticity of substitution between the factors of production (capital and labour), the price elasticity of the final product, the share of labour output within the total production cost, and the price elasticity of the other factors of production.[1] Thus, the labour demand of a firm mainly depends on the price of its product, the wage level, and the productivity of the workers. It will hire additional labour until the return on their product (marginal productivity) is higher than the wage cost. The wage elasticity of labour demand in the long run (when capital adjusts as well) equals the elasticity of substitution between labour and capital.[2]

In reality, the labour market is more complex than the above model, for several reasons. Human labour, which is the product on this market, is inseparable from the people who do the work; therefore, supply and demand does not only depend on wages. People are not all alike, and employers cannot always measure their exact productivity. Firms often operate on non-competitive markets, which make them monopolies to some extent, and as such, they can influence the prices of their products and/or the level of wages as well. The state regulates the labour market much more thoroughly than others: it determines the terms of layoffs and the maximum of working hours, it levies various taxes and contributions on wages, and sets the minimum wage. These peculiarities increase the cost of hiring and firing – for both parties.

This chapter explores the labour demand effects of social security contributions, which are one of the main tools of state regulation of the labour market. The ensuing subchapters briefly summarise earlier empirical evidence and provide a more detailed account of recent results.

In order to place these results into a common conceptual framework, let us return to the simple model presented in *Figure 1.2* of *Chapter 1* (Introduction), which shows employment on the horizontal axis, and wage on the vertical axis.[3] The demand curve is downward sloping: the higher the total wage cost, the lower the number of workers employed by the firm. The supply curve, however, is upward sloping: the higher the net wage, the higher the number of people who want to work. The two panels of the figure differ in the wage elasticity of labour demand: a given change in wages induces a smaller increase in

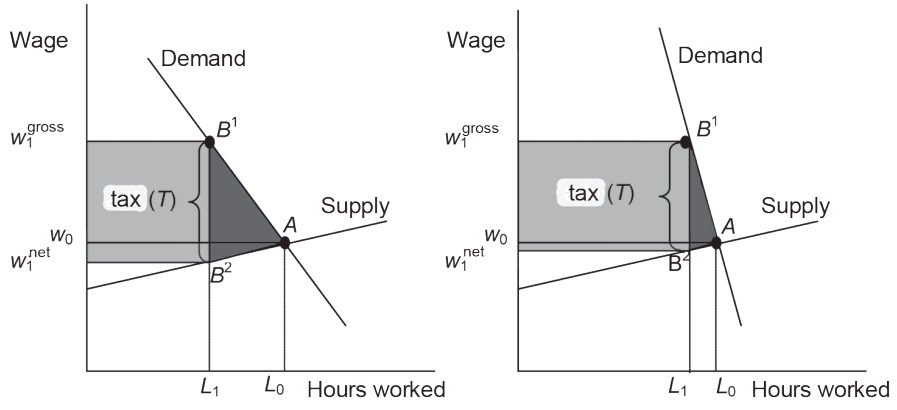
1 For the derivation of the labour demand curve see e.g. *Bosworth et al.* (1996).

2 To be precise: this statement assumes a two factor CES production function with constant returns to scale.

3 The next couple of paragraphs are based on *Scharle et al.* (2010).

labour demand in the right panel (i.e. the elasticity is lower). Market equilibrium occurs where demand equals supply at a given wage (point *A* in the figure, $L_0$). At this point, the total cost of labour equals the net wage ($w_0$).

**Figure 5.1.1: Equilibrium of labour demand and supply with a unit tax on labour**




Let us now introduce a unit tax of *T*. In this case the new equilibrium occurs at the employment level ($L_1$) where the difference between the gross and the net wage equals the tax ($T = B_1 - B_2$).[4] Without supply and demand adjustment, public revenue would equal $T \times L_0$, but the introduction of the tax decreases employment, therefore, the actual revenue is going to be $T \times L_1 < T \times L_0$.

How is the newly introduced tax burden shared between workers and employers? The figure shows that the gross wage increases by ($w_1^{gross} - w_0$), while the net wage decreases by ($w_0 - w_1^{net}$), and their relative magnitude depends on the *relative* slope of the demand and supply curves.

The existing empirical evidence suggests that the wage elasticity of labour demand in Hungary is in the middle range by international comparison. Although *Köllő* (1998) finds a relatively low parameter value (–0.17) for the period following the regime change, later studies based on micro-level data reveal an elasticity of around –0.5 and –0.8, in line with comparable estimates for mature market economies (*Kőrösi*, 2002a). *Jakab and Kaponya* (2010) use macro-level data for VAR-estimations and find a long-term partial effect of a similar magnitude (–0.67). The elasticity of substitution between capital and labour can also be identified using the investment equation, since – maintaining the assumption of a neoclassical environment – the price elasticity of capital demand equals the elasticity of substitution between inputs. According to an estimation based on the investment equation in *Kátay and Wolf* (2004), this long-term elasticity is –0.8, which is close to the estimates based on a labour demand equation.

The elasticity of demand for labour is highest at low wages – i.e., among the low-skilled. *Kertesi and Köllő* (2003) analyse firms' labour demand for 2000–

4 This result is independent of the legal incidence of the tax (i.e. who should be paying it) – see also *Subchapter 5.5*.

2001 with models distinguishing between three types of labour (unskilled, young–skilled, and older–skilled). The demand for unskilled labour (workers with lower secondary education or less) is much more elastic to wages: in the short run, a 1 per cent increase in wages is associated with a 0.4 per cent decrease in the demand for labour by firms, while this decrease stays below 0.2 per cent for skilled labour. These values are relatively low, but fall within the normal range for developed market economies (*Hamermesh*, 1993). The time series analyses of the demand for blue- and white-collar labour by *Tarjáni* (2004) for the years between 1992 and 2002 yield similar results.[5] Thus, a decreasing of tax burdens is likely to affect the employment of the low skilled, which is where the gap between Hungary and the EU 15 is most apparent.

The four subchapters of this chapter extend these findings in three separate directions. *Subchapter 5.2* reviews the results of earlier studies on wage subsidies. *Subchapter 5.3* – by presenting the results of a new paper – analyses how targeted wage subsidies for specific groups of workers affect the labour demand for the given group. *Subchapter 5.4* reviews the options for differentiating the minimum wage – which functions as a lump-sum tax on unskilled labour – in order to reduce its negative effect on demand. Finally, *Subchapter 5.5* gives a brief review of the international literature on the effect of social security contributions depending on whether they are paid by workers or employers.

## 5.2 The impact of previous wage subsidy programmes on employment

PÉTER GALASI & GYULA NAGY

Few studies examined the impact of wage subsidy programmes on employment in Hungary in the second half of the 1990s and the first half of the 2000s. The main characteristics of these studies are reviewed by *Cseres-Gergely and Scharle* (2012) (particularly: *Table 7.A2*, p. 171). This chapter provides a brief overview of the main findings of these studies.

Wage subsidy programmes were characterised by the following in the given period: employers were eligible for a subsidy of up to half of the wage cost for a maximum period of one year if they hired workers who had been registered as unemployed for at least six months (in the case of new entrants for at least three months) and retained them in work for at least twice the duration of the subsidy. Each year approximately 10–30 thousand people participated in wage subsidy programmes (October closing headcount) in the given period, and three months after leaving the programme 60–70% of participants were in non-subsidised employment (*MTA KTI,* 2012).

The first *programme impact evaluation* using control groups took place in the mid-1990s (1995–1997) as part of a project funded by the World Bank. In addition to research, the World Bank project also concentrated on development

5 See also *Galasi (2002)* on labour supply in Hungary and *Kőrösi* (2002b, 2005) on labour demand.

and created the monitoring system for active labour market measures in the employment office. The findings of this research are presented here based on *O'Leary* (1998).

In addition to wage subsidies, the research also included other programmes. The sample was selected from the unemployed register and the sample consisted of 1,000–1,500 participants per programme. The number of participants in the control group was approximately 4,500 people. All programme and control group samples were representative. The first observation took place in the second quarter of 1996 and the second observation in the first half of 1997. This design allowed registering the labour market status of all participants in programme and control groups at two distinct time points, as well as any changes over a minimum of six months.

Four outcome indicators (that measured the impact of programmes) were defined: 1) the individual was employed in a non-subsidised job or was self-employed at any point during the observation period (JOB1); 2) the individual was employed or self-employed with or without support at any point during the observation period (JOB2); 3) the individual was employed in a non-subsidised job or self-employed at the second observation (JOB3); 4) the individual was employed or self-employed with or without support at the second observation (JOB4).

The impact of programmes was measured using three methods. All estimation methods were based on the assumption of conditional independence, thus the methods did not deal with the issue of unobserved heterogeneity between groups.

First, the means of the outcome variables for programme participants (treatment) and control groups were compared (unadjusted programme effect). In reality this method does not measure the effectiveness of programmes because the results include the effects of both observed and unobserved heterogeneity between groups; however they are useful as a comparison with the results of other methods to see how well they dealt with the effect of differences in the composition of groups.

Second, the impact of programmes was estimated using regressions: with the outcome variable on the left, other observed variables on the right and a dummy variable of programme participation. In this case the programme impact is indicated by the coefficient of the programme participation variable estimated with different regression procedures. The procedure was repeated with an added interaction variable on the right side that indicated whether the participant received any other assistance from the job centre in addition to the programme. The estimation was carried out using the method of least squares; when estimating successful job finding as a dependent variable this is known as "linear probability model" in the literature.

Third, the impact of the programme was estimated using the method of matched pairs. The essence of this method is that each participant in the treat-

ment group is matched with at least one participant from the control group who is identical or very similar in terms of observable indicators. If the matching is successful, the impact of the programme is the mean difference between the values of the outcome variable of the matched pairs. The similarity or the difference of individuals is computed using a method estimating multi-dimensional distance. In this case *Mahalanobis distance* was used to calculate the distance between individuals.

Around 35 descriptive variables indicating the participants' socio-demographic characteristics, educational attainment, previous labour market history, previous and current occupations, and desired occupations, the characteristics of household (demographics, number of children, household income) and dummy variables for counties were used as independent or matching variables.

*Table 5.2.1* gives a summary of the estimated values of main programme effects and their significance. Negative values and non-significant estimates indicate that the programme has no positive impact on a specific outcome variable as measured by a certain method.

Table 5.2.1: Wage subsidies – net programme effects

| | Wage subsidy | |
|---|---|---|
| | effect | *t* value |
| **Unadjusted effect** | | |
| JOB1 | 0.17 | 9.96 |
| JOB2 | 0.24 | 14.42 |
| JOB3 | 0.20 | 11.90 |
| JOB4 | 0.21 | 12.60 |
| **Adjusted effect using regression** | | |
| JOB1 | –0.09 | 4.68 |
| JOB2 | 0.00 | 0.06 |
| JOB3 | –0.02 | 1.12 |
| JOB4 | 0.00 | 0.11 |
| **Effect calculated using matched-pairs method** | | |
| JOB1 | –0.10 | 5.57 |
| JOB2 | –0.02 | 1.32 |
| JOB3 | –0.02 | 1.23 |
| JOB4 | –0.01 | 0.31 |

JOB1: the individual was employed in a non-subsidised job or was self-employed at any point during the observation period. JOB2: the individual was employed or self-employed with or without support at any point during the observation period. JOB3: the individual was employed in a non-subsidised job or self-employed at the second observation. JOB4: the individual was employed or self-employed with or without support at the second observation.

Source: *O'Leary* (1998).

Only positive and significant effects suggest that the programme had a measurable and quantifiable impact on a specific outcome indicator as measured by a

given method. The programme outcome indicating the success of job finding can be interpreted as the estimated mean difference between the employment probabilities of the two groups.

The unadjusted effects are significant and positive; or to put it differently, programme participants are more likely to obtain employment than the control group. However, if we control for the effect of observed variables– using regression or matched pairs methods –, then these effects partly disappear or change direction (significant and negative). Therefore, it can be concluded that the observed job finding advantage among participants of wage subsidy programmes compared to the control group is due to the more favourable observable characteristics of the participant group. Thus the programme has no positive impact on the employment probabilities of participants.

The impact of wage subsidy on job finding was also addressed by other studies (*Galasi, Lázár and Nagy,* 1999, *Galasi and Nagy,* 2005); however these cannot be considered programme impact evaluations because they did not use control groups and their estimation methods (limited dependent variable models and duration models) are not suitable for calculating programme effects.

The study by *Galasi, Lázár and Nagy* (1999) was based on the empirical database used by *O'Leary* (1998) and set out to measure the relative success of three active programmes (wage subsidy, business start-up and public works) concentrating on the observable characteristics of participants. The outcome variable was the probability of job-finding among participants. Job-finding was defined as an unemployed person taking up non-subsidised employment or working as self-employed in their own business.

The authors estimated a logistic probability (logit) model where the probability of job-finding was on the left and on the right were age groups, educational attainment (binary variable), binary programme variables (reference: public works) and the methods used for job search. In addition they added a binary variable to the explanatory variables, the value of which was one if after leaving the programme the individual claimed unemployment benefit, and zero in all other cases. The model also included some household characteristics of the participants (such as household income, number of dependants and family members in employment) as well as the employment rate of the "small region" to indicate the local labour market situation.

The model is suitable to assess the impact of each programme on the probability of job-finding independently from the observed characteristics of participants and the local labour market situation. The parameter estimation for the binary programme variables suggested that both business start-up and wage subsidy programmes are more effective than public works (as measured by the probability of job-finding), and business start-up subsidy is more effective than wage subsidy.

*Galasi and Nagy* (2005) examined trends in the employment probability of the long-term unemployed taking part in wage subsidy and training programmes over a four-year period between 2002 and 2005, using the monitoring database of active measures. Here only findings related to wage subsidy programmes are presented. In the monitoring of active measures information about the employment situation of the individual was collected using survey methods at the end of the third month after exit from the programme. Therefore in a way it measured the short-term impact of programmes. This survey did not have a control group, however information was available about participants in each programme. For participants of wage subsidy programmes the follow-up questionnaire was answered by employers. The questionnaire only asked whether the individual was still employed by the same employer at follow up. (There was no information as to whether the individual worked elsewhere.) Therefore the remainder discussed the probability of being retained in work.

Around 62–64% of participants leaving the programme were retained in work. It is possible that some of those who were not retained by their employer in the programme found employment elsewhere; therefore the results provided information about the lower limit of employment probability. Even if there had been information on the job-finding of all programme participants, given the short time scale of the evaluation between exit and follow-up, this would have only measured the short-term impact of the programme. Another issue was the high rate of non-response: 23–28%. Therefore there might be a selection bias in the final sample, and for this reason the authors estimated the probability of being retained in work using a binomial probit model. Technically this estimates two equations – returning the questionnaire and employment – the error terms of which are correlated with each other if there is a self-selection bias. Statistical tests indicated that the assumption of self-selection was indeed correct in most cases. On the right side of the "retention in work" equation were gender, educational attainment, age, occupation, counties, local unemployment rate and the duration of the subsidy (less than 180 days, 180–270 days, 271–360 days, 361–540 days, more than 540 days). Estimations were carried out for each year and also pairs of years (2002–2003, 2004–2005).

Findings indicated that there was a weak but significant correlation between gender and the probability of being retained in work. Women were slightly more likely to be retained by their employers than men. The relationship was stable over time and women's advantage in terms of job retention was around three per cent. The effect of age was significant and positive in each year, the youngest age group (under 25) was less likely to be retained in their job than other age groups; there were no systematic (permanent over time) differences between the retention probabilities of other age groups.

The authors found significant differences also by educational attainment, using primary school education as a reference for comparison with other edu-

cation levels. Programme participants without completed primary education were the least likely to be retained in work and higher than primary education was an advantage in most cases. Most equations indicated that those with a vocational secondary education had the highest relative chances, and those with a tertiary education had no, or diminishing, advantage over time compared to participants with a primary education.

As far as the duration of the wage subsidy was concerned, wage subsidies that lasted 180–270 days were associated with higher probability of retention than wage subsidies for less than 180 days. This was the only stable result over time: all parameters are positive and significant. Apart from this, there were many non-significant parameter estimates that suggested that the duration of the wage subsidy had no impact on the probability of retention. There were only two occupations that were significantly associated with retention in work after exit from the programme. The estimation of parameters in all equations was negative and significant for semi-skilled occupations (such as jobs in material handling, janitor, clerical assistants), and similar results were found for manual labour jobs in the construction industry.

Finally, in less favourable labour market conditions (indicated by a higher local unemployment rate) the probability of retention declined. This relationship was very strong each year, however it was getting somewhat weaker over time, and (the absolute value of) the parameter decreased: while in 2002 it was nearly –0.72, in 2005 only –0.30.

Summarising briefly the main findings of studies looking at the impact of wage subsidy programmes, two main conclusions can be put forward: first, according to the only programme impact evaluation study in Hungary these programmes did not improve employment chances in the mid-1990s; second, there were differences in the probability of being retained in work among participants of wage subsidy programmes according to gender, age group and educational attainment: women, those over 25, and with higher than primary school education were more likely to be retained by the employer who received the wage subsidy, than men, those aged 25 years or younger and with a primary education or lower.

## 5.3 The impact of a wage subsidy for older workers

ZSOMBOR CSERES-GERGELY, ÁGOTA SCHARLE & ÁRPÁD FÖLDESSY

### *The importance of targeted wage subsidies*

Voucher-type targeted wage subsidies reduce wage costs for specific groups of workers for a limited period and can be accessed at no or very low cost for the employer. Due to their targeted nature, they are cheaper to implement than across the board cuts in taxes or social security contributions. The low administrative cost makes them more appealing to employers compared to traditional wage subsidies, which typically involve a lengthy application process and also depend on the discretion of a public official who allocates the limited resources available for such grants.

Providing a targeted and temporary wage subsidy can be effective in two cases: 1) for workers lacking sufficient experience and 2) for workers subject to discrimination.[6] In the first case the subsidy compensates the employer for the low productivity of an inexperienced worker and also allows the worker to acquire some experience during the subsidised period so that they can retain the job after the subsidy has expired. In the second case, the subsidy compensates for the risk of hiring someone with (perceived) low productivity. If, for example, employers think that long term unemployment is a sign of lower productivity (at least on average), a temporary subsidy can make them more open to hiring long term jobseekers and testing their productivity in practice. Some of the newly hired workers will prove to be equally productive and will retain their jobs,[7] while others may prove less productive and lose their jobs. But even in the latter case, the subsidy removed them from the discriminated group and allowed them to acquire some work experience.

The recent global financial crisis has increased the policy relevance of wage subsidies as a means of preventing the rise of long-term unemployment and speeding up recovery. Such subsidies are especially relevant for new Member States struggling to meet EU employment targets.

In this subchapter we summarise new evidence on the *Start extra* scheme, a voucher-type targeted wage subsidy for older workers introduced in Hungary in 2007, based on the recent results of *Cseres-Gergely et al.* (2012). *Start extra* is very similar to the targeted payroll tax subsidies in Belgium and Finland and a targeted tax credit in the US, which earlier studies have shown to have some positive impact.[8]

### *Potential limitations in programme efficiency*

According to *Kluve* (2010), wage subsidies and services/sanctions are the most effective in increasing re-employment rates. The effectiveness of wage subsidies however has been questioned on several accounts. First, not all empirical

6 See *Lovász* (2012) for an explanation and a summary of empirical evidence from Hungary.

7 This follows from the nature of statistical discrimination: while long term jobseekers may on average be less productive, long term unemployment is not a deterministic feature, i.e. there is considerable variation in workers' productivity within the group.

8 For a review of the international evidence, see *Cseres-Gergely et al.* (2012).

studies found positive and significant effects. In fact, the few existing papers on transition countries have all shown a neutral or negative impact (*Kluve,* 2010, *Betcherman et al.* 2004). Second, wage subsidies are relatively expensive, which implies that the magnitude of their effect is as important as its sign, i.e. only a relatively large impact can make such programmes cost effective. Third, the narrow targeting of subsidies may stigmatise recipients and reduce both take-up and effects (*Katz* 1996). Fourth, deadweight and substitution costs are likely to be high (*Betcherman et al.* 2004). Deadweight loss occurs when individuals who would have been able to find a job anyway absorb the subsidy. Substitution occurs when employers dismiss non-subsidised workers in order to replace them with subsidised ones. Both reduce the efficiency of subsidies, and, unless accounted for, will also distort the estimates of their net impact.

### *The design of the Start extra scheme*

The *Start extra* scheme was introduced in 2007 as an extension to an existing scheme for school leavers, and was phased out in 2012. It was a quasi-voucher scheme that offered a temporary reduction on payroll tax (social security contributions) to employers hiring the holder of the "voucher". The amount of the subsidy varied across eligible groups, as summarised in *Table 5.3.1* All long-term unemployed were eligible for *Start plusz*, and *Start extra* doubled the subsidy for a selected subgroup with multiple disadvantages, i.e. for jobseekers above 50 and those who had only completed primary education.

**Table 5.3.1: Rules of the various Start schemes at the time of introduction**

| Name | Eligibility | Amount of subsidy (% of total wage cost)* | | Ceiling on subsidy |
|---|---|---|---|---|
| | | 1st year | 2nd year | |
| Start | School leavers: below 25 (30 for graduates), no prior paid job | 14 | 7 | 1.5 × minimum wage (2 × for graduates) |
| Start plusz | On parental leave or care allowance, or registered unemployed for 12 months within preceding 16 months, not eligible for old age pension | | | 2 × minimum wage |
| Start extra | Over 50 or primary education only, and registered unemployed for 12 months within preceding 16 months, not eligible for old age pension | 25 | 14 | 2 × minimum wage |

* In 2007, the employer's contribution was 32% of the gross wage, and this was waived in full during the first year of employing a person with a *Start extra* voucher. The flat rate health contribution was waived in both years in all schemes, which was 1,950 HUF a month (about 8 EUR), or around 3% of the minimum wage. The subsidy was further extended in 2009 and replaced by a new scheme in 2012.

The scheme (all three variants) had been administered by the tax authority who issued a plastic card to eligible persons which indicated the type and eligibil-

ity period of the subsidy. Cards were issued only if claimed, but the evaluation of claims was automatic, and local job centres had been actively encouraging job seekers to claim the card.

The validity of the card and thus the period of eligibility started on the day of issue. Jobseekers were therefore advised to claim the card immediately before starting their job, so that their employer would be eligible for the maximum length of the subsidy. The subsidy lasted for a maximum of two years.

Between July 2007 and December 2008, the *Start extra* card was claimed by 8,859 persons and issued to 8,392 persons. Less than 2% of the claims were declined by the tax authority, and some 5% was not issued for other, unknown reasons. During the same period, the number of persons employed with the subsidy started to grew steadily, peaking at 4,998 in November 2008. This suggests that most cards had been claimed once the job seekers had a job offer, as recommended by job centres. Until the end of 2008, 6,115 persons had been hired with the *Start extra* card, and of that, 3,127 were long-term jobseekers aged over 50 with at least secondary education.

The *Start extra* subsidy is well targeted considering that re-employment probabilities are significantly lower for uneducated and older job seekers. Demand for older workers declined significantly in the 1990s, partly due to the sharp drop in their relative productivity and also due to discrimination (see *Lovász*, 2012 for a review of empirical evidence). There is also some evidence that wage subsidies are more effective if targeted at the long-term unemployed (as in the *Start extra* scheme) rather than at low-ability workers (*Brown at al.*, 2011).

### *The employment and wage impact of the Start extra scheme for older workers*

There are very few empirical studies on Hungarian active labour market programmes and the two earlier papers that evaluate the impact of traditional wage subsidies have somewhat conflicting results.[9] As far as we know, *Cseres-Gergely et al.* (2012) was the first attempt to evaluate the re-employment effect of the *Start* schemes.

*Cseres-Gergely et al.* (2012) estimate the effect of the *Start extra* subsidy for older workers with at least a secondary education, exploiting the particular design of the scheme, i.e. that it is available for jobseekers aged 50 or above, but excludes otherwise similar jobseekers aged just below 50. They find a significant positive effect on both re-employment probabilities and wages in the case of men aged over 50, but no significant effect for women. Their estimates are interpreted as the *additional* effect of the extra subsidy (on top of the base subsidy of *Start plusz*) for multiply disadvantaged groups.

The dataset they use was drawn from administrative records, constructed for the Institute of Economics, Research Centre for Economic and Regional

9 *O'Leary* (1998) found negative or zero employment effects and a significant increase in earnings on the first job, except for job seekers aged over 45, where effects on employment were also positive and significant. Using data for 2010, *Csoba and Nagy* (2012) estimated a 24-fold increase in log-odds of employment, which is a dubiously large effect.

Studies of the Hungarian Academy of Sciences (IE-CERS HAS), containing a 50% random sample of the total working age population. It is a panel of the employment and job search history of working age individuals covering the period between January 2002 and December 2008. Thus, jobseekers are observed for 18 months following the introduction of the programme. There is information on age, sex, dates of entering and exiting employment, earnings (pension insurance records), unemployment history and type and period of receiving various transfers (including disability benefits) and sick leave. There is no data on the actual claiming the Start cards or on the employer.

In the case of older workers, the programme design generates a discontinuity in eligibility, which can be used to identify the programme effect. In this case, the treatment group is formed by those eligible for participation and are slightly above the age 50, while the control group is formed by those who are similar to them in all aspects, but stay slightly below age 50 during the observation period. Those with at most primary education must be excluded, as they are eligible for the same support regardless of age.

The discontinuity design strategy assumes that heterogeneity in the variable with the discontinuity is irrelevant in determining outcomes. This is not completely so in this case, as age tends to reduce the chance of re-employment, but we can account for this in the estimation strategy by using a precise age measure.[10] Although age is changing over time, it has an almost fixed distribution in adjacent time-points. Because of this and because the discontinuity design provides us with randomly allocated treatment and control groups, this strategy yields consistent estimates of the programme effects. If the differential effect of extraneous factors on outcomes over time (such as seasonality or the business cycle) is to be taken into account separately from unemployment duration, it has to be controlled for using some statistical method, such as a difference in differences strategy, where we look at the difference between the control and the treatment outcomes before and after the programme.

Treatment is defined as eligibility for the Start card. This is not only a pragmatic decision taken due to the lack of better data, but is also justified on the basis of the official information on claims, take-up and subsequent employment, which suggest that claiming the voucher is most likely to happen after the outcome, that is, after the employer decided to hire the job seeker. "True" take-up therefore is not actual participation, but the ability to participate: being informed of the scheme and of the age condition by either the employer or the job seeker.

Based on the above considerations, *Cseres-Gergely et al.* (2012) define the treatment group as those aged between 50 and 52.5 and the control group includes those aged between 45.5 and 48.5 in June 2007. The 18-month gap between them ensures that no member of the control group becomes eligible for participation during the observed period. In other respects the two groups

10 We also check the presence of the effect by repeating the estimation for age groups below and above the eligibility threshold, before and after the programme was made available.

both fulfill the eligibility criteria at the time the scheme was introduced, i.e. they have accumulated 12 months of registered unemployment.

Re-employment effects are estimated in various specifications: probits for the probability of being employed 15 or 18 months after the introduction of the scheme and duration models (a modified Jenkins type probit) for the probability of exit to a job at any time after the introduction of the scheme (*Jenkins*, 1995). Wage effects are estimated in standard Mincer-type wage equations, where they use the interaction of the treatment dummy and a dummy indicating spells after the introduction of the programme. This is interpreted as the programme effect, i.e. as a shift in the wage advantage (or more likely, disadvantage) of older jobseekers re-entering employment.

The average marginal effects on employment estimated in various model specifications tend to be small but positive and significant for men, and insignificant for women. The first two columns of *Table 5.3.2* show the increase in participants' employment probability compared to non-participants 15 and 18 months after the introduction of the program, respectively, controlling for individual and regional characteristics and for seasonality. The former is included as a test of whether the global crisis starting in late 2008 may have affected the programme. The third column shows the increase in participants' probability of *entering* a job, controlling for changing overall job-entry chances over time, besides controls listed above. The fourth column shows the same probability for persons with lower[11] secondary vocational education. Results are robust to the definition of employment and unemployment in the data. The preferred specification (presented below) includes controls for age, education, and past work history.

**Table 5.3.2: Employment effects for job seekers aged around 50**

| | 15 months | 18 months | Total | Job finding probability for lower secondary vocational |
|---|---|---|---|---|
| | after the introduction of the program | | | |
| Men | 0.1040** | 0.0782 | 0.0144*** | 0.0164** |
| Women | 0.0638 | 0.1040 | 0.0016 | –0.0034 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Note: See full regression results in *Cseres-Gergely et al.* (2012).

For men, the positive effect is driven by job seekers with lower secondary vocational education, who constitute 74% of the sample. For the higher educated, there is no significant effect, which may be due to the ceiling on the subsidy (which reduces the value of the subsidy at high wages) or possibly to stigma effects, which may be stronger in white collar occupations.

As shown by the coefficient of the interaction of the treatment and the programme period in *Table 5.3.3,* the subsidy for job seekers aged over 50 has a significant positive effect (the effect on the subsequent wages of men).

11 Completed a vocational secondary school that does not offer a school leaving (A level) certificate required for entering university level education.

For women, the subsidy has no significant effect either on employment, or on wages. A possible explanation is that older women are less likely to actively look for a job, which lowers the potential impact of any wage subsidy that is by design dependent on job search and at the same time, it also makes its estimate less precise. An earlier result by *Micklewright and Nagy* (2010) points to a similar direction: they found that a mild tightening of job search criteria for unemployment benefit recipients had a significant positive effect on the probability of re-employment only in the case of women aged over 30.

Table 5.3.3: Wage effects job seekers aged around 50

| | Men | Women |
|---|---|---|
| Eligibility (aged over 50) | –0.200* | –0.0302 |
| | (0.114) | (0.151) |
| After June 2007 | 0.147** | 0.340*** |
| | (0.0614) | (0.0933) |
| Eligibility after June 2007 | 0.157* | 0.0978 |
| | (0.0893) | (0.132) |

Note: See full regression results in Tables B3 in the Appendix of *Cseres-Gergely et al.* (2012).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The above results give gross estimates of the program effect which is valid only if the control group was not affected by the program, for example through a replacement of employees by long-term unemployed similar to them and eligible to the subsidy. As a crude check for substitution effects, *Cseres-Gergely et al.* (2012) examine the probability of becoming unemployed for the employed population around the time of introducing the subsidy and find no significant trend in the job loss probabilities of workers aged below 50 with secondary or higher education. This suggests that substitution is unlikely to lessen the impact of the programme.

The total cost of the scheme is relatively modest, compared e.g. to re-training or public works programmes in Hungary. Between July 2007 and December 2008, the *Start extra* scheme cost a total of 1 billion HUF per annum. This amounts to 593 EUR per person (not controlling for right censoring in employment spells). Neglecting the costs of administration, which are likely to be very low, the cost of the programme is the additional subsidy (on top of *Start Plusz* available to all long term unemployed). The short term benefits of the programme include savings on social assistance expenditure and employee's social security contributions (17% of the gross wage). Long term benefits may include social security contributions following the expiration of the subsidy, longer employment spells in the subsequent work history, postponed retirement and savings on health care costs. For lack of empirical evidence on the magnitude on these long term effects (in Hungary), *Cseres-Gergely et al.* (2012) concentrate on the short term balance.

*Cseres-Gergely et al.* (2012) conclude that short run benefits exceed the cost if deadweight loss – that is the share of those who would have found a job without the subsidy – is below 20% of subsidised jobs. As a crude measure of the latter, the number of subsidised job entries as recorded by the Tax Authority is compared to the number of entries by potentially eligible job seekers as observed in the dataset. Results suggest that there may be some deadweight in the programme but that it is not very large.

### *Conclusions and policy implications*

Wage subsidies are often promoted as an efficient means of increasing demand for low skilled workers, however, existing evidence on their employment effects is somewhat mixed, especially in the case of transition economies. A recent evaluation of the Hungarian *Start extra* scheme for older workers suggests that well designed targeted wage subsidies can be effective in a transitional context as well. The Hungarian *Start extra* subsidy for jobseekers with at least secondary education and aged over 50 appears to be cost effective for men, even considering its short term benefits only.

The overall efficiency of this programme could be improved by narrowing the target group to jobseekers with less than upper secondary education and possibly by supplementing it with incentives for job search, especially for women. The fact that *Cseres-Gergely et al.* (2012) found no significant effect for educated jobseekers also implies that the recent government plans to cut social security contributions for all workers aged over 50 (regardless of education) is likely to carry considerable deadweight loss. Restricting the measure to those with at most secondary education would improve its cost efficiency.

## 5.4 The pros and cons of differentiating the minimum wage in Hungary

ÁGOTA SCHARLE & BALÁZS VÁRADI

This subchapter does not present new findings, but aims to summarise what we could expect of a targeted reduction of the minimum wage as a tool for increasing employment, based on existing Hungarian and international literature. The suggested introduction of a lower minimum wage for school leavers, proposed by the Hungarian minister for national economy in June 2012, gives immediate relevance to the subject. We begin with an overview of the functions and effects of the minimum wage as well as the main characteristics of its domestic regulation, with a special focus on the idea of differentiation. We then aim to reconstruct and analyse the reasoning that may buttress the governmental and expert proposals "regarding the differential" modification of the gross minimum wage.[12] Finally, we briefly outline the proposal of Scharle and Váradi (2009), arguing for a regional differentiation of the minimum wage.

12 *Gábor* (2012) and *Köllő* (2012) provide a more comprehensive summary. For a general overview, see *Neumark and Wascher* (2008), for a Hungarian language outline see *Gábor* (2012).

## *The minimum wage and its effects*

The minimum wage is a policy instrument that is widely (though not universally) applied in the developed world. The relevant international literature generally distinguishes between three social functions of minimum wage regulations: 1) achieving social equity, 2) fostering employment and 3) minimising income inequalities. Hungarian national policy often cites a fourth point justifying minimum wage increases: that of reducing tax avoidance.

The first point encapsulates the social expectation that the state should support the most vulnerable employees and that there is a certain amount of remuneration for human labour that employers must not fall short of. According to the International Labour and Employment Relations Association, the basic purpose of the minimum wage is to satisfy this demand (*ILO,* 2009). This function, however, is difficult to describe with the models and empirical analyses of economics. Consequently, the labour economics literature primarily focuses on the effects that changes to the minimum wage have on employment and distributive justice.

The theory regrettably does not provide a definitive answer concerning employment. The simplest among the models of labour economics is the textbook equilibrium model that supposes perfect competition, a positive wage elasticity of labour supply and a negative elasticity of labour demand, applying the Marshallian cross to the labour market. Within this framework there is a definitive impact on employment: the minimum wage is either not binding (if it stays below the equilibrium wage level that is socially optimal), or it causes unemployment and deadweight loss. This is because those employer-employee pairs for whom it would only be worthwhile to sign a contract if they could agree on a wage that is lower than the minimum wage would be deprived of the possibility of such a mutually beneficial transaction. In this model, then, the minimum wage is ineffective or downright harmful in terms of employment growth.

However, as soon as we allow for market failures in our models, the introduction or increase of the minimum wage has the ability to improve social welfare and employment levels to a certain point. This holds true even if the employer is monopsonistic (or multiple employers form a cartel), as well as in the more plausible case where an employer hiring several employees *ceteris paribus* has to pay a higher wage than its competitor that works with fewer employees. There are models with multiple equilibria, one characterised by low wages and low performance, and another by high wages and high performance. In these scenarios, the introduction or increase of the minimum wage may push the economy over the tipping point from the former into the latter, creating a more advantageous social welfare climate. Yet other models that consider the effects of company training, friction and job search produce results that enable an increase of the minimum wage to raise employment rates within a cer-

tain interval. The models that examine factors with ripple effects prove even less conclusive than the predictions based on partial equilibrium models (for a more detailed overview see *Köllő,* 2012, *Gábor,* 2012).

Concerning the third social function, under certain circumstances in their perfect competition model *Lee and Saez* (2012) find that by way of improving the income status of some of the poor, the positive distributive impact outweighs the social harm caused by the reduction in employment that the minimum wage necessarily entails, if distributive justice has enough weight on the social agenda. The income inequality reducing impact of the minimum wage strongly depends on more than one factor: the way minimum wage rise affects income distribution through some employees losing their jobs and others starting to earn more, as well as to what extent may the concepts of "minimum wage earner", "low wage earner" and "low productivity worker" be equated.

If the actors of the economy can also adapt to the minimum wage rise by tax avoidance, the impact is going to look different. The relative cost of formal (registered) employment will increase and there is a greater motivation toward partially (grey) or fully informal employment (black market jobs). This may alleviate the potential negative employment tendencies but it simultaneously decreases the extra income that a surge in formal employment would reasonably entail. (Even if the tax avoidance tendencies of grey market workers decrease, the ratio of grey or black market workers will grow.) The subject is discussed in greater detail in *Chapter 6* of this *In Focus – I.*

If the main message of the theory proves to be: "it depends", we have to turn to empirical research. Do econometric analyses provide unequivocal replies to the question of whether the minimum wage rise grows or shrinks employment rates and income inequalities?

Lamentably, gauging the impact minimum wage has on employment is charged with statistical and methodological issues. Until the beginning of the 90s there was a collectively accepted view based on econometric analyses, stating that minimum wage rise affects employment figures negatively, the only question being its extent. However, when *Card and Kruger* (1994) published their groundbreaking study, the acceptance of the theory was replaced by animated disputes. Nonetheless, according to the overview of *Gábor* (2012), 60 to 80 per cent of current studies continue to find significant negative employment tendencies, with only 20 to 40 per cent of articles rating the impact on employment as not significant or positive.

The minimum wage rises of 2001 and 2002 provided a good opportunity for domestic empirical analyses in Hungary. The increase was substantial on an international scale: within two years, the minimum wage rate jumped from 29 per cent of the average wage to 41 per cent, surpassing even Canadian and British levels. Though the aggregated figures do not show a decline in this period of the increased labour demand, econometric studies found employment effects to be

negative, in unison with most of the international findings. *Kertesi and Köllő* (2004) demonstrated that among companies with 5–20 employees 12 thousand workers were made redundant after the first rise. *Elek et al.* (2012) analysed the impact that the increase of average wage (entailed by the minimum wage rise) had on employment up to 2003. According to their study, in the companies that were strongly affected by the rises the average wage rate grew significantly faster, while employment levels rose significantly slower (or shrunk faster).

According to Köllő's 2012 findings, minimum wage rise on a grand scale alleviated *income inequalities*, even if only short term. The Gini coefficient of gross income went back from the 0.39 pre-increase levels to 0.36 (though by 2005 it reached 0.38 again). This temporary decrease in inequality is not insignificant: it roughly corresponds to the 2005 differences between "old" and "new" EU member states.[13] The impact on *household income inequalities* was weaker, however, explained by the fact that minimum wage earners are typically not the first earners in the household. At the time of the great rises less than 20 per cent of them belonged to the lowest income quartile (*Benedek et al.* 2006, *Szabó,* 2007).

### *Regulating the minimum wage in Hungary*

In Hungarian regulation the rate of the minimum wage is established annually, without a straightforward formula or clear criteria. It is determined by the government, with representatives of employment organisations involved to a varying degree: sometimes to a large extent, at other times merely in a consulting role (*Gábor,* 2012, *Neumann and Váradi,* 2012). Before the latest public work regulations came into effect, the minimum wage was almost universally extended to a large group of employees. Differentiating between jobseeker qualities (such as age, education, experience, ability to work etc.) has not been part of Hungarian minimum wage regulation for long. With the 2006 introduction and 2007 enforcement of guaranteed minimum income the Hungarian minimum wage regulation also introduced an (upwards) differentiation; but it was the 2012 labour code that allowed for differentiation of guaranteed minimum income levels between "certain groups of employees" (article 153 clause 2). As emphasised by *Gábor* (2012), none of the instances of the above-mentioned practice are exceptional. For all of them, we can find a varying number of European countries practicing a similar differentiation.

### *Arguments for the selective downward modification of the minimum wage*

As demonstrated above, both Hungarian and international empirical evidence suggests that if we can identify labour market segments where the gross wage cost of the guaranteed minimum income is "too high" (compared to the average or median income, for instance), in other words, where the supposed employment reducing impact of the minimum wage is significant, the general

13 EU-15: 29.9; the 12 new member states: 33.2. (Source: *Eurostat*.)

employment situation can be improved by reducing the minimum wage levels pertaining to these groups. If the positive impact is large enough, and the social costs (of a political, budget-related, or administrative nature or originating from boosting the black economy or creating arbitrage opportunities) and side effects of downward reduction are not too significant, a modification of this kind may serve to improve social welfare even if the other two functions of the guaranteed minimum income (fairness and equity) are somewhat hurt by it.

Modifications of this kind are not a rarity in the developed world: a number of European countries apply downwardly modified minimum wage policies (see *Benedek et al.* 2006, Table 1), according to age (youth: the Netherlands, Slovakia, France, Ireland, Belgium, Great Britain), time in service (entry level jobs: Czech Republic, Poland, Cyprus), altered work capacity (Czech Republic, Slovakia) or casual worker status (Spain). These modifications typically target groups with a low average wage level, among whom the value of the (universal) minimum wage would be comparatively high. This is, in fact, the environment where the minimum wage reduction can be expected to yield significant positive employment effects.

Whether this is beneficial for the society on the whole can only be determined after carefully weighing the sum of its effects. To illustrate the considerations associated with selective differentiation, let us summarise the reasoning of a related policy proposal.

### *Regional minimum wage in Hungary*

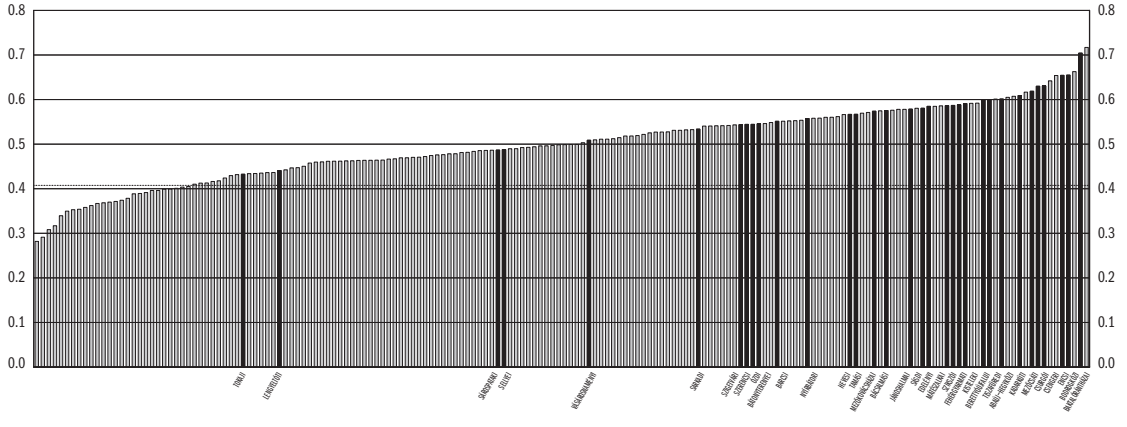
*Scharle and Váradi* (2009) point out that even though *Rutkowski* (2003) and *Smith* (2007) suggest its application if there is significant territorial dispersion between wages and price levels, the regional modification of the minimum wage is not common practice in Europe. However, the 2005 OECD country review of Hungary explicitly suggests its implementation (*OECD,* 2005). The recommendation is based on the idea that uniform minimum wage levels impact underdeveloped areas more strongly, for two reasons. Firstly, the price and wage levels are typically lower, therefore the countrywide minimum wage is higher both in real value and compared to the local average wage. Secondly, the proportion of unskilled workers is characteristically higher in these territories. Hence, supposing that the net employment impact of the minimum wage is greater on the unskilled than on the skilled, the underdeveloped regions are going to be affected much harder. Regional differentiation (a minimum wage rate that is lower than the national level) is suggested in the hope of counterbalancing this effect. This proposal is nuanced, but, on the whole, strengthened by the findings in *Chapter 6* of this *In Focus – I.* Benedek et al. describe the distribution of disguised minimum wage earners (arguing that there is a higher volume of this kind of tax avoidance practice in the capital, as well as among those with a higher effective income, under-represented in the regions in question). But the region-

by-region separation of actual minimum wage earners from the disguised ones would require further study, utilising the findings in the above mentioned article.

We know relatively little of the territorial differences between price levels in Hungary, though the time series of *Dusek and Szalka* (2008) largely reinforce the positive correlation between income levels and price levels; a connection that is in line with the theoretical prediction. This implies that the differences between nominal sub-region average wages overstate the difference between real wages (the problems entailed by regional price level differences and taxing nominal income were also touched upon in the introductory 1st chapter eaarlier). At the same time, considering that the territory of a median sub-region is no more than 480 square kilometers, geographic mobility and product arbitrage prevent the emergence of substantial differences in price levels between small and densely populated sub-regions.

The data in *Figure 5.4.1* suggests that a minimum wage policy that is efficient on a national level may affect underdeveloped regions more strongly. This coincides with calculations by *Kertesi and Köllő* (2004) stating that the wage shock implied by the minimum wage rises of 2001 and 2002 was largest for young persons, unskilled workers and those living in high unemployment regions.

Figure 5.4.1: Minimum wage rates in proportion to sub-region average wage rates, 2008




Note: The 33 sub-regions with the worst conditions are marked black; the dashed line denotes the national average. The weighted wage tariff data underestimate the average wage, therefore the above ratio is somewhat rounded up; however, this has little bearing on the relative situation of sub-regions.
Source: *Scharle and Váradi* (2009), Figure 2.

If we consider territorial differentiation, the first point to address is what territorial unit it should apply to. *Scharle and Váradi* (2009) suggest sub-regional differentiation since a significant part of inequalities is not reflected on a county level. Taking commuting into account, a sub-region largely corresponds to the area delineated as the local labour market. On a sub-regional level, if there

are enough competitors present, wages will level out in the short term, without movement of workforce or capital. In this milieu the political and administrative framework necessary for differentiation can also be set up.

The proposal identifies four plausible groups of criteria to establish the extent of moderation:

– indicators demonstrating the high presence of a low productivity work force especially affected by the minimum wage level (the rate of registered unemployed people and the proportion of the permanently unemployed and the young jobless; the ratio of people with altered labour capacity and the proportion of unskilled workers in the active population),
– as an indicator of the demand for unskilled labour, the proportion of the employed in the unskilled population,
– the proportion of minimum wage/average wage ratio, measuring the efficiency of the minimum wage; the so-called Kaitz index[14] that includes the proportion of those employed on minimum wage and the shock measured at the 2001 rise,
– and tax payments per capita, measuring the income status.

The various indicators highlight various sub-regions as severely disadvantaged. Structured in a table, *Scharle and Váradi* (2009) identify the few sub-regions that seem to be the most likely candidates for differentiation.

They then move on to confront the political difficulties of regional differentiation and, taking the aims and interests of the stake-holders into consideration, attempt to develop a politically viable arrangement. They thus compare three different potential solutions, presenting the advantages and disadvantages of each, as well as the foreseeable reaction of stake-holders:

– allowing for the reduction of the minimum wage by modifying the labour code, with sub-regional development councils retaining the right to establish the exact extent thereof,
– reducing the gross cost of the minimum wage by utilising EU development funds, inspired by the example of the *Start* card for entry level employees,
– reducing the gross cost of the minimum wage by relief from social security contributions, employing budget resources.

Finally, through an international comparison they conduct calculations on the desirable extent of differentiation. They also suggest rules aimed at decreasing the risk of arbitrage and, inasmuch as possible, present the budget and employment related impact of a few imaginable scenarios. According to their calculations based on earlier empirical estimations, in these sub-regions a 30 per cent decrease of the minimum wage could boost unskilled employment levels by 6–12 per cent within 2 or 3 years. The developments of the past two years, especially the strengthening of the administrative role of the district, and the proposed amendment to the labour code make even the first version of the proposal (which seemed somewhat far-fetched in 2009) feasible.

14 The Katz index is the ratio of the minimum wage and the average wage, multiplied by the number of people employed on minimum wage.

## 5.5 A review of the international literature on the differing effects of employer versus employee contributions

ÁRPÁD FÖLDESSY

In the classic model of economics, the labour market effects of taxing employers and employees are equivalent (this is the so called tax liability side equivalence, or LSE): the economic burden does not depend on whom the tax was levied on in the legal sense (*Musgrave,* 1959; *Stiglitz,* 1988; *Fullerton and Metcalf,* 2003). This is corroborated by empirical analyses as well, such as *Tyrväinen* (1994) or *Robertson and Symons* (1990), who show that such differences in the types of taxes have no effect on the fluctuation of wage costs or unemployment in OECD countries. This stems from the classic model, in which labour supply is determined by the net wage and labour demand by the total wage cost, and their equilibrium depends on the difference of these two (and the sum of taxes). Therefore, the share of employee and employer contributions within total taxes is of no consequence.

However, in most countries, the allocation of social security contributions between employees and employers is the subject of lively debates among politicians and the general public as well (*Borck et al.* 2002; *Ruffle,* 2001). To account for this interest, the economic literature has turned to examining the assumptions behind the equivalence theorem. The first of these is the perfectly competitive labour market, in which gross wages freely adjust to changes in the tax system. This assumption may not hold if the minimum wage is close to the equilibrium wage, unions are strong (*Riedl and Tyran,* 2003), taxation is progressive (*Lockwood and Manning,* 1993, *Holm et al.* 1995, *Rasmussen,* 1997, 1998, *Andersen and Rasmussen,* 1999), or if the unemployment benefit is tied to gross wages (*Picard and Toulemonde,* 2001). The latter situation arises when the unemployment benefit is indexed to the market wage but is non-taxable, which is quite common in OECD countries.

In the absence of such external constraints, wage adjustment may still be imperfect if for example workers resist nominal cuts in the net wage, which leads to wage rigidity. In this case, real wages can only adjust to the new equilibrium level with an increase in the level of prices, which definitely disproves the equivalence principle in the short run. While *Bewley* (1999) names efficiency wages as the primary cause of endogenous wage rigidity, *Pisauro* (1991) shows that the equivalence is also valid in these labour markets, as long as agents base their decisions on the net wage. However, as *Riedl and Tyran* (2003) point out, in an efficiency wage world it is unlikely that decisions are solely based on the net wage. This hypothesis relies on the results of *Kerschbamer and Kirchsteiger* (1999), who conduct a laboratory experiment and find that the tax burden tends to be larger for the party which is legally obligated to pay it. As the first step toward disproving the equivalence principle

the authors test the rationality condition, and after finding that it holds for a convincing share of participants, they relax the assumption that individuals only want to maximize their after-tax earnings. They conclude that labour market decisions are in fact influenced by certain social norms of work and material well-being as well as net wages, which suggests that the validity of the equivalency principle is limited.

*Riedl and Tyran* (2003) focus on the social norm of gift-exchange, the essential mechanism behind efficiency wages (*Campbell and Kamlani,* 1997). In theory, employers offer their workers higher wages than the market equilibrium level as a quasi-gift, hoping for a level of effort higher than that which can be enforced by supervision. This partly goes beyond the assumption of a perfectly rational and utility-maximizing worker, but is considered quite realistic in view of the existing social norms. However, *Akerlof* (1982) shows that the equivalence is valid in the case of gift-exchange as well: according to his hypothesis, labour markets of this type enable workers to regard taxes independently from the relationship to their employers, and thus base their decisions on the level of gross wages.

The wage paid by the employer is of particular importance in exchange-based labour markets: as long as it is observable by the employer, it indicates the generosity of the employer's gift and through this determines the level of effort to be made in return. However, according to the hypothesis, the wage paid by the employer will depend on the legal incidence of the tax: they pay the gross wage if the tax is levied on employees and the net wage if it is levied on employers.

In accordance with this theory, if the burden of contributions and taxes is levied on workers, the wage which they can observe and use as an indicator for employer recognition will be the gross wage, and will choose their effort level accordingly. If, however, taxes and contributions are levied on the employer, the observable wage will be the net wage. Therefore, such a tax system – since workers observe the net wage, rather than the gross wage – causes a decrease in the perceived generosity of employers and thus in worker effort as well.

In such a case, employers, who are concerned with employee satisfaction (and effort), will be interested in raising the net wage. By contrast, if the tax burden is shifted from employers onto workers, the gross wage will become the observed wage which is high enough for the employer to attempt a cut (reducing the net wage as well). Thus, in an efficiency wage world, the incidence of taxes has an opposing effect on net wages, which disproves the tax liability side equivalence principle.

*Riedl and Tyran* (2003) test the above hypothesis on Dutch college students using behavioural experiments. Their results indicate that the presence of equivalence can be proved in the short run as well. Their results hold for markets which are independent from each other and have different tax systems, and also for a change in the tax systems implemented on the same market. The in-

cidence of taxes has no significant effect either on worker effort or on the income distribution between employers and workers.

The external validity of the experiment is restricted by a number of factors, such as the fact that in the experiment by *Renner and Tyran* (2003) the labour market has fairly large excess supply (40 per cent). Furthermore, disregarding long-term contracts between workers and employers could have affected the results: these are proven to increase wage rigidity on markets where the employer is not perfectly aware of worker productivity. The experiment also disregards the fact that the lack of information and awareness on the tax system by workers can strongly influence their perception of wages. While well-informed workers may tolerate a cut in net wages following a tax burden shift to the employers' side, that may be harder to accept for those who have no exact information regarding it. Finally, being well informed or not about taxes may vary across the different types of tax. For instance, successful communication by the government can raise tolerance and awareness toward new taxes, while other types of taxes excluded from this may escape workers' attention (*Sausgruber and Tyran,* 2005).

*Gourke* (2000) points out the importance of social security contributions, which are – in contrast to the income tax – independent of the taxpayer's source of earnings. While according to the equivalence principle, a change in gross wages compensates workers in the event of a shift in the legal obligation for paying income taxes from employers to workers, this cannot be achieved in full in the case of a similar shift in social security contributions. This is because the income tax is borne exclusively by those employed, but social security contributions also apply to jobseekers and the inactive population. The latter two groups have no employer to compensate them for the shift, which will therefore affect their net income – for jobseekers this equals the unemployment benefit minus social security contributions. Thus, regarded in a broader sense, the shift changes the relative level of labour income as opposed to non-labour incomes, which has an unavoidable effect on labour supply.

All in all, it is fair to say that the equivalence principle regarding worker and employer taxes has been empirically verified by the literature. However, the validity of some of the assumptions behind the principle may be questioned under certain conditions, such as a binding minimum wage, strong union activity, a progressive tax system (*Lockwood and Manning,* 1993; *Holm et al.* 1995; *Rasmussen,* 1997, 1998; *Andersen and Rasmussen,* 1999), taxable unemployment benefits (*Goerke,* 2000) or unemployment benefits tied to the gross wage (*Picard and Toulemonde,* 2001). One or another of these conditions applies in almost every OECD-country, and thus in Hungary as well.

Finally, let us return to the role of social norms which are potentially important determinants of worker behaviour beside net wages. Even though analysing these with the tools of economic analysis is dubious, *Kerschbamer and*

*Kirchsteiger* (1999) present convincing evidence of their effects. By contrast *Riedl and Tyran* (2003) show that there are norms (namely gift-exchange and efficiency wages) that do not alter the equivalence of the effects of worker and employer taxes.

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# 6. TAX AVOIDANCE, TAX EVASION, BLACK AND GREY EMPLOYMENT

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## Introduction

There are various forms of tax avoidance and tax evasion related to the labour market. While some of the workers are employed lawfully and pay taxes and contributions on their wages (declared work); others, although registered receive part of their pay as envelope wages without paying taxes, or may reduce their tax liability using other – unlawful – means (for example sham contracts). A third group of workers might not even be registered (black work/undeclared work). Black and grey work are against the law and thus fall into the category of *tax evasion*, while within "white" (lawful) employment it is possible to identify groups (e.g. of entrepreneurs) that use *tax avoidance* methods that are legal in order to reduce their tax liability.

It is not accidental that black and grey work and legal tax avoidance are at the centre of economic policy debates in Hungary. Their prevalence has major implications for the aggregate economic effects of minimum wage increases, tax cuts to low skilled workers or other economic policy measures. This chapter provides an overview of empirical results – mainly using existing studies – concerning tax evasion and the labour market to help attain a clearer understanding. Following a brief theoretical introduction, it presents empirical findings from international studies on the prevalence of the shadow economy and undeclared work and then moves on to explore black and grey work, as well as tax evasion among entrepreneurs in Hungary, using detailed, micro level data. Finally, the last sub-chapter considers the income redistribution effects of tax evasion, still using micro-level data. The economic policy implications of the findings are also discussed at various points.

## Factors that determine tax evasion

According to the traditional economic approach (see for example *Slemrod and Yitzhaki,* 2002) economic actors make decisions about tax evasion by comparing the potential costs and benefits – or differently the payable fine and the amount of tax that can be evaded.[1] Therefore, higher fines and increased (or better targeted) inspection will definitely reduce tax evasion whereas the effect of tax rates in the theoretical models is unclear as they influence both potential benefits and costs. However, it is difficult to explain the willingness to pay taxes using the standard model – considering the limited risk of being caught and the rates of potential fines –, therefore the more recent literature on be-

1 The expected value of the loss is equal to the sum of the fine and the tax liability multiplied by the probability of being caught.

havioural economics incorporates the effect of the social environment, such as respect for rules and the need for belonging to groups.[2]

Another strand of the theoretical literature considers the distorting effects of tax evasion. In this approach, tax evasion reduces effective tax rates in a predictable way, therefore the main negative consequence of tax evasion is not the loss of tax revenue but the fact that it has a differential impact on different sectors. Therefore it distorts economic activity and also leads to an unintended re-distribution of income between economic actors.

Coming to empirical findings, the international literature identifies various factors associated with tax evasion, including black and grey work. Various studies, using macro-level data (see for example *Christie and Holzner,* 2006), showed a positive association between the tax burden and the extent of tax evasion. Using micro-level data from Quebec *Lemieux et al.* (1994) showed that the tax burden influenced the decision between white and black work. In his analysis of the flat-rate tax reform in Russia, *Slonimczyk* (2012) found that informal employment declined among employees who experienced a decline in their tax rates. Various empirical studies looked at the impact of the tax burden on declared income, although there were mixed findings on what might have caused changes in reported income: tax evasion (i.e. grey work), tax optimisation (for example turning labour income into capital income) or changes in labour supply. This debate is presented in detail in *Chapter 2* of *In Focus –I*; however generally it can be assumed that both channels have a role in adjustment (see for example the review by *Saez et al.* (2012) or the article by *Gorodnichenko et al.* (2009) on tax reform in Russia). In addition to taxes, factors considered to influence black and grey work include over-regulation of labour and product markets, the administrative burden of businesses, loss of eligibility for welfare provisions when taking up declared work, and laxity of tax inspection (see for example *Koettl and Weber,* 2012).

## Estimating the prevalence of the shadow economy using aggregate data

The shadow economy can be measured using direct and indirect methods. Direct methods use secondary analysis of population and business surveys and (micro-level) administrative data, for example calculating the extent of the shadow economy based on the amount of tax arrears uncovered by the tax authority's investigations. Indirect methods estimate *total* economic activity and income using a range of related *proxy* variables, and compare them with *reported* economic performance and income. The comparison can be made at the micro level – for example using household survey data on consumption and food consumption as proxies for actual income, such as in *Pissarides and Weber* (1989); or at the macro level – for example estimating total economic ac-

2 For a summary of the theoretical literature on tax avoidance and tax evasion in Hungarian see for example *Scharle et al.* (2010).

tivity based on cash flow or energy consumption, see for example *Lackó* (1998). The advantage of macro-level approaches is that they need less data, while the advantage of micro level ones is that they provide information about the distribution of hidden activities. *Schneider* (2004) provides a detailed description of these methods.

The majority of international comparative studies suggest that the share of the shadow economy is higher in Hungary than in Western Europe, however lower than in some Eastern European countries. According to *Schneider's* (2004; 2012) indirect estimates using macro-level data, the shadow economy made up 24–26% of the GDP in Hungary between 1999 and 2007. This was similar to Poland, however significantly higher than in the Czech Republic and Slovakia (17–19%), or Austria and Germany (10–16%), but lower than the estimated 30–34% for Romania. *Elek et al.* (2009b, Table 1) reported various figures concerning the shadow economy in Hungary.

Some international comparative studies assess the loss of tax revenue due to the shadow economy comparing "theoretical" tax revenue, estimated using income and consumption data from national accounts and tax regulations, with actual revenue from taxes. *Christie and Holzner's* (2006) rough estimates suggested that 46% of consumption was hidden from VAT payment, and 30% of the personal income tax base as well as 36% of social insurance contributions were hidden in Hungary. However, this calculation did not take into account the overall complexity of the tax system and the presence of tax allowances, therefore the figures should be considered upper estimates – nevertheless they might still be suitable for international comparison. This comparison also suggested that tax evasion was higher in Hungary than in Western Europe and its magnitude was similar to that in other Visegrád countries. A more exact estimate of the evasion of main taxes in Hungary was provided by *Krekó and P. Kiss* (2008) who argued that the evaded part of the VAT base was 12–14% of GDP in 2005, equivalent to 23–27% of household consumption (the VAT base) and thus considerably lower than *Christie and Holzner*'s (2006) estimates. According to *Krekó* and *P. Kiss* the hidden VAT was around 2% of GDP; while the total quantified tax evasion – including tax evasion by employees and the self-employed – came to around 7–8% of GDP.

## International estimates of shadow employment

With regards to labour-market related forms of tax evasion, cross-country comparisons in the international comparative literature cannot always fully consider all dimensions of shadow employment (grey and black work); therefore they use more easily measurable proxies. Hence entrepreneurs without employees, unpaid family workers, employees without a written employment contract or (as a broader category) workers employed by micro businesses (less than five employees) are often considered informally employed workers. The different

proxy categories provide different estimates for informal employment. Considering the three most frequently analysed categories, six per cent of the non-agricultural workforce were entrepreneurs with no employees and 2.6% were employed without a written employment contract in Hungary in 2006–2007 (the latter nearly halved since 2002), while approximately 2% of the workforce had more than one job. These figures, with some exceptions, are broadly similar to those of other Visegrád countries – however the share of those without an employment contract and of entrepreneurs are considerably lower than in the less developed OECD countries, such as Mexico and Turkey.[3]

According to the Eurobarometer Survey of the European Commission in 2007, seven per cent of the Hungarian sample responded that they had done undeclared work in the previous 12 months and eight per cent of those in employment said that they regularly received all or part of their pay as an envelope wage. Thus, data suggest that both black and grey work is more widespread in Hungary than the EU average (five per cent for both). Interpretation is made more difficult by the fact that the highest rate of undeclared work was recorded in Denmark (18%) while Southern European countries reported very low rates (one to four per cent in Cyprus, Malta, Italy, Spain and Greece), which seems to contradict information from other sources. This suggests that cross-country differences in black and grey work are very difficult to measure reliably with survey methods due to differences in the willingness to respond and in the interpretation of questions.

The remainder of this chapter explores wage-related tax evasion in Hungary using a secondary analysis of micro-level (administrative and population survey) data that were mainly collected for other purposes. This approach minimises the underreporting bias of surveys specifically designed to measure tax evasion, however it still has the advantage of micro-level analysis which permits the disaggregated analysis of tax evasion. These studies typically use data until 2007 or even earlier, therefore *Box 6.1* at the end of this chapter analyses changes in the prevalence of envelope wages in the past four years using population surveys from 2008 and 2012.

## Measuring undeclared work using administrative data

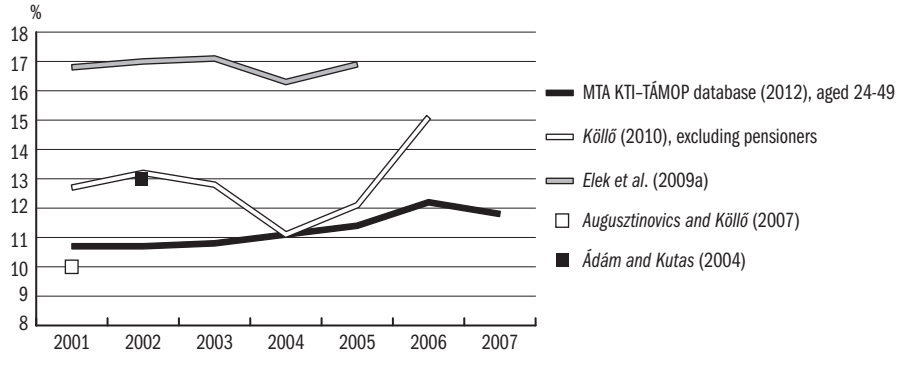
Within undeclared work, the share of those workers can be estimated who have not been declared to the authorities by their employers but in different surveys respond that they are working. For the comparison, the number of declared workers (i.e. whose employers pay the employment-related contributions) can be calculated using individual-level administrative data from the Central Administration of National Pension Insurance (in Hungarian: Országos Nyugdíjbiztosítási Főigazgatóság, ONYF) and the National Tax and Customs Administration (in Hungarian: Nemzeti Adó- és Vámhivatal, NAV, previously APEH); total employment is taken from the KSH's Labour Force

3 Source of data: *OECD* (2008). The computations are based on European Social Survey, European Labour Force Survey and OECD Labour Force Statistics databases.

Survey (LFS).[4] The validity of the comparative (discrepancy) method depends on whether the majority of undeclared workers report their work in the LFS. Indirectly this is suggested by the fact that the LFS recorded the highest level of employment compared to other surveys (Population Census, KSH Time Use Survey, Tárki Monitor) in 2001 (*Elek et al.* 2009b).

Recently various studies estimated the level of undeclared employment in LFS data using the comparative method *(Figure 6.1).*

**Figure 6.1: Estimates of undeclared employment in the LFS, 2001–2007 (percentage)**




Source: From referenced studies.

Results are slightly different depending on the methods and the sub-samples used, but they always fall into the range of between 10–17 per cent and do not seem to indicate major changes in 2001–2007. (This is the case despite the fact that the minimum wage increased considerably in 2002 which, according to the theoretical models, would have implied an increase in undeclared work.) *Ádám and Kutas* (2004) compared LFS data with tax return data from NAV. *Elek et al.* (2009a) modelled the LFS definition of employment on a database of 200,000 contribution payers from the ONYF and used the start and end date of insurance periods to adjust for any gaps in contribution payment (i.e. for fragmented employment).[5] With a slightly different approach, *Augusztinovics and Köllő* (2007) used the insurance qualifying time from the ONYF database to correct fragmented employment, focusing on the non-retired population. Finally, the Social Renewal Operational Programme (in Hungarian: TÁMOP) 2.3.2-09 coordinated by the Institute of Economics of the Hungaran Academy of Sciences (MTA KTI, the predecessor of the Research Centre for Economic and Regional Studies, in Hungarian: Közgazdaság- és Regionális Tudományi Kutatóközpont, KRTK) used a much larger sample of panel data – administrative data from half of the population – however its estimates refer only to the 25–49 year old population and indicate relatively low undeclared work levels (See Annex on pre-publication data.)

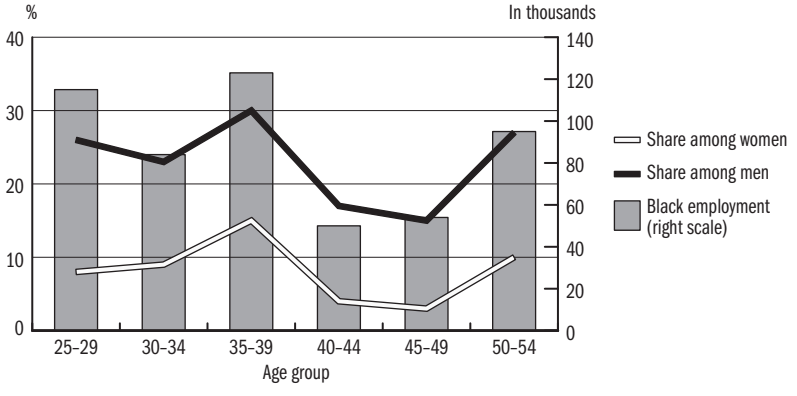
4 The Labour Force Survey defines people in employment as those who did at least one hour's paid work in the reference week or did not do any paid work but had a job and were temporarily away.

5 For the exact matching of the Labour Force Survey's and ONYF's definition of employment see the Appendix of *Elek et al.* (2009a).

These results are consistent with estimates from surveys: the prevalence of undeclared work was estimated at 15% by *Semjén et al.* (2009b), while *Czibik and Medgyesi* (2007) estimated approximately 10%. *Köllő* (2010) used a joint KSH–ONYF survey (see *Bálint et al.* 2010) to estimate black employment among those who worked in the same job according to the LFS from a given year until 2008. Completely undeclared work (no qualifying service for pension during the year) even in this relatively stable group of workers reached on average 8.4% each year between 1999 and 2006.[6]

Using micro-level databases it is possible to analyse undeclared work based on gender, age, place of residence and occupation. First, it can be concluded that undeclared work is substantially less common among employees than entrepreneurs. For example the number of entrepreneurs was estimated at 527,000 based on the LFS as opposed to 302,000 according to ONYF in 2004 (*Elek et al.* 2009a). Undeclared employment is significantly more common among men than women, and in terms of age, it is most prevalent in the 25–39 age group. Overall, nearly half of the undeclared workers are in the 25–39 age group (see *Figure 6.2*).

**Figure 6.2: The number and percentage of undeclared workers in the total workforce by age group and gender in the LFS and ONYF samples, 2004**




Note: Considering that pensioners in employment were not required to pay pension contribution in 2004 and employment in the 15–24 age group was very low, data is only presented for the 25–54 age group. According to calculations based on the MTA KTI–TÁMOP database (see Annex of this chapter) in 2007, when pension contribution had to be paid, undeclared employment was about five per cent – well below average – among the 50–74 year olds.
Source: *Elek et al.* (2009a).

The prevalence of undeclared work is highest in the central parts of the country and it is above average on the Great Plain. However, the regional estimates might be biased because ONYF records the permanent address while LFS uses the place of actual residence; therefore some of the workforce moving into regions with more job opportunities might not appear there as a regis-

6 The results might be biased by the fact that those people who were the most motivated to participate in the joint KSH–ONYF survey were those who suspected that they were not declared by their employers to the relevant authorities. This bias could be partly adjusted by applying weighting based on observable characteristics.

tered employee. However, other data suggest that migration is low so this bias is probably not substantial. The findings of these studies are consistent with the results of a survey reported by *Sik and Tóth* (1998) in that undeclared work was least prevalent in Transdanubia, particularly the Central-Transdanubia region. The estimates according to occupational groups are very sensitive to the accuracy of categorisation, therefore only some unequivocal results are highlighted here: undeclared work is prevalent and common among workers in building construction, drivers, machine operators, technicians and people in personal services. Above average prevalence is found among security guards, architects, secondary school and university graduate IT workers, university graduate cultural occupations and in repair and maintenance. There is no, or very limited, undeclared employment among secondary school and university graduate employees in health and human services (working mostly in the public sector), university graduates in general (except architects and cultural occupations), in catering and in elementary occupations (except agricultural workers).[7] Undeclared employment is below average in the retail sector and in light industry as well.

The database used by *Köllő* (2010) is the only database that combines LFS and ONYF data for the same individuals, therefore the probability of reporting can also be analysed using multivariate estimation. The study included individuals who said that they had been working in the same job without interruption and looked at the actual ratio of these that appeared in the ONYF register as opposed to the expected 100 per cent. The coefficients of variables explaining the percentage of reporting indicated below-average ratios where higher levels of undeclared employment would have been expected based on the findings of other studies and everyday experience (small enterprises, self-employed, casual workers, new entrants and those near pension age, people in atypical employment, male, Budapest, areas affected by high unemployment). The controlled (multivariate) estimation showed that reporting was lowest among people with a non-vocational secondary education. The ratio of reported qualifying time was somewhat, although not significantly, higher among those with a primary education or below, while among those with a secondary vocational qualification the data show that the ratio was around 3–4% higher (compared to those with a non-vocational secondary education). College graduates reported more working days by four percentage points, while university graduates by eight percentage points than comparable people with a non-vocational secondary education.

## Measuring grey work

Underreporting of wages is prevalent in some sectors even in Scandinavian countries, often cited as examples of a high level of tax compliance.[8] It is particularly common that entrepreneurs pay the compulsory minimum wage.

7 These findings do not exclude the possibility that the prevalence of undeclared employment is high among the self-employed in these occupations.

8 Based on inspections carried out in 678 pizza restaurants, the Danish tax authority found that wages were under-reported for 40% of the workers. The majority of the others were completely undeclared. One third had their "first day at work" at the given workplace (*Kolm and Nielsen,* 2008).

This "disguised minimum wage" is especially common in countries on the European periphery, and it was also widespread in Hungary until recently. Softer and harder facts on this were reported by the *World Bank* (2005) for multiple countries, *Erdogdu* (2009) for Turkey, and *Kriz* et al. (2007), *Masso and Krillo* (2009) and *Meriküll and Staehr* (2010) for the Baltic States. In various countries, such as Latvia, Lithuania, Hungary and Romania, the number of people who are paid the minimum wage is (or was a few years ago) suspiciously high, despite the minimum wage – average wage ratio being near the international average (*World Bank,* 2005). Although there might be various reasons for the high number of people earning around the minimum wage, tax evasion is certainly one of them (for alternative arguments see for example *Shelkova,* 2008 or *DiNardo et al.* 2005). In an international comparison, *Tonin* (2011) found a strong relationship between the rate of people who are paid the minimum wage and the estimated size of the black economy.

Hungarian studies so far – except for *Elek et al.* (2009b) – were based on the assumption that fraudulent employers register their workers at the minimum wage to minimise their tax liabilities, however workers are also paid envelope wages. This assumption is strong far from obvious. Even if it is true that entrepreneurs maximise their profit in the short run if they pay the national minimum wage, in the long run this strategy has costs as well: on the one hand it might trigger the protest and exit of workers, and on the other hand it might increase the probability of being caught if the tax authorities are suspicious of companies paying the minimum wage. "Registering workers at the minimum wage" becomes the dominant form of underreporting wages if workers have limited bargaining power and/or see no strong relationship between contribution payment and future eligibility for transfers (pension, unemployment and health care), moreover the tax authorities do not consider minimum wage as a signal of tax fraud.

Incentives and permissive conditions for "registration at minimum wage" were undeniably present in Hungary before 2007. Due to high contributions the potential gain from underreporting wages was high and has remained high. As is highlighted by *Tóth and Semjén* (2009) the majority of those who are paid the disguised minimum wage accept underreporting out of necessity. The relationship between contributions and benefits is loose and the probability of being caught only increased in 2007 when – following the examples of Bulgaria (2003) and Croatia (2003) – a contribution base equal to twice the minimum wage was introduced. This made it clear that policy makers considered the payment of minimum wage as a "signal of tax fraud". This measure reduced the number of people paid the minimum wage by 60% in a single year; however this does not mean that underreporting of wages became less prevalent, but the optimum method of hiding the tax base changed.

Research in Hungary started relatively late in 2007 and estimates of the prevalence of underreporting of wages are rather uncertain and spread across a wide range depending on the methods and assumptions applied.

The *existence* of underreporting of wages was studied using indirect methods by *Tonin* (2011), and *Benedek et al.* (2006). Tonin found that food consumption declined more in poor households where one or more family members earned the minimum wage than in similarly poor, but non-minimum wage earning households after the increases of the minimum wage in 2001–2002. Thus, he concluded that the typical worker earning the minimum wage receives some of his pay as an envelope wage (for more details see *Box 6.2*). On the contrary, *Benedek et al*. found that the average person earning the minimum wage does not consume more compared to their income than a similar worker who earns more than the minimum wage.

### *The number of workers earning the minimum wage*

Attempts to estimate the *magnitude* of underreporting face difficulties from the outset because it is difficult to establish how many people are earning the minimum wage. Payroll statistics are only available for companies of five or more workers, while the general assumption is that the majority of workers earning the minimum wage are employed by companies with 0–4 employees. One of the first attempts to establish the number of people earning the minimum wage was by *Krekó and P. Kiss* (2007, 2008); in a period when some of the data necessary for reliable estimates was not available. They started out from the observation that 30% of tax payers reported an annual income of less than twelve times the monthly minimum wage in 2005. After adjusting these figures using data on daily working time and assumptions on annual working time, they concluded that 700–750 thousand people were paid no more than the minimum wage in 2005, approximately equivalent to 25–27% of the workforce at that time. Later, more accurate estimates could be made using ONYF's data on contribution payments (the KELEN database) because these provide more accurate information on the length of contribution payments within the year[9] and also allow a distinction between wages and income-dependent transfers that appear in personal income tax returns as labour income such as unemployment allowance, child care allowance and sick pay.

Estimates based on ONYF data suggest that a smaller rate of workers were paid the minimum wage. Using data from 2004 *Elek et al.* (2009b) estimated the number of workers earning the minimum wage at or below 472,000 people (17%). They also concluded that only 40% of those with an annual "labour income" less than twelve times the monthly minimum wage were actually paid less than the minimum wage per month. The majority did not reach this level because they were not working throughout the whole year.

9 The duration of employment in one year can only be estimated from personal income tax returns – based on information on tax credits.

Even more accurate calculations can be done using the very large 50% sample of the MTA KTI–TÁMOP database (for details on the database see the Annex of the Chapter). According to this data set, 21.3% earned no more than twelve times the monthly minimum wage annually in 2005. However, if only the income of employees and public sector workers is considered (and the income of entrepreneurs and transfers are disregarded) then the annual rate drops to 15% while the rate of those whose average daily earning falls below the daily minimum wage amounts to only 10.2%. This rate is only slightly higher than the 9.6% reported in the Wage Survey (in Hungarian: Bértarifa-felvétel) based on the monthly pay of workers in companies with five or more employees and public sector workers.[10]

Finally, the April – June wave of the KSH's Labour Force Survey in 2001 provided useful information, since it also covered earnings as a special feature. The survey identified 486,000 employees whose monthly pay was not higher than the minimum wage; this corresponded to 17.7%.[11]

Based on the above calculations it might be concluded that the total number of people who were paid the minimum wage or less was between 300 and 500 thousand during the peak of the mid-2000s; well below the 1–1.5 million figure suggested by the media.[12] The question is, how many of these were committing tax fraud?

### *The number of disguised minimum wage earners*

*Krekó and P. Kiss* (2007) estimated the number of disguised minimum wage earners based on the assumption that wages and the rate of part-time workers were the same in companies with 0–4 workers and in larger companies. They found that companies employed more than 450,000 people fraudulently at the minimum wage in 2005, somewhat more than 15% of the total workforce. The rate of fraudsters was estimated at 70% in small companies. Furthermore, it was estimated that for more than 300,000 part-time workers employers reported shorter working time than the actual number of hours worked.

*Elek et al.* (2009b, 2012) used the *double hurdle* econometric model to estimate the probability of fraud in 2003 and 2006 data.[13] The model starts from the assumption that the (latent) true wage can only be observed if two conditions are met simultaneously: the individual's productivity is above the minimum wage level *and* is not underreporting. In all other cases the minimum wage is observed instead of the true wage. If model variables can capture the variance in productivity and fraud, then the probability of fraud and the true earnings of individuals can be estimated. Both estimations were based on data from the Wage Survey for companies with five or more employees, where payments *under* the minimum wage were practically non-existent. Thus the aim was to identify envelope wages for those who were paid in a narrow range around the minimum wage.

10 Using the original weightings of the Wage Survey provided by the National Labour Office, this rate is 7.6%. The above figure is obtained using the correction weights computed by the IE HAS Databank that also take into account that the response rate among small businesses is below average. It should be noted that six per cent of the 2005 Wage Tariff Survey's sample worked in companies with 0–4 employees.

11 For this computation we converted the net monthly wage into the gross monthly wage using the tax table and then calculated full-time monthly equivalent earnings based on the number of working hours paid. This value was then compared to the minimum wage which was, at that time, 40,000 forints.

12 Google returns 1,502 search results for the term "one million minimum wage earners" (*in Hungarian: "egymillió minimálbéres"*).

13 The model was first used by *Cragg* (1971) to model the consumption of durable goods. Since then the model and its extensions have been used by numerous studies, however we are not aware of many applications in the field of wage distributions (but see *Shelkova,* 2008 and *Di Porto,* 2011).

*Elek et al.* (2009b, 2012) estimated the rate of disguised minimum wage earners in the private sector using the above method at 7–11% in 2003 and 5.5–6% in 2006. They found that approximately 40–50 of those earning the minimum wage received envelope wages as well in the two years (however, the estimate is rather sensitive to the assumptions on the wage distribution).[14] The estimated true wage of fraudsters was significantly above the minimum wage (by about 2–2.4 times in the two years), which follows from the fact that the probability of fraud is highest among high-skilled minimum wage earners.

Estimates also show that disguised minimum wages are more common than the average in free-lance or retail type occupations that are characterised by frequent cash transactions.[15] This is not surprising since the presence of costumers using cash provides more opportunities for tax fraud. While underreporting was estimated to be 15% among cleaners, in the construction industry it was 50–60%, and nearly 100% among managers and university graduates. The share of disguised minimum wage earners in the total workforce is highest in the construction and retail sectors.[16] The probability of underreporting is negatively associated with the size of the company; furthermore it is low in foreign-owned companies (*Tóth and Semjén* (1996) and *Semjén and Tóth* (2004) reported similar findings). The probability of underreporting is higher in Budapest and in villages compared to towns; which is consistent with the findings reported by *Semjén et al.* (2009b) for example. The presence of tourism increases, while the density of enterprises decreases the probability of tax fraud.

Not only is the probability of fraud higher among more educated minimum wage earners with better earnings potential – this is expected –, but also they are responsible for a disproportionately large part of the contribution and tax base hidden as a result of underreporting wages. This is not addressed explicitly in the above studies; therefore it is discussed here using 2006 data from the paper by *Elek et al.* (2012), see *Table 6.1.*

**Table 6.1: "Disguised" minimum wage earners in the quintiles of the estimated true wage, 2006**

| | Quintiles of the estimated true wage | | | | | Total |
|---|---|---|---|---|---|---|
| | bottom | 2nd | 3rd | 4th | top | |
| Minimum wage earners (percentage) | 41.6 | 8.0 | 8.0 | 7.9 | 6.4 | 14.8 |
| Probability of fraud among minimum wage earners (percentage) | 33.4 | 54.2 | 61.5 | 70.6 | 84.9 | 47.5 |
| Fraudulent minimum wage earners in the group (percentage) | 13.9 | 4.3 | 4.9 | 5.6 | 5.4 | 7.0 |
| Excess of the simulated real wage above the minimum wage (thousand forints) | 3.6 | 22.3 | 54.1 | 106.1 | 285.7 | 95.1 |
| The distribution of hidden wages (percentage) | 2.0 | 3.8 | 10.4 | 23.1 | 60.7 | 100.0 |

Source: Own calculations based on results reported by *Elek et al.* (2012).

14 *Elek et al.* (2009b) estimated the proportion of disguised minimum wage earners at 40–65% of all minimum wage earners in 2003; the lower end indicates a scenario when tax evasion only happens among minimum wage earners. (Allowing tax evasion above the minimum wage changes both the true wage distribution and the number of disguised minimum wage earners.) *Elek et al.* (2012) estimated the proportion of disguised minimum wage earners at around 50% for 2006.

15 For the definition of categories see *Köllő* (2008), *Appendix 4.*

16 It should be noted that these results include only employees and not the self-employed.

For *Table 6.1* business sector employees observed in the Wage Survey were ranked into quintiles (one-fifths of equal number) based on their estimated true wage; for non-fraudsters this was equivalent to the actual wage and for fraudsters to the predicted true wage. The table shows that the probability of fraud among minimum wage earners in the bottom quintile was 33%, while it was 85% among the potentially highest earners. Although the number of disguised minimum wage earners declines, the excess of the true wage above the minimum wage increases sharply towards the high end of the (true) income distribution. Based on this information it is possible to calculate how the amount hidden from taxation is distributed between quintiles of workers: over half of it goes to the quintile with the highest (true) pay.[17] The policy implications of this will be discussed later.

It should be noted that the above calculation ignores the underreporting of working time as a form of evading the minimum wage (*Krekó and P. Kiss,* 2007; *Elek et al,* 2009b; *Semjén et al.* 2009b), which frequently occurs in the lower segments of the market and somewhat mitigates the inequalities reported in the table. *Box 6.3* examines whether the introduction of the stamp book for casual workers (in Hungarian: alkalmi munkavállalói könyv) reduced the extent of the black economy – through the registration of previously undeclared workers, or boosted it – by switching regular employment into casual work.

### *Policy implications*

What is the effect of the fight against the underreporting of wages on the labour market? *Kolm and Nielsen* (2008) examined this question using a partial equilibrium framework, thus ignoring the impact on investment and budget. According to their model stricter inspection increases unemployment through an increase of production costs (that is equivalent to the increase of effective tax rates). Higher labour taxation, somewhat surprisingly, reduces unemployment: the return on underreporting is higher if tax rates are higher, therefore increased labour supply puts a downward pressure on wages and makes it possible to expand demand as well as employment.

Obviously, the underreporting of wages also influences the labour market via reducing budget revenues, particularly in countries characterised by high state intervention and where the tax burden on legal employment is high. What is the impact of underreporting on the budget? *Köllő* (2008) deliberately attempted to give an exaggerated *upper bound estimate* for hidden wages and foregone tax revenues. He attempted to estimate the increase in the tax base and revenues based on the following assumptions: a) all minimum wage earners are fraudsters, b) all workers currently receiving the minimum wage would be paid the same as what workers with a similar education and experience are getting who are not paid at the minimum wage level, c) labour demand is insensitive to wages, and d) underreporting can be eliminated at zero cost. Under these admittedly

17 Given that the groups are of equal size, the total amount of hidden income is the sum of the product of the numbers in the third and fourth rows.

unrealistic conditions, social security contributions would go up by 8.5% and income tax revenues by 9.7%. This would mean an additional revenue equivalent to 1.3% of the GDP (approximately 250 billion forints in 2003). However, if it is considered that not all people who are paid the minimum wage are fraudsters and their true pay is lower than that of similar workers paid above the minimum wage, labour demand is price elastic and combating tax evasion is expensive, then this figure most likely remains well under 1% of the GDP.

In a similar analysis, *Elek et al.* (2009b) sought to answer a similar question: by how much would budget revenues have increased if all workers paid the minimum wage had been receiving the simulated wage using the double hurdle model? The estimated impact on the budget was 0.6–0.7% of the GDP – in the case of companies with five or more employees. *Krekó and P. Kiss* (2008) estimated the loss from the tax base as a result of workers paid the minimum wage or less at 2% of the GDP (out of this the loss of tax revenue could be around 1% of the GDP), however this is biased by the overestimation of the number of minimum wage earners. Whichever findings are considered, the hidden tax base of disguised minimum wage earners is considerable smaller than the loss of the tax base due to tax evasion by entrepreneurs and VAT fraud. *Krekó and P. Kiss* (2008) estimated these at around 7% and – as previously highlighted – 12–14% of the GDP respectively in 2005–2006.

The easiest way to combat underreporting seems to be an increase of the minimum wage. This was one of the arguments in favour of the minimum wage increases of 2001–2002, and it was one of the stated aims of the introduction of the double contribution liability in 2007. However, in addition to its benefits – no additional cost – this solution has major disadvantages. Various studies (*Kertesi and Köllő,* 2004; *Halpern et al.* 2004; *Köllő,* 2008) pointed out that the increase of the minimum wage reduced labour demand and made low-productivity and low-paid labour more expensive. On the other hand, as is clearly shown by *Table 6.1*, raising the minimum wage will only have a small impact on the total amount of foregone labour taxes and contributions. A drastic increase, for example by 20,000 forints, would reduce the tax base hidden by the top quintile only by 10%: instead of 285,000 forints on average to 265,000 forints (or in the second quintile from 106,000 forints to 86,000 forints). Considering that the top two quintiles hide four fifths of the total wages, the overall "whitening" effect would not be significant; nevertheless it would make it considerably more expensive to employ low-productivity workers.

Underreporting at the minimum wage level among employees became negligible in 2007,[18] and peaks appeared in the wage distribution around the "skilled minimum wage" and the double of the minimum wage. Changes in the composition of people underreporting their wages are illustrated by characteristics of the 80,000 employees who were paid twice the minimum wage in 2007. The average wage of this group was only 91,500 forints in 2005; therefore they saw

18 See for example *Elek et al.* (2009b, Figure 4) on the trends in the number of minimum wage earners between 2000 and 2007.

an increase of over 40% in two years. This was considerably higher than the 20% which people earning less than twice the minimum wage in 2007 achieved in two years. This suggests that the prevalence of tax evasion was higher than the average in the second group in previous years (and it is likely that they are still receiving some of their pay as envelope wages on top of their increased wage). There were significantly more people from Budapest and in managerial positions among those earning twice the minimum wage than among those earning slightly less. The suspicion of underreporting is further increased by the fact – as shown by *Elek et al.* (2012) – that companies labelled as fraudulent in 2006 were more likely to increase the pay of their minimum wage earners to the double of the minimum wage in 2007 than other companies.

It should be noted that the differentiation of the minimum wage and the introduction of a contribution base that is larger than the minimum wage – if implemented out of budgetary considerations – essentially mean a simple form of *presumptive taxation*. This simple form implies excessively high tax burden for some businesses while others can easily comply with the regulations. Differentiating the minimum wage according to certain employee characteristics cannot be considered a sophisticated solution either, because presumptive taxation would require the definition of contribution minimums adjusted to the characteristics of businesses.[19] However differentiating according to educational attainment seems adequately targeted from a budgetary perspective in Hungary, considering that around nine tenths of graduates who are paid the minimum wage are fraudsters according to the findings of the above studies.

Unfortunately there is limited information about tax evasion above the minimum wage, an area becoming increasingly important, and its analysis poses serious methodological difficulties. The main drivers for tax evasion probably remained the same and only the peak at the minimum wage became "blurred"; thus underreporting of wages remains an important area for research.

## Tax behaviour of the self-employed

Due to its special nature, the tax behaviour of the self-employed is discussed separately. Compared to employees, they have more – legal and illegal – opportunities to minimise their tax liabilities, for example by declaring their labour income as capital income. Based on a comparative analysis in the European Union, *Krekó and P. Kiss* (2007, 2008) estimated the loss of tax base for the self-employed at around 6,7–7,5% of the GDP and the loss of tax revenue approximately half of this between 2005 and 2007.

Similarly to the tax-price elasticity literature discussed in *Chapter 2* of *In Focus – I*, *Benedek* (2011) estimated the elasticity of taxable income among the self-employed, and disaggregated it into labour supply and other (mainly tax avoidance) responses.[20] The tax reform used for the analysis was the introduction of the simplified business tax (in Hungarian: egyszerűsített vállalkozói

19 About the notion and its application see for example *Musgrave* (1981), *Tanzi and Casanegra di Jantscher* (1987) and *Arachi and Santoro* (2007), regarding applicability in Eastern Europe see the papers by *Pashev* (2007) and *Wallace* (2002).

20 For a similar international study see *Kopczuk* (2010).

adó, EVA) in 2003. For those who opted in, the simplified business tax offered a general low marginal tax rate as opposed to the complex and higher marginal tax rates of the regular business tax. The EVA replaced not only the personal income tax for entrepreneurs but also dividend tax as well as VAT; however the tax base was the gross revenue that could not be reduced by offsetting the expenditures of the company. Therefore switching to EVA was worthwhile primarily for medium and high income companies with small expenditure ratios.

The database used by *Benedek* (2011) was a 10% sample of entrepreneurs submitting a tax return in 2006 that included each line of the tax return as well as information about gender, age, labour market status and region for 2000–2006. The analysis was based on data from 2001 and 2004.

The results of the estimation showed that the marginal tax rate had a significant impact on the income reported by entrepreneurs. The estimated tax-price elasticity was 0.07–0.12 depending on the specification. This value includes all possible channels of response – i.e. labour supply, tax evasion and the reclassification of income (for example between salary and non-salary payments). When the regression also controlled for tax evasion using proxy variables, the estimated elasticity dropped to 0.043–0.055. Considering that the role of non-salary payments is limited for entrepreneurs, the two main forms of adaptation were labour supply and tax evasion. Thus the latter could be considered labour supply elasticity of entrepreneurs, and the difference between the two values was explained primarily by the elasticity of tax evasion.

This estimated total elasticity is low compared to other countries, particularly the elasticity found in the United States; however it is somewhat higher than the elasticity of employees estimated using data from Hungary (for more on the results of estimations in the international literature and research in Hungary, see *Chapter 2* of *In Focus – I.*) As will be shown in the next sub-chapter, tax evasion among entrepreneurs is very high. This suggests that they aim to minimise their tax liabilities under any conditions either using legal tax optimisation methods or tax evasion; this explains the relatively low tax-price elasticity. Contrary to total elasticity, the elasticity of labour supply can be considered substantial – although low by international comparison – which shows that the real productivity of entrepreneurs responds to changes in taxation.

## Tax evasion and income redistribution

Finally, the extent of tax evasion is examined using indirect methods. Indirect methods using micro data estimate tax evasion by comparing income and consumption information (e.g. *Pissarides and Weber,* 1989, *Lyssiotou et al.,* 2004) or different income categories (e.g. *Fiorio and D'Amuri,* 2005, *Matsaganis and Flevotomou,* 2008). These calculations do not distinguish black and grey employment, and other forms of tax evasion, therefore they can be considered an overall measure of tax evasion.

*Benedek and Lelkes* (2011) compared data from the HCSO's household budget survey (HKÉF)[21] with individual-level data from the tax authority to estimate the impact of tax evasion on redistribution and revenues. To estimate tax evasion at the individual level, information on both real and reported income is necessary. The problem is that no single database in Hungary has both type of data, so the database for the analysis must be merged from two different sources.[22] The joint database of the household budget survey and tax data is suitable for estimating the underreporting of income.[23]

It is estimated that income is underreported on average by 9–13% *(Table 6.2);* however it varies greatly according to the level of income.

**Table 6.2: Underreporting of income by taxpayers' income deciles, 2005**

| Taxpayer's income decile based on real income[a] | Real taxable income (thousand forints) | Extent of underreporting[b] (percentage) |
|---|---|---|
| 1st (bottom) | 301 | 26–30 |
| 2nd | 692 | 25–29 |
| 3rd | 892 | 14–18 |
| 4th | 1,070 | 10–14 |
| 5th | 1,248 | 9–13 |
| 6th | 1,432 | 8–12 |
| 7th | 1,690 | 9–13 |
| 8th | 2,014 | 8–12 |
| 9th | 2,560 | 10–13 |
| 10th (top) | 4,534 | 13–16 |
| Mean | 1,682 | 9–13 |

[a] Real income: gross taxable income in 2005.
[b] Underreporting of income = (Real income – Reported income)/Real income. The estimations were run using two specifications, the bottom and top values indicate the results of the two estimations.
Source: *Benedek and Lelkes* (2011).

The underreporting of income is U-shaped: it is highest at the bottom and top end of the income distribution. It is approximately 14–30 per cent among the bottom third of tax payers and 13–16 per cent in the top decile, while it is lower among middle-earners. As a percentage, the prevalence of underreporting is highest among the low paid; however in absolute terms its value is much greater in the top decile.

Apart from the income, there are substantial differences in terms of other variables as well. Entrepreneurs underreport their income by around two thirds (67%), while the same figure among employees is only four per cent. Nevertheless, high underreporting among entrepreneurs is not characteristically Hungarian. For example a study found that even in Sweden – which has a high level of tax compliance, entrepreneurs underreport their income by about 30% (*Engström and Holmlund,* 2009). Underreporting is higher among men than among women, which might be explained by men's smaller risk aversion

21 *In Focus – I* already uses the new name of the Hungarian Central Statistical Office's Household Budget and Living Conditions Survey (KSH HKÉF). However, that paper still refers to it by its previous name: Household Budget Survey (HKF).

22 The estimation uses the following two samples: First, the budget survey from 2005 (representative of the Hungarian population) with 9,270 active age participants who, by their own admission, pay taxes. Second, an approximately 5% sample of personal income tax returns for the tax year 2005, that consisted of 217,530 tax payers after data cleaning. Both datasets had information about individual characteristics that were the basis for the statistical matching to integrate the two datasets. The source of real taxable income was the budget survey; meanwhile information on the reported income came from the tax dataset.

23 The utilisation of this method is based on the assumption that the budget survey provides information about real earnings with no under-reporting. However, if earnings are under-reported by households – although they are higher than in the tax dataset – then the computed under-reporting underestimates the real level of under-reporting.

(*Eckel and Grossman,* 2008). In terms of regional distribution, the findings suggest that underreporting is highest in Central Hungary, followed by West Transdanubia. Finally, tax evasion is somewhat higher in older age groups and that might be explained by the higher prevalence of entrepreneurs in this category *(Table 6.3)*.[24]

**Table 6.3: Underreporting of income by main source of income, region, gender and age group, 2005**

| | Share of population (percentage) | Estimated reported income[a] (thousand forints) | Underreporting of income[b] (percentage) |
|---|---|---|---|
| **Main source of income** | | | |
| Wage | 90 | 1550 | 4 |
| Business income | 10 | 770 | 67 |
| **Region** | | | |
| Central Hungary | 31 | 1796 | 17 |
| Central Transdanubia | 11 | 1380 | 8 |
| West Transdanubia | 12 | 1350 | 13 |
| South Transdanubia | 7 | 1284 | 9 |
| Northern Hungary | 12 | 1363 | 5 |
| North Great Plain | 13 | 1287 | 9 |
| South Great Plain | 14 | 1295 | 12 |
| **Gender** | | | |
| Male | 50 | 1581 | 17 |
| Female | 50 | 1362 | 7 |
| **Age group** | | | |
| 16–29 | 18 | 1147 | 9 |
| 30–44 | 39 | 1497 | 14 |
| 45–59 | 41 | 1593 | 12 |
| 60–65 | 2 | 1462 | 20 |

[a] Real and reported income: Gross taxable income in 2005.
[b] Underreporting of income = (Real income – Reported income)/Real income
Source: *Benedek and Lelkes* (2011).

The impact of tax evasion on the income distribution can be examined using a microsimulation model. As a result of tax evasion, families pay approximately 20% less personal income tax than they should be paying based on their true income. If tax evasion is taken into account, income inequalities are much greater than suggested by reported income. In this case, the Gini Coefficient and the P90/P10 indicators are around 5–7% higher, mainly as a result of higher underreporting of income among high earners. This also explains that taking tax evasion into account the 2005 tax system was less progressive than it seemed on the basis of reported income.

24 The latter two findings seemingly contradict the findings regarding black employment: this suggested that the prevalence of undeclared employment was lowest in the Transdanubian regions and highest in the youngest age group. However, this subchapter looks at tax evasion in general and not only undeclared employment.

## Concluding remarks

This chapter has provided an overview of empirical findings related to black and grey employment as well as tax evasion in Hungary, based on micro-level data. According to estimates based on the comparison of KSH's Labour Force Survey and administrative data, the prevalence of undeclared (black) work was around 10–17% – depending on the methods used and the selection of the sub-sample – in Hungary between 2001 and 2007. The findings do not highlight any noteworthy trends over time. The prevalence of black work is above average among men, the self-employed and in Central Hungary, as well as in certain occupations such as building construction and services.

To examine the phenomenon of grey employment, the number and distribution of disguised minimum wage earners in 2006 – before the introduction of the double minimum wage rule – was analysed using the double hurdle econometric model. It was estimated that disguised minimum wage earners are concentrated in certain groups: their number and share was higher for example in the construction and retail sectors and in micro enterprises. In other occupations that are also characterised by a high number of minimum wage earners – for example cleaners and unskilled workers –, the prevalence of underreporting of income was much lower. It was also shown that over half of the loss of the tax and contribution base could be attributed to the top quintile of the true earnings distribution. Therefore a uniform increase of the minimum wage – apart from reducing the employment of unskilled workers who were really paid the minimum wage – has only a limited impact on the amount of wages hidden from taxation, and thus, it does not have a substantial aggregate impact on reducing the shadow economy. Differentiating the minimum wage based on carefully selected characteristics (such as the introduction of a university graduate minimum wage), however seems to be an effective measure.

Finally, the total amount of unreported income – from black and grey employment as well as other sources – was estimated comparing data from the Hungarian Central Statistical Office's Household Budget Survey and tax returns submitted to the tax authority. The average rate of underreporting was found to be 9–13%, higher in the lowest and highest income groups. Estimates concerning the distribution of underreporting were by-and-large similar to the findings related to black and grey employment: tax evasion was higher among men, entrepreneurs and in Central Hungary.

## 6.1. The prevalence of envelope wages and the fear of unemployment

ISTVÁN JÁNOS TÓTH & MIHÁLY FAZEKAS

There are different types of undeclared work. A worker can be (a) employed by an unregistered business, (b) employed illegally by a registered business, (c) employed legally by a registered business and receive one part of their wage declared to the tax authorities and the other part as an undeclared envelope wage. If a worker is not employed by the company although effectively works there and receives his/her payment against a VAT invoice issued by another company (typically his/her own) then this is considered a variant of case (b) or (c).

This chapter explores whether the crisis has had an impact on the prevalence of envelope wages and it also looks at the relationship between previous unemployment experience and workers' willingness to accept envelope wage payments. First, the potential effects of the crisis will be discussed, then the data for the analysis, and finally the main findings will be presented.

In terms of undeclared work, registered businesses could have responded to demand and supply shocks associated with the crisis or unrelated government shocks (such as the increase of the minimum wage, statutory pay increases etc.) in a number of ways: 1) they laid off some of their workforce and "re-employed" them illegally, 2) increased the share of envelope wage payments within the workers' pay package, or 3) they increased the proportion of undeclared workers against declared workers, in extreme cases they froze hiring legally and only took on undeclared workers who were then paid envelope wages. All three adjustment strategies lead to the increase of envelope wage payment both in terms of prevalence and amount.

On the contrary, it might also be argued that the crisis and government measures had a negative impact not only on companies that register their employees but on the undeclared labour market as well. Demand for the products of businesses employing undeclared workers also *declined* despite their relative advantage in terms of labour cost compared to their competitors that employ registered workers (to a greater extent). Furthermore the decline in the share of undeclared work might also be associated with *sectoral* factors: due to the decline in consumption (particularly consumer services characterised by high under-reporting) and its stagnating at a lower level than before the crisis, or the collapse of the construction industry in Hungary, companies that relied more heavily on undeclared work might have been more likely to leave the market or reduce the number of their (undeclared) workers.

However, another possibility is that the flat income tax introduced in 2011 might have created incentives for declared as opposed to undeclared work for both employers and – particularly higher-paid – employees through the reduction of the tax wedge and no changes in the probability of inspection. These potential effects could have reduced the prevalence and extent of envelope wage payments.

The sum of the various effects can only be established with empirical analysis using multiple data sources. This chapter presents the relevant findings of two surveys that can provide useful information for further economic analysis. The first survey took place in 2008 and the second in the spring of 2012, both using a sample of 1,000 adults from the general population aged between 18 and 60 years.* Data was representative and homogeneous in terms of gender, age groups and type of settlement in both surveys.

Results suggest that at least 14.6% of 18–60 year olds received envelope wage payments at least once in the previous two years in 2008, while the same figure was 14.4% in 2012 – therefore the situation has not changed over the past four years. The survey also asked those who received part or all of their pay as an envelope wage to estimate the share of their last such pay within their total net earnings. Again, there were no considerable changes compared to the situation before the crisis: 29 per cent said that they received less than a quarter of their net earn-

* For the questionnaires and main characteristics of the surveys see link in the on-line version.

ings as an envelope wage payment, 17 per cent said less than half, eight per cent said no more than three quarters, three per cent said more than that but not their total pay, and 44 per cent stated that they received their total pay as an envelope wage.

There were various changes in the relationship between the prevalence of envelope wage and the characteristics of workers over the past four years; however the direction and strength of correlations often remained the same. For example, receiving envelope wage payments was more common among men (18–19%) than women (11%) both in 2008 and 2012.

Similarly, the willingness to accept envelope wage payments was consistently associated with previous unemployment experience. While 9 per cent of respondents who had never been unemployed received envelope wage payment in 2008 and 2012, 22 per cent of those who had experienced unemployment before said that they had received envelope wage payments within the previous two years.

With regards to other factors, there were some changes. In 2008 envelope wages were significantly more prevalent among workers in Budapest (19%) than those in the countryside (14%); by 2012 the situation changed and they became less prevalent in Budapest (12%) and increased somewhat among those living in the countryside (15%). There were similar changes in the age groups of workers: while in 2008 envelope wages were more common in the age group under 30 (21%) and 30–44 (16%) (their prevalence being 9% above 45), in 2012 the prevalence of envelope wages was high only among young people (20%) and in the other two age groups it was 13%.

Looking at the characteristics of people who take up undeclared work in the 2008 survey, it emerges that envelope wage payment was particularly common in a clearly defined group of workers (those avoiding poverty) – see *Fazekas et al.* (2012). This group is characterised by not having any assets apart from the property where they live, have a low level of education, work in semi-skilled or vocational jobs and often they or one of their family members has already experienced unemployment. People in this group move between a) legal employment with fully declared pay, (b) undeclared work and (c) unemployment. This highlights the link between unemployment and the prevalence of envelope wages. It can be assumed that the acceptance of undeclared or mixed pay is heavily influenced by the risk of unemployment. If there is such risk or it is higher, then the worker is more likely to accept envelope wage payments as well. The risk of unemployment was measured by asking the question "have you ever been unemployed since you first started working?" and the number of months in work during the previous year. The analysis of this relationship on the pooled database of 2008–2012 shows a correlation in the expected direction between past unemployment and receiving envelope wage payments (the probability of this is 2.7–3.2 times higher). The same result is obtained if gender, education, type of settlement and age are included in the analysis as control variables.[**]

[**] For detailed results see link in the on-line version.

## 6.2. Minimum wage or minimum tax?

MIRCO TONIN

What is the interaction between minimum wage legislation and the underreporting of earnings? *Tonin* (2011) looks at this issue by investigating the massive minimum wage increase that took place in Hungary in 2001, when the statutory monthly minimum wage was increased from 25,500 HUF (98 EUR or 90 USD using the average exchange rate for 2000) to 40,000 HUF (156 EUR or 140 USD using the average exchange rate for 2001).

The basic idea is that the minimum wage can have an impact on compliance, as it usually represents the smallest possible amount that has to be declared to be in the official economy. The impact is similar when declaring a sub-minimum amount is permissible, but attracts higher scrutiny by the tax authority (*Tonin,* 2013a).

In an environment in which firms and workers can collude to report to the fiscal authorities an

earnings amount that is different from the true one, the minimum wage poses a constraint on this decision and induces an increase in compliance by some, while pushing others out of the formal labour market into the black economy or into inactivity. As a result, there is bunching of declared earnings at the minimum wage level. Other things being equal, the higher the importance of underreporting in the economy or in a given sector or profession, the higher the spike in the distribution of declared earnings at the minimum wage level.

With underreporting of earnings, a minimum wage hike implies that some workers who on paper experience an increase in their earnings are actually just swapping some of the cash, "tax-free", payments for declared, and therefore taxable, income. As a result, they experience an actual drop in disposable income, as they are forced to declare a higher share of their true compensation (their effective tax rate goes up). Workers who were already declaring more that the new minimum wage before the hike, albeit possibly also underreporting, are instead unaffected.

Given that undeclared payments are not directly observable, it is necessary to employ some indirect measures to see whether this is indeed what happened in Hungary in 2001. *Tonin* (2011) looks at the change in food consumption or in the consumption-income gap, i.e. the difference between consumption and income in a given period, using the Hungarian Household Budget Survey Rotation Panel.

In particular, the study compares the change in food consumption (or the change in the consumption-income gap) in the period 2000–2001 between households affected by the minimum wage hike (the treatment group) and similar but unaffected households (the control group). Households in the treatment group are those with at least one member employed before the hike in the private sector for a (declared) wage above the minimum wage in force (25,500 HUF), but below the much higher to-be minimum (40,000 HUF). Households in the control group are those in which there is an employee with a similar wage employed in the public sector or an employee earning somehow above the to-be minimum before the hike. These two groups are comparable in the sense that there is a lot of overlapping in terms of total household income and, more importantly, the dynamics of food consumption did not differ between these two groups in the period just prior to the minimum wage hike, i.e. in 1999–2000.

What the analysis shows is that the dynamics of food consumption (or of the consumption-income gap) instead differs after the minimum wage hike, with households that apparently gained from the higher minimum wage, the ones in the treatment group, experiencing a drop compared to households in the control group. Interestingly, when considering skilled and unskilled/semi-skilled employees separately, the drop is present only for the former group, while there is no drop whatsoever for the latter. This suggests that underreporting of earnings is concentrated among relatively high productivity (skilled) employees declaring low wages rather than among low productivity (unskilled/semi-skilled) employees, who are more likely to be genuinely earning wages close to the minimum. There is also some evidence that, when considering skilled employees, the effect is particularly strong for households whose total income is relatively high, i.e. above 100,000 HUF.

One alternative explanation for the drop could be an increase in labour market risk after the minimum wage hike for the treatment group. If labour market risk were indeed the driver, then one would expect the low skilled to have a stronger treatment effect compared to skilled employees, while the opposite appears in the data. In any case, to avoid this confounding factor, only employees who remained employed for at least 12 months after the hike, i.e. for the whole of 2001, are considered in the analysis. This makes it more likely to have workers with an under-declared wage in the sample used in the analysis than in the population as a whole. One indeed could expect workers receiving cash side-payments to be more likely to keep their job after a minimum wage hike compared to workers complying with fiscal regulation, as unreported income may act as a buffer to absorb the minimum wage shock.

The study suggests that the minimum wage can affect compliance with fiscal regulation. However,

it is rather blunt as an instrument to fight underreporting. A too low minimum wage would fail to make a dent on underreporting, while a too high one may push firms and workers underground or simply price-out low skilled workers. It is possible to devise similar but more targeted instruments to fight underreporting. Bulgaria, for instance, has introduced sector- and occupation-specific "minimum social insurance thresholds" on which social security contributions have to be paid (*Tonin,* 2013a).

Tonin (2011) has thus shown evidence of underreporting of earnings and its interaction with minimum wage legislation in the Hungarian context. These issues, however, are not specific to Hungary. Within European labour markets, there is evidence of a positive correlation, after controlling for the minimum wage level, between the extent of underreporting of earnings in the economy, as measured through a Eurostat survey (*EC,* 2007) on cash-in-hand payments by employers, and the proportion of full-time employees with earnings at the minimum wage level (*Tonin,* 2013b).

This correlation is consistent with the role of the minimum wage in an economy with underreporting highlighted above, while it is possible to exclude alternative explanations related to the prevalence of small firms in the economy or to the tax rate. The practice of officially declaring the minimum wage and paying additional remuneration as cash in an envelope seems not to be peculiar to Hungary, but is relevant in many countries in Central and Eastern Europe.

## 6.3. Tax evasion in the Hungarian mini-job scheme

ÁRPÁD FÖLDESSY & ÁGOTA SCHARLE

*The advantages of mini-job type employment contracts*

Simplified employment contracts, such as the German mini-job scheme can boost employment by reducing the administrative burden of hiring and employment, provided that the reduction is effective in practice. In most cases, the simplification is implemented in the compliance rules of taxes and contributions, e.g. in the case of Hungary, buying a single welfare contribution stamp replaces the reporting and payment of various social security contributions and personal income tax. The simplification decreases both the fixed and the transaction costs of hiring and employment, which on the one hand increases demand for labour (especially at low wage levels, where this fixed cost is relatively high, compared to wages), while on the other hand it may promote registered employment ("whitening").

In Hungary, the so called stamp book for casual workers (stamp book or SB hereinafter) introduced in 1997 and abolished in 2010 included further incentives: in most years, the price of welfare contribution stamps was lower than the sum of taxes and contributions on the minimum wage payable in a regular employment contract. The most favourable year was 2005, when the tax and contribution burden was 18–24 per cent of the total wage cost with a SB, as opposed to 40 per cent in a regular contract at the minimum wage (*Budapest Institute,* 2012).

*Previous studies on the whitening effect of the stamp book for casual workers*

The stamp book reduced wage costs as well as administrative costs for seasonal and casual labour. This may have increased demand for labour and may have reduced unregistered employment. In the following, we only consider the latter effect. The actual whitening effect of the stamp book – in contrast with the unambiguously positive demand effect – cannot be predicted on a theoretical basis. In accordance with policy aims, it might have provided an incentive for reporting previously undeclared labour (whitening), but unintentionally, it also promoted the legal or semi-legal underreporting (greying) of the wage cost for registered employment. Determining the relative magnitude of these two effects is an empirical question.

Previous studies on the stamp book, along with non-representative surveys and reports prepared by the government administration mainly focus on the types of abuse, e.g. the case of buying fewer

welfare stamps than implied by the actual number of hours worked (*ÁFSZ,* 2008; *Semjén et al*. 2008a, 2009a). However, the recurrence of such forms of abuse does not necessarily prove that the stamp book was ineffective. Consider the case of when the worker in question had been engaged in fully unregistered (black) work or was not employed at all: his or her employment with a stamp book would in this case generate revenue for the budget and increase registered employment even if the contribution stamps were not paid for the full length of their contract.

*Semjén et al*. (2008b) survey the employment record of workers using the stamp book in the spring of 2008.[*] Their results indicate that in most cases the booklet was used either to legalize previous black employment to some extent, or during a period of probation. The survey also revealed that most respondents never met a labour inspector during their employment, or if they did, the inspector did not always fine the non-compliant employer. Finally, *Elek et al.* (2009b) analysed the whitening effect of the stamp book using the administrative data of the Central Administration of National Pension Insurance (in Hungarian: Országos Nyugdíjbiztosítási Főigazgatóság, ONYF). According to their calculations, the bigger half of those employed with a stamp book in 2006 had no other, registered job during the year, In fact, a vast majority of them had not worked in a registered job in the preceding two years. However, the revenues gained from the stamp book were modest (around 3 billion HUF in 2006), which implies a net fiscal loss even if as little as 5 per cent of that smaller half of potential cheaters did in fact abuse the booklet.

### *Examining the stamp book using administrative data*

The linked administrative database of the Institute of Economics, Hungarian Academy of Sciences allows us to examine the performance of the stamp book over a longer time span (see the Appendix by Mónika Bálint in *Chapter 1* of *In Focus – I*).[**] The raw aggregate data reveal a rapid increase in the number of stamp book contracts, mainly among those who had been previously unemployed. There was also a rapid rise in the number of workers without any prior registered status which would have made them eligible for social security benefits. The majority of those previously unemployed had been registered as such for several months prior to entering employment with the stamp book. The share of those who had been unemployed for one month only, was just below 15 per cent – and did not increase substantially in the months when the formerly unemployed could be employed at a reduced contribution rate. However, around 20–25 per cent of those with a stamp book had previously worked in regular, declared employment. Those switching from a fully registered job to grey employment would be found in the latter group, but not all of this group may be cheaters. Considering the above, we estimate that roughly one quarter of those employed with a stamp book contributed to the "greying" of employment. At the beginning of the period under analysis, the degree of abuse at the individual level was still minor: between 2002 and 2006, the median of the previous wages for those entering a SB job from a regular job was 0–3 per cent larger than the minimum wage in the given year. The same value is 12–18 per cent for 2007 and 2008.

The composition of those employed with a stamp book confirms our assumption based on prior labour market status (i.e. that those who had worked before are shifting to grey employment). Those entering a SB job from unemployment are on average less educated, they had been unemployed for several months prior to entry, and there was no significant increase in the number of such entrants between August 2002 and December 2005, when previously unemployed jobseekers paid a discounted contribution rate in a SB job. By contrast, those who had a registered employment spell before their SB job were more likely to enter during the discount period,

[*] The survey was conducted in April 2008, in Szabolcs and Győr-Sopron counties and Budapest, in a sample of 159 individuals.

[**] We used the version of the database which contains the originally daily-level labour market information in monthly aggregates.

more likely to have a short period of unemployment before their SB job, and less likely to live in the disadvantaged northern regions.

In summary, the share of workers entering a SB job from regular employment (i.e. those potentially shifting to grey employment) is considerable, but in our calculations, remains below one quarter of SB workers. Based on previous studies, according to which grey employment is more common e.g. among men and in the central part of the country, the improved targeting for labour inspection may be an efficient tool for curbing the abuse of the stamp book.

Determining the net fiscal impact of shifts between black, grey and fully registered employment would require further and more detailed calculations, on a database which documents the nature of employment relationships on a daily basis. Finally, in order to determine the net benefit of the stamp book, one would also need to estimate labour demand effects. This is because the reduction in the wage cost could potentially increase employment (white, grey, or black), either through an increase in hiring (if some of those labelled above as "becoming whiter" had in fact not been employed before) or through a decrease in the risk of job loss (if some of those labelled as "becoming greyer" would have lost their jobs in the absence of the SB scheme).

## APPENDIX

### The MTA KTI–TÁMOP database

The database contains data on half of the population aged 15–74 in Hungary, using the social insurance number to link administrative datasets from the Central Administration of National Pension Insurance (in Hungarian: Országos Nyugdíjbiztosítási Főigazgatóság, ONYF), National Health Insurance Directorate (in Hungarian: Országos Egészségpénztár, OEP), the Hungarian State Treasury (in Hungarian: Magyar Államkincstár, MÁK), and the National Labour Office (in Hungarian: Nemzeti Munkaügyi Hivatal, NMH). The database originally contained records of variable length. It was subsequently homogenized, so it currently records whether an individual was employed on the 15th day of each month between January 2001 and 2009. For computations reported here, to ensure comparability of the datasets, assisting family members and employees claiming old age pension have been excluded from the Labour Force Survey (LFS). Furthermore, we only considered those birth cohorts that might have been included in the administrative dataset. Employees in the LFS may include a subset of farmers exempt from tax and contribution payment (licensed traditional small-scale producers, in Hungarian: őstermelő) and therefore excluded from the ONYF dataset. Currently the database is undergoing preliminarly tests to assess the reliability of the data. Once these are over, the database will become accessible for the broader research community. A more detailed description of the database and its availability is provided in the Appendix of Chapter 1 of *In Focus – I.*

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