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ASSESSMENT OF THE TAX AND TRANSFER CHANGES IN HUNGARY BETWEEN 2010 AND 2017 USING A MICROSIMULATION MODEL

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Assessment of the tax and transfer changes in Hungary between 2010 and 2017 using a microsimulation model*

(A 2010–2017 közötti adó- és transzferváltozások elemzése mikroszimulációs modellel)

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Contents

Abstract

In this study, we analyse the immediate budgetary and the long-term macroeconomic and fiscal effects of measures concerning taxes, contributions and transfers in the period between 2010 and 2017 with a microsimulation model. The corresponding tool is an updated and extended version of the behavioural general equilibrium microsimulation model developed by the Magyar Nemzeti Bank. Among the relevant fiscal policy measures, we primarily took into account the changes in labour taxes, the main elements of the transformation of social benefits and indirectly several other tax changes (on sales, capital and consumption taxes) over the period between 2010 and 2017. Our results suggest that the policy measures examined might contribute to Hungarian GDP growth by nearly 6 percent with a labour supply growth exceeding 6 percent from 2010 onward. The measures have a positive effect on the general government balance, improving the fiscal position over the long run by more than HUF 200 billion. The effects of the statutory changes are evaluated separately and cumulatively. The results of the study might be significantly influenced by the calibrated parameter values in the macromodel that is linked to the microsimulation.

JEL: C54, E62, H22, H31
Keywords: behavioural microsimulation, micro macro model, taxation, transfers, tax reform

Kivonat

Tanulmányunkban mikroszimulációs modell segítségével számszerűsítjük a 2010 és 2017 között hatályba lépett adó-, járulék- és transzferintézkedések azonnali költségvetési, valamint hosszú távú reálgazdasági és fiskális hatásait. A használt eszköz a Magyar Nemzeti Bankban fejlesztett viselkedési mikroszimulációs modell aktualizált és kibővített változata. Az érintett szabályváltozások között figyelembe vettük a munkát terhelő adók valamennyi lényeges változását, a szociális juttatások átalakításának főbb mozzanatait, valamint közvetetten számos egyéb adónemváltozást is (forgalmi, tőkét és fogyasztást terhelő adók) a 2010–2017-es időszakban. Eredményeink szerint a vizsgált intézkedések összességében a hazai GDP szintjének közel 6 százalékos bővülését hozhatják a munkakínálat 6 százalékot meghaladó ütemű növekedése mellett. Az intézkedések kedvezően hatnak az államháztartás egyenlegére, hosszú távon összesen több mint 200 milliárd forinttal javítva a költségvetés pozícióját. A törvénybe iktatott változások hatásait külön-külön és kumuláltan is értékeljük. A vizsgálat eredményeit a modell kalibrált paraméterei jelentősen befolyásolhatják.

JEL: C54, E62, H22, H31
Kulcsszavak: Viselkedési mikroszimuláció, mikro makro modell, adók, transzferek, adóreform.

1 Introduction and literature

1.1 INTRODUCTION

As of 2010, a comprehensive tax reform was implemented in Hungary, and structural as well as parametric reforms took place on the expenditure side of the budget simultaneously. The rates of taxes on labour declined significantly during the tax reforms, which was partly offset by the raising of sales and consumption taxes as well as by the introduction of several sector-specific taxes. On the expenditure side, mainly the conditions of transfers to working-age inactive people became stricter or were somewhat changed. Evidence-based policymaking might benefit from an updated microsimulation model that is able to quantify the labour market impact and other real economic effects of recent years' changes regarding taxes, contributions and transfers. In addition, this tool allows the tracking of the partial as well as of the cumulative effects of the measures.

A key task of taxation is to co-ordinate between economic policy objectives and allocation objectives, i.e. to efficiently provide sources for the financing need of publicly produced or funded goods and services – primarily in the form of taxes and contributions. A further objective or consequence of taxation may also be an intention to increase social welfare, including the influencing of income distribution, stimulation of the economy and fostering employment growth. While the basic objective of social welfare benefits is the redistribution of incomes, their labour market stimulating effect is also of key importance. Overall, changes in tax and transfer rules have a major indirect impact – stemming from changes in individual behaviours – on the labour market and the real economy, and the exploration and quantification of these mechanisms may constitute a research result that can be utilised in practice from a decision-maker's aspect.

The advantage of the microsimulation technique is that it allows the examination of the interrelationship between various policy changes at individual level, with a possibility to quantify the impact of non-linear economic policy measures. In our case it means that individuals belonging to specific income groups react differently to the various changes in taxes, contributions and transfers (e.g. in terms of the probability whether to work or not, or the number of hours worked), which can be examined in a more detailed manner using microsimulation tools than by using the aggregate approach.

1.2 LITERATURE AND THE FOUNDATIONS OF THE MODEL

The model[1] calculates the measures' macroeconomic and fiscal impacts compared to a no policy change scenario through a series of iterations between the labour supply created by a microsimulation that is based on detailed household statistics and a general equilibrium reaction that is described by a macromodel. The microsimulation examines the effects of changes at the level of small economic units, in our case households. Its basis is a database that contains economic agents' characteristics that are important in terms of modelling, including, inter alia, the sociodemographic and economic features typical of them. The first step of the analysis is that we map how a measure affects individuals and households, and with the help of the microsimulation we can take into account the interrelations between the individual elements of the tax and transfer system (Benedek et al., 2012).

[1] For presenting the impacts of the changes that took place in the tax and transfer system between 2010 and 2017 we use a microsimulation tool, developed by Benczúr et al. (2011) for their studies with a similar subject. The tool is presented in the study by Benczúr, Kátay and Kiss (2012), while curious readers may find more comprehensive papers that describe the operation and guiding principles of the model in detail in the series of studies published in The Hungarian Labour Market Yearbook: Benczúr–Sándor (2012), Bálint (2012), Benczúr–Kiss–Mosberger (2012), Kátay–Scharle (2012) and Benedek et al. (2012). Although we have altered the model in a number of ways (see Chapter 2), we have not changed its fundamental structure.

Of the available data sources, Benczúr, Kátay and Kiss (2012) chose the Household Budget and Living Conditions Survey (HBLS) of the Hungarian Central Statistical Office (HCSO) as database serving as a basis for the model.[2] The HBLS is a household survey based on questioning and carried out every year since 1993. Its objective is to show the incomes and expenditures of households, and thus it contains substantial information on various incomes from work or social transfers, and it contains specific information on individuals, e.g. regarding gender, age or educational level. Compared to the personal income tax database, in respect of the modelling it is an advantage that the HBLS contains those individual and household characteristics that are necessary for the simulation of the labour supply adaptation, while the PIT database would be suitable to serve as a basis of the model only if it was merged with other databases that contain these data.

One of the disadvantages of the HBLS is the biasedness of income distribution. The database does not contain representative data of different income quantiles (typically of the lowest and highest income categories), thus in its 'raw' form it does not provide a precise picture of the income distribution. In the sample of the survey, inter alia, the young and those with tertiary education are underrepresented, while pensioners and the unemployed are overrepresented (Bálint, 2012). In order to eliminate the biasedness, during the data cleaning of the HBLS the model adjusts the income distribution of the HBLS for wage correction on the basis of the personal income tax database. The adjustment does not concern other taxed incomes originating from the database, e.g. incomes from agricultural activity or self-employment.

Due to methodological reasons, the analysis of Benczúr–Kátay–Kiss (2012) was performed based on the data of the 2008 survey. Choosing that year was justified by the fact that the state of the Hungarian economy in that year can be considered fairly neutral from a labour market standpoint, which is a precondition of the model framework suitable for preparing comparative statics exercises (the comparison between two steady states). The data wave most suitable in terms of changing the base year for us was the 2014 survey, i.e. the latest one available at the time of preparing our analysis.

The microsimulation takes into account two types of labour market adaptations to the new policy rules. Labour market adaptation on the extensive margin means the change in the probability whether to work or not, considering what chances the given individual has – taking into account his unique characteristics as well – to obtain at least as much additional income by working as the cost of being employed, which is the sum of losing the income from transfers and the cost of losing leisure. Namely, the individual evaluation of leisure as well as the relationship (indifference/preference) between the expected earned income and the profit obtained from the available social transfers determine the probability of working. Adaptation on the intensive margin shows the change in effective labour utilisation, i.e. how much less or more individuals would like to work as a result of the policy measure, provided that they want and are able to take up a job. According to the findings of Benczúr–Kátay–Kiss (2012), the two types of labour supply responses are typical of different parts of income distribution: the extensive adaptation tends to affect the lower deciles of the income distribution, while the intensive response is mainly typical of those with higher earnings.

In the past years, adaptation of this model has accelerated in the regional countries. The first example of international application is the article by Galuščak and Kátay (2014), who compared the Czech and Hungarian activity rates with the help of the model. They found that almost one half of the difference between the two activity rates can be explained with the difference between the tax and transfer systems. Another version of the model that was enhanced by a different methodological block was used by Horváth et al. (2015) as well as Senaj et al. (2016) in the impact analysis of the termination of the flat rate personal income tax in Slovakia.

[2] The number and availability of databases containing individuals' detailed characteristics (age, gender, income etc.) are limited in Hungary. The study by Bálint (2012) mentions three potentially suitable databases: the Household Budget and Living Conditions Survey (HBLS) of the HCSO, the personal income tax database of the NTCA (hereinafter: PIT database) and the database produced by merging databases compiled by various budgetary institutions (e.g. the Central Administration of National Pension Insurance, the National Health Insurance Fund or the Hungarian State Treasury). In addition to the above, the fourth data set may be the Hungarian Household Panel used by the microsimulation model of TÁRKI TÁRSZIM (Rudas et al. (1998), Tárki (2004, 2005, 2008)).

2 Description of the model

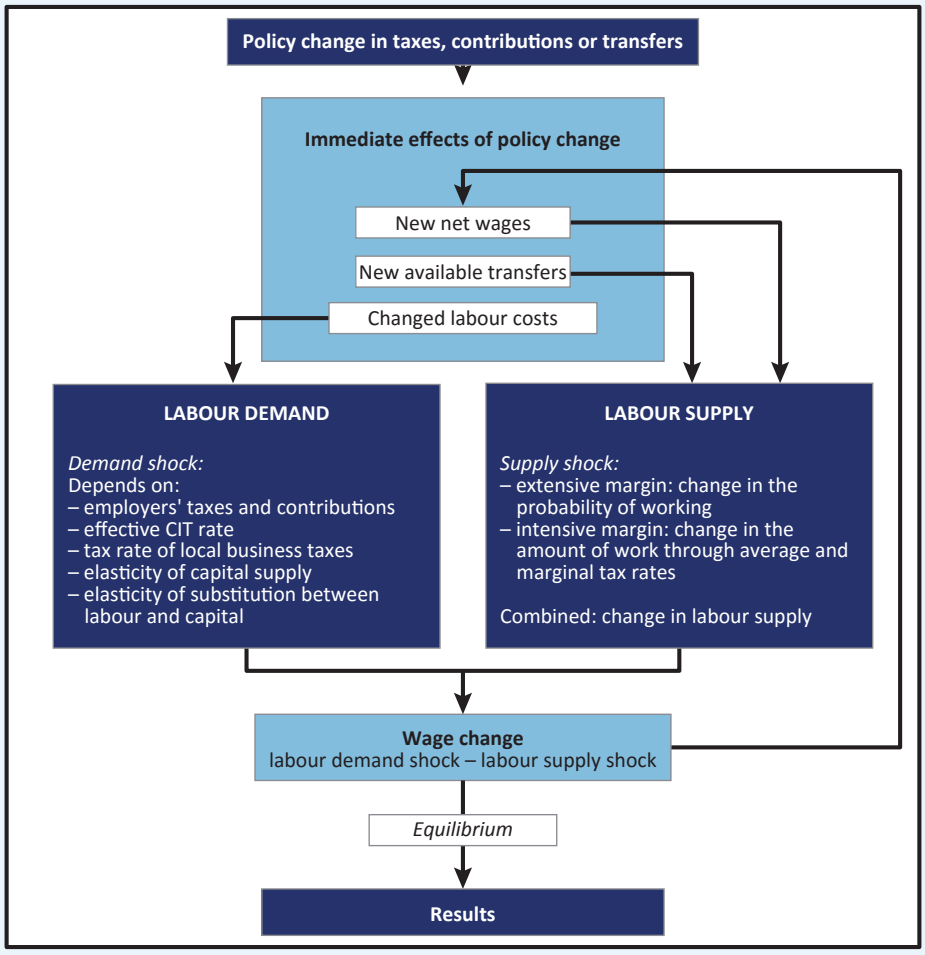
2.1 MICROSIMULATION

On the extensive margin of labour supply we simulate the decision-making mechanism concerning activity. Upon making the decision whether to work or not, an individual considers which case is more useful: when working, they exchange leisure for wage; or if they do not work, and can dispose of their own free time (Kátay–Scharle, 2012). Based on Benczúr et al. (2014), the microsimulation contains this decision-making situation as a determination of individual probability of labour market participation as follows:

$$P(active) = \Phi(\gamma \cdot \log W_i + Z_i \cdot \alpha' + \bar{\psi} \cdot \log T_i)$$

The probability of whether a given individual works or not depends on three factors: the increase in welfare stemming from taking up a job (W_i), i.e. the change in net disposable income as a result of taking up a job; the amount of available transfers (T_i); as well as other observed individual characteristics (Z_i).

Chart 1:
Schematic structure of the microsimulation model



The model simulates the macroeconomic and fiscal effects of the changes in the tax and transfer system through the following steps (*Chart 1*):

(1) Based on available data, for each individual aged between 15 and 74 years the model estimates the before-change probability of taking up a job, determines the ex ante average and marginal tax rates, in addition, the model also calculates the economy's aggregate labour supply before the policy change.

(2) With the entry into force of the new tax and transfer rules the model determines the immediate effects first. This procedure is called static microsimulation. The static microsimulation reveals the immediate financial gains or losses of the individuals and of the general government. In addition, the model recalculates the income increase resulting from taking up a job and the amount of transfers available in the case of inactivity, which influence the labour supply reaction on the extensive margin and determine the ex post average and marginal tax rates for the quantification of the intensive adaptation.

(3) The model calculates the labour supply adaptation on both the extensive and intensive margins.

a) On the extensive margin, following the estimation of probabilities of taking up a job after the change, the model calculates two hypothetical amounts: in the case of the employed, how much the individual would receive in transfers if they were inactive; in the case of the inactive, how much would their potential earnings be if they worked. In the case of the latter, this calculated income means the potential gross wage, which equals the amount of ex post gross wage of employees after the measure was implemtented. Furthermore, it is necessary to determine the probability of labour force participation as well; in the model it was defined by Benczúr–Kátay–Kiss (2012) as the difference between the probability of taking up a job and the group-specific conditional employment probability estimated from the Labour Force Survey (LFS). The aggregate labour supply on the extensive side is the sum of potential gross wages (weighted by the employment probabilities).

b) On the intensive side the model calculates the impact of the change in average and marginal tax rates on the effective labour supply, then, based on this, it corrects the individual and aggregate labour supplies as well. Employees reacting to the policy measure consider the available disposable income following the measure more valuable than part of their leisure, thus they will increase their labour to the point where the choice between additional income from additional working hours and the utility of leisure becomes indifferent again. The impact of average and marginal tax rates on taxable income is described by the following equation:

$$\Delta \log y_i = \zeta \cdot \Delta \log\left(1 - mtr_i\right) + \omega \cdot \Delta \log\left(1 - atr_i\right) + o \cdot \left[\log y_i + X_i\right] + u_i,$$

where y_i indicates the taxable income of the ith individual, mtr_i indicates their effective marginal tax rate, and atr_i represents their effective average tax rate. The notion of marginal tax price refers to the expression (1– mtr_i). The inclusion of the terms shown in brackets is optional: logy_i is the initial income level, X_i indicates individual characteristics, while u_i is the error term of the estimation (for details see Benczúr–Kiss–Mosberger (2012)). The Greek letters indicate the coefficients of the variables on the right side of the equation. The interpretation of the coefficients in this specification indicates (log-log) elasticities. In the equation, the marginal tax price elasticity of taxable income is indicated by the α parameter, which shows the percentage change in a taxpaying individual's taxable income when the marginal tax price of their income increases by one percent (tax avoidance and tax evasion are not taken into account in the model; see Subchapter 2.3). In the equation, the coefficient of the marginal tax rate is 0.2 in the top quintile, i.e. the tax rate change modifies the income level of the active individuals in the fifth quintile and accordingly the labour supply as well in proportion to that (Benedek et al., 2012). It was assumed during the simulations that changes in the average effective rate do not affect the changes in taxable income ($\omega = 0$). If a rise in average tax rates stimulates income generation, the sign of the coefficient is significantly negative in the estimation. Accordingly, an income effect can be identified, with which taxpayers strive to restore their earlier income levels. With the existence of an income effect ($\omega < 0$) the behavioural effect of marginal tax price elasticities would be lower (for its size, see the results in Table A.4 of the Appendix). During their regression exercises, Benczúr, Kiss and Mosberger (2012) – depending on the specification – found both significant positive and negative ω coefficients. According to their findings, the marginal tax price elasticity (ζ) of those with higher incomes is robust in the range of 0.1–0.2.

As a result of the microsimulation, the labour supply shock will be the weighted sum of the heterogeneous (not uniform) individual labour market responses to the tax changes. Accordingly, the multiple times weighted, so-called effective labour supply considers the probability of working for all individuals, the number of working hours, the (differentiated) natural rate of unemployment (non-accelerating inflation rate of unemployment, NAIRU) as well as the individual productivity. Each group of individuals faces different kinds of frictional unemployment, and (in this model framework) changes in their productivity are only reflected by their labour cost paid by the employers (unit labour cost, ULC). The behavioural effect of the above two is identified during the modelling procedure (see above: extensive and intensive adaptation). Accordingly, the indirect effects of the relevant policy changes concerning taxes and transfers on frictional unemployment and productivity fall outside of the modelling framework. These unique features are presumed to be constant over time.

2.2 MACROECONOMIC MODEL

(4) As the next step, the aggregate labour supply shock is introduced into the macromodel, which is an amended version of the neoclassical model of Scharle et al. (2010), and is able to calculate the long-term steady state of a small, open economy. It follows from the assumption of a small, open economy that capital supply is almost perfectly elastic, and its rate of return corresponds to the global rate of return. At the same time, the macromodel does not explicitly contain the rest of the world as an economic agent. It is also assumed that investment does not have any adjustment costs.

The representative firm faces the following profit maximisation problem:

$$\max_{K,L}\left[\left(\alpha K^{\beta}+(1-\alpha)L^{\beta}\right)^{\frac{1}{\beta}}(1-\tau_s)-w(1+\tau_w)L-\frac{r}{1-\tau_k}K\right]$$

where K indicates the total capital stock, L the aggregate labour supply, w the gross wage, τ_s, τ_w and τ_K the effective sales tax rate, the employers' taxes and contributions and the effective tax rate on capital, respectively, while r represents the after-tax rate of return on capital. Of the parameters, β can be deduced from the elasticity of capital–labour substitution (σ) ($\beta=\frac{\sigma-1}{\sigma}$), while α is the function of the revenue ratio and user cost of capital (see Chapter 2.4.3).

Two first-order conditions follow from the profit maximisation (through first partial derivatives with respect to capital and labour supply), which are the following after sorting:[3]

$$(1-\tau_s)\left(\alpha k^{\beta}+1-\alpha\right)^{\frac{\beta-1}{\beta}}\alpha k^{\beta-1}=\frac{r}{1-\tau_k}$$

$$k=\left[\frac{\alpha}{1-\alpha}\cdot\frac{(1-\tau_k)(1+\tau_w)}{r}w\right]^{\frac{1}{1-\beta}}$$

where k indicates the capital–labour ratio ($k=\frac{K}{L}$). It follows from the first-order conditions that the wage is fixed by the technology, the rate of return on capital after taxation, the tax imposed on the effective capital as well as the employers' taxes and contributions; consequently, it is completely independent of the number of the employed (Scharle et al., 2010).

Following loglinearisation around the equilibrium, the equations (together with the definition of the capital–labour ratio) will be as follows:

$$\hat{k}=\frac{1}{\alpha\bar{k}^{\beta}}\left(\frac{1}{1-\alpha}\right)^{\frac{\beta}{1-\beta}}\frac{1}{1-\beta}\left(\frac{\bar{w}(1+\overline{\tau_w})}{1-\overline{\tau_s}}\right)^{\frac{\beta}{1-\beta}}\left(\hat{w}+\widehat{(1+\tau_w)}-\widehat{(1-\tau_s)}\right)$$

[3] In the case of the second equation the sorting also includes the substitution of the partial derivative with respect to capital into the derivative with respect to labour supply.

$$\hat{k}=\frac{1}{\alpha\bar{k}^{\beta}}\left(\frac{1}{\alpha}\right)^{\frac{\beta}{1-\beta}}\frac{1}{1-\beta}\left(\frac{\bar{r}}{\left(1-\bar{\tau}_k\right)\left(1-\bar{\tau}_s\right)}\right)^{\frac{\beta}{1-\beta}}\left(\hat{r}-\left(\widehat{1-\tau_k}\right)-\left(\widehat{1-\tau_s}\right)\right)+\left(\frac{1}{\alpha}\right)^{\frac{1}{1-\beta}}\hat{k}$$

$$\hat{k}=\hat{K}-\hat{L}$$

where $\hat{k}$ indicates the percentage change in the capital–labour ratio, and $\bar{k}$ is the *ex ante* equilibrium value of the capital–labour ratio. The percentage changes and equilibrium values are similarly marked in the case of the other variables as well. The aggregate labour supply shock, which is included in the model as a result of step (3), is represented by $\hat{L}$.

An equation determining the aggregate capital supply is also needed for closing the macromodel. Scharle et al. (2010) inserted the supply of capital from the international market in the following, reduced form into the model (where η denotes the elasticity of capital supply):

$$\hat{K}=\eta\hat{r}.$$

The equilibrium value of the capital stock and gross wages is produced on the basis of the two first-order conditions, i.e. the definition of the capital–labour ratio and the capital supply function. If the change in the level of gross wages calculated from the macromodel is not consistent with the aggregate labour supply shock, the simulation continues from step (2), and individual wages are indexed by the wage level received from the macromodel. The iteration lasts until a new steady state is reached (i.e. wages in the microsimulation are consistent with those of the macroeconomic model).

2.3 LIMITATIONS OF THE MODEL

The microsimulation model analyses the long-term effects of the changes in the tax and transfer system on labour supply and the budget, at the same time it has certain shortcomings in other areas (Benedek et al., 2012). Upon interpreting the results, it is worth considering these limitations; therefore, below we call the attention to the main limitations of the model and to their impacts on our results. In addition to the previously published limitations of the model (see Benczúr–Kátay–Kiss (2012), Benedek et al. (2012) and Baksay–Csomós (2014)), this subchapter emphasises a number of other problems as well.

- The model is basically suitable for comparative statics exercises, comparing the two steady states prior to and following the measures. The steady state following the changes is for a long period; the time horizon of the modelling is approximately 8–10 years. This model framework is not suitable for analysing the developments between the two steady states.

- According to the assumption of the model, in the long run the various socio-demographic distributions (age, gender, income, territorial distribution) remain unchanged and correspond to the distributions experienced in the database that serves as a basis for the analysis or possibly to the ones adjusted during the data cleaning. Accordingly, the model does not take into account, for example, the changes in age or income distribution over time, as a result of which the fiscal effects of the changes in the tax and transfer system may be under- or overestimated, depending on the particular measure. For the partial elimination of this problem, the model was updated to the 2014 data wave of the HBLS.

- The model is supply driven, i.e. it focuses on the effect of the changes in the tax and transfer system from a labour supply standpoint. This is indicated by the fact that on the demand side (for lack of a domestic database containing characteristics that individually affect companies' labour demand decisions) one single representative firm has perfectly elastic labour demand and that only the labour taxes and contributions and the transfers that influence the labour force were included in the model as separate items. Other revenues and expenditures of the budget are simulated by the model with a more aggregate approach; one effective tax rate on capital, on consumption and companies' sales each.

- Households' consumption and investment decisions are not modelled, and thus there is no feedback from the direction of consumption to the labour demand decision. Disposable income is completely consumed by consumers. Accordingly, changes in consumption, and thus for example VAT revenues, are certainly overestimated by the model in the short run or in the medium term, but according to Benedek et al. (2012), over the long term the model provides a proper approximation regarding these variables.

- Of the consumption expenditures of households, a significant portion of purchased consumption is missing, and in the case of respondents to the survey the amounts spent on excise goods (such as alcoholic beverages and tobacco products) are underreported, or these types of spending by households might become included in other expenditure items. These deficiencies result in a downward biasedness of the estimated VAT revenues.

- Looking at the coverage and validity of the household statistics from the income side, it is important to mention that incomes from pensions and especially from self-employment are underrepresented. In the case of the main benefits of the provision for pensions (old-age pensions, disability and rehabilitiation benefits as well as widower pensions) it is observed that those who receive average provisions are overrepresented, while wealthier pensioners are underrepresented. Hardly one half of the income from self-employment is reflected in the survey. Incomes from other sources than work affect the extensive side adaptation by reducing the probability of labour market participation if the income of the members of the household are relatively high. As these incomes are incompletely included in the survey, the extensive side adaptation may overestimate the probability of taking up a job to some extent. Nevertheless, higher inactivity is mainly observed in the lower income quantiles, which is only moderately affected by the above mentioned phenomenon. However, the impact may be greater among young mothers who receive child care support, where the earner spouse's income position may have a significant effect on the probability of returning to the labour market.

- From the side of the state the model is not closed, the model does not contain any constraints regarding the budget deficit or government debt that would react to the general government's financing need and the macromodel through interest rates. This does not cause any problem in the case of reforms that are close to neutral to the fiscal balance or whose effect is moderate; in other cases, however, it may result in an overestimation of macroeconomic effects. Another limitation is that the model is unable to take into account the effects of every government policy measure (see Chapter A.5 in the Appendix).

- The model does not contain the mechanism of job seeking and finding employment. It may be important if a measure affects the process of job seeking and the employment probability. For example, a too strict reform of the transfer system may take place to the detriment of economic efficiency if the matching of employees and jobs becomes less adequate as a result of the reform. Accordingly, the model may overestimate the employment and output effects stemming from the tightening of the transfer system.

- Labour market participants having various, different unique characteristics are perfect substitutes of one another in the model. This may be oversimplification if in fact there is labour market friction, for example in terms of qualification, experience or geographical location, and may also lead to an overestimation of output effects.

- According to the long-term assumption of the model, for lack of market frictions, labour demand completely absorbs additional labour supply, implying in the general equilibrium framework a capital adjustment whose degree is similar to that of the labour factor.

- Due to the assumption concerning the perfect elasticity of real wages (which ensures the employment expanding effect of labour supply shocks), we can examine the impact of the measures related to the minimum wage only regarding certain transfer types that are directly tied to the minimum wage. As the minimum wage significantly affects the employability of low-productivity employees, leaving the minimum wage out of the model may result in an overestimation of employment growth and of the revenues from the personal income tax and contributions.

- Contrary to the study by Baksay–Csomós (2014), we do not take into consideration the short-term effect of the minimum wage increases in the period between 2010 and 2017 and of the wage compensation system between 2013 and 2014 (i.e. the expected pay rise) on net incomes.

• The model framework does not take into account the impact of tax optimisation on the economy or the impact of tax and transfer changes on the shadow economy and the self-employed.[4]

2.4 MODEL UPDATES

In our study, we use a partly updated version of the original model, which means the updating of its background database (HBLS), the addition of a new income-grossing module to the microsimulation and the reestimation of the macromodel's parameter values. In the subchapters below we discuss all the updating processes that were carried out, and at the end of the chapter we elaborate on the reasons behind leaving the previously estimated behavioural elasticities unchanged during the exercise.

2.4.1 Data and microsimulation block

At the time of the model updating, the 2014 data wave of the HBLS was available. In our opinion, the macroeconomic situation in 2014 was sufficiently close to equilibrium to comply with the conditions of the model, and thus we applied the model using this database.

A reasonable condition of using the database is that it should be adequately representitive of household incomes. The HBLS unfortunately does not meet this condition because some groups are overrepresented (for example those with low incomes or pensioners), while others are underrepresented (primarily those with higher incomes). In order to achieve higher representativity, we adjusted the income percentiles of the survey on the basis of the percentiles calculated from the personal income tax returns (percentile compliance or wage adjustment procedure).[5]

By reweighting incomes, aggregate individual pieces of information will be consistent with external target aggregates. The disadvantage of the tool is that it overwrites (to some extent) the base weight system that ensured undistortedness according to certain characteristics upon formulating the questionnaire (demography and geographical location in the case of the HBLS).

2.4.2 Differences between data waves

The most fundamental difference between the 2008 survey used by the original version of the model and the current, 2014 one is that households responded concerning their income in gross terms in 2008, whereas the 2014 questionnaires had to be completed with net values, apart from earned incomes.[6] In order to eliminate this difference, we complemented the microsimulation part of the model with a so-called gross income calculation module (accordingly, upon calculating net income from the thus produced gross incomes result in the income data of the HBLS[7]).

A significant difference can be identified in the demographic parameters of the two surveys, because the weight system of the 2014 HBLS was elaborated on the basis of the key figures of the 2011 census. Previously, the 2008 survey had reflected the 2001 demographic conditions, which became significantly outdated in a decade. In addition, the HCSO retroactively revised the HBLS weights till 2010, and thus our model updating is one of the first that takes into account this result.

[4] According to Benedek et al. (2012), in Hungary it is less possible to influence the size of taxable income with allowances, and the estimated parameters are much lower compared to the countries that apply a wide range of exemptions and allowances. In addition, within the upper deciles of the income distribution there is not much difference between the elasticities of those who only have income from employment and of the decile as a whole (Benczúr et al., 2012).

[5] Further database management methods are also available to dissolve this constraint. On domestic data, the tool of multiple linking was used for example by Benedek–Kiss (2011) in a way that during the procedure the data of the survey were linked up with tax return data (for more details on the method see Subchapter 5.2 of TÁRKI (2005)). Methodological proposals for amending the weight system of questionnaire surveys are given, inter alia, in the studies related to applied statistics by Cserháti–Keresztély (2010), Deville–Sarndal (1992) as well as Creedy (2003).

[6] The reason for the difference in the calculation is that as of 2012 the Hungarian Central Statistical Office gradually approximated the methodology of the budgetary survey to the standards of the EU statistics on income and living conditions (EU-SILC). As a result of the methodological change-over, the set of variables of the survey and sometimes its content also changed. The ensuing differences were also standardised, complying with the variables list of the previous model.

[7] Family and job seekers allowances as well as the reported family tax allowances were systematically corrected. Further deviation from the income data of the HBLS is observed in the income types included in the household questionnaire, where the incomes declared at household level were evenly distributed across the adults living in the household.

The income data in the 2014 survey reflect the income effect originating from the behavioural responses to the measures between 2010 and 2014; therefore, the updated version of the model is not suitable for analysing the changes of the pre-2014 period. Accordingly, our partial results concerning the pre-2014 measures are based on the simulations carried out on the original, 2008 version of the model, whereas we examined the measures of the years after 2014 on both model versions (see Chapter A.4 of the Appendix). As one of the main aims of the study is the presentation of the updated model version, regarding the period after 2014, the study contains the findings of the simulations prepared in the updated model version. The cumulative results depict the values of the simulation run on the 2008 version of the model.

2.4.3 Updating the macromodel and the effect of its parameters on the results

The key parameter values of the macromodel connected to the micro simulation are shown in Table 1. The effective tax rates and the revenue ratio of capital were calculated based on the national accounts data. The relevant values of substitution elasticity and of the user cost of capital were reestimated on the basis of the production function approach of Kátay–Wolf (2004). As the net user cost of capital decreased to a historical low level, the capital–labour substitution elasticity shows relatively high dispersion in the Hungarian literature,[8] moreover the elasticity of capital supply significantly affects our results, hence we conducted analyses concerning the sensitivity of the parameters of the model. The relevant results are shown in Chapter A.1 of the Appendix.

Table 1
Parameter values of the macromodel

Parameter	2010	2014	2017
Effective tax rate on capital	0.069	0.058	0.059
Effective tax rate on sales	0.016	0.020	0.021
Effective tax rate on consumption	0.201	0.230	0.232
Income share of capital		0.36	
Elasticity of capital-labour substitution		0.80	
User cost of capital		0.174	
Elasticity of capital supply		15.0	

Note: For an elaborate description of the change in effective tax rates see Subchapter 3.3.

Using the values of Table 1, parameter β of the macromodel:

$$\beta = \frac{\sigma - 1}{\sigma} = \frac{0.8 - 1}{0.8} = -0.25$$

Knowing the β value, α can also be determined through the rearrangement of the first-order condition with respect to capital (Benczúr–Kátay–Kiss, 2012):

$$\alpha = \left(\frac{\frac{r}{(1-\tau_K)(1-\tau_S)} K}{Y} \right)^{1-\beta} \left(\frac{r}{(1-\tau_K)(1-\tau_S)} \right)^{\beta} = 0.36^{1.25} \cdot 0.174^{-0.25} = 0.432$$

Following the substitution of parameters α and β as well as of the effective tax rates, the first-order conditions for 2014 will be as follows (τ_w = 0.27, as the rate of the social contribution tax was 27 percent in 2014):

$$(1-0.22)\left(0.432k^{-0.25} + 1 - 0.432\right)^{\frac{-0.25-1}{-0.25}} \cdot 0.432k^{-0.25-1} = \frac{r}{1-0.058}$$

[8] In the literature, the value of the capital–labour substitution elasticity is 0.8 according to Scharle et al. (2008) and 0.6 according to the calculations of Jakab–Kaponya (2010).

$$k = \left[\frac{0.432}{1-0.432} \cdot \frac{(1-0.058)(1+0.27)}{r} \cdot w \right]^{\frac{1}{1+0.25}}$$

The future (nominal) values of the macroeconomic indicators used in the model were taken into account on the basis of the official forecast and estimates of the Magyar Nemzeti Bank.

2.4.4 Labour supply elasticities

Benczúr–Kiss–Mosberger (2013) and Kiss–Mosberger (2015) estimated the elasticity of taxable income during a period when high-income individuals were taxed intensively (extraordinary tax on individuals; progressive tax system with two and three-income tax brackets), while Varga et al. (2015) estimated it based on the 2011 expansion of the family tax allowance. Based on the former authors' findings, the marginal tax elasticity of the upper two income deciles is within the range of [0.1–0.2] and might be mostly considered as originating from supply responses. In the latter study, the elasticity is only identified based on the behaviour of those reporting family tax allowance and is estimated to be around [0.2–0.25]. During the model updating, we used the estimated 0.2 tax price elasticity parameter.

In line with the approach of the model, Benczúr et al. (2012, 2014) estimated the probability of taking up a job (adjustment on the extensive margin) using consecutive, cross-sectional data (1998–2008) of a complete labour market cycle. By extending the time horizon the estimated elasticities would be distorted as we would consider more years spent in recession than in the boom phase; therefore, our calculations are based on the earlier estimation results.

3 Relevant policy measures taken into account

Based on their impact on labour market decisions, the measures taken into account in our study are classified into three different categories. The first block contains the measures that affect labour supply decisions; the majority of the measures under review belong here. The second block is for policy changes that affect labour demand, while the third category comprises other measures, mainly the ones concerning effective tax rates.

3.1 SUPPLY SIDE MEASURES

The measures concerning **labour supply** comprise a significant structural change in the personal income tax system. As a result of the changes, the progressivity of the income tax system was abolished, and the personal income tax became a flat rate tax of 16 percent. Since 2011, a single personal income tax rate is applied on the tax base as a whole, whereas earlier the tax rate was 17 percent up to an annual income of HUF 5 million, and the taxable income above this threshold was subject to a tax rate of 32 percent. It was even more progressive in the preceding years; in 2009 the limit of the lower tax bracket was HUF 1.7 million, and the two rates were 18 and 36 percent. The eliminiation of the general tax credit scheme, which had reduced the tax liability in the lower income categories, contributed to the creation of the linear, flat rate tax system. The super grossing of incomes was phased out in parallel with the changes concerning the tax credit scheme but with a contrasting effect, i.e. the personal income tax base was not adjusted for the employer's contributions any longer. Earlier, starting from 1 January 2010, the personal income tax base was increased by the amount of employer's contributions, i.e. 27 percent. In 2011, the size of the increase in the tax base declined to one half (13.5 percent, half supergrossing), then, in 2012, the half supergrossing was abolished for those earning below a monthly gross of HUF 202,000, and starting from 2013, the income tax system did not contain any tax base inflating element.

Instead of granting allowances and tax breaks on a universal basis, the focus of economic policy shifted to targeted allowances. The significant increasing of the family tax allowance and its later extension to employee's contributions served social policy purposes. Prior to 2011, family tax allowance was available only for those with three or more eligible children, and its amount was small (HUF 4,000 monthly). As of 2011, those with one or two children are also entitled to a substantial personal income tax allowance, and the tax break for those with three children also increased considerably. In order to offset missing revenues, employer's contributions were raised: the rates of the health insurance contribution and the pension contribution rose by 1 and 0.5 percentage points, respectively. Simultaneously, the upper value ('ceiling'), which maximised pension contributions and had resulted in a regressive element within the tax system in the previous years, was also eliminated. In 2016, the flat rate personal income tax declined further by 1 percentage point to 15 percent. In the same period, the annual gradual increasing of the tax allowance of those with two children started. Accordingly, the former monthly HUF 10,000 allowance per child, which was the same as for those with one child, will gradually grow in 4 years up until 2019 to a monthly HUF 20,000 for those who have two eligible children. Of this, we took into account the effect of the rising of the family tax allowance to HUF 15,000 in the period until 2017.

Regarding transfers, we took into consideration the main changes related to the jobseeker's allowance, the child care allowance ('GYES') and the raising of the retirement age. The maximum disbursement period of the jobseeker's allowance was reduced from 270 days to 90 days, its second phase was terminated and it also became more difficult to become qualified as a jobseeker in legal terms (the jobseeker's employment prior to losing the job has to be twice as long as prior to the introduction of the new rule). The maximum amount of the jobseeker's allowance declined from 120 percent of the minimum wage to 100 percent thereof, and the jobseeker's aid was terminated. At the same time, in parallel with tightening the allowances concerning the benefits system, the GYES was extended by one year, until the child becomes three years old.

3.2 DEMAND SIDE MEASURES

Economic policy can stimulate **labour demand** mainly by reducing employers' tax and contribution burdens. The measures taken on the demand side may be divided into two main parts: the introduction of the Job Protection Action Plan in 2013 and the reduction of the social contribution tax in 2017.[9] The targeted allowances of the Job Protection Action Plan aim groups that are disadvantaged from a labour market standpoint and socio-demographic groups where economic activity is low. In the case of employees falling under the Job Protection Action Plan, based on the employee's gross wage, the employer may receive a tax break from a tax base up to HUF 100,000 as social contribution tax and vocational training contribution cuts.

Pursuant to the tripartite wage agreement concluded at end-2016, the rate of the social contribution tax declined by 5 percentage points to 22 percent in 2017. It mainly has a stimulating effect on corporate labour demand, which meets adequate labour supply in our model due to lack of labour market frictions. The degree of allowances that may be received within the framework of the Job Protection Action Plan was modified simultaneously with the reduction of the tax rate. Two types of allowances are distinguished: up to a HUF 100,000 tax base the reduction applicable to the upper rate used to provide a social contribution tax break of 27 percent, which has been modified to 22 percent in 2017 for the given groups, which include employees below the age of 25 with limited work experience, long-time jobseekers and women returning from maternity leave (maternity allowance – 'GYED', child care allowance – 'GYES') in their first two years of employment. The other form of the allowance, up to the same gross tax base, formerly provided an exemption of 14.5 percent, while from 2017 it is 50 percent of the all-time rate for those below the age of 25 with more experience, for women returning from maternity leave from the second year[10] and for those over the age of 55 as well as those with elementary occupations and agricultural workers.

3.3 MEASURES CONCERNING EFFECTIVE TAX RATES

The model captures the taxes on capital, consumption and sales by using an aggregate rate for each of them. Accordingly, the various tax measures concerning these tax types appear condensed into one rate for each.

The **effective rate of taxes on capital** declined from 6.9 percent to 5.9 percent between 2010 and 2017, which is primarily attributable to the changing of the corporate tax system. First the limit of the upper 19 percent corporate income tax bracket shifted from HUF 50 million to HUF 500 million, with limiting the write-off, and the tax base was expanded as a result of the changes that took place in the case of tax type expenditures. The system of tax deductions was also restructured. From the previous 10 and 19 percents, the corporate income tax rate declined to a single 9 percent rate starting from 2017.

Between 2010 and 2017, various types of taxes were introduced that played the roles of sector-specific or crisis taxes, and in line with their moderate ratio in fiscal revenues, their weight in the effective rate of capital taxes is also lower. These taxes include the bank levy, the utility tax, the increasing of energy suppliers' income tax and the widening of its tax base, the corporate surtax, the credit institutions' contribution and the sector-specific surtaxes.[11] In the calculation of the effective tax rate we took into account the raising of the simplified entrepreneurial tax rate, the introduction of the small business tax ('KIVA') as well as the reductions of its rate in 2016 and 2017.

During the years under review, the **effective rate of consumption taxes** rose from 20.1 percent to 23.2 percent. The increase is primarily related to the rise in the upper rate of the value added tax and to several excise duty increases, but

[9] In our study, we analysed the impact of measures coming into force until 2017. Consequently, we have not modelled the further reduction of at least 2 percentage points of the social contribution tax rate due in 2018.

[10] Employees below the age of 25 receive the lower allowance from the third year, while long-time jobseekers and mothers with up to two children returning from GYES or GYED may receive it only in the third year. Those with at least three children are eligible for the higher allowance in the first three years of employment, and the lower one in the fourth and fifth years.

[11] The corporate surtax, the sector-specific surtaxes and the credit institutions' contribution were phased out in 2010, 2013 and 2017, respectively, but in terms of cash flow, there were payments and refunds in connection with these taxes in the years following the phasing out as well, amending the effective rate of the taxes on capital to a slight extent. The aforementioned, phased-out taxes on capital were typically replaced by sales type taxes (e.g. financial transaction levy).

the introduction of various other types of taxes also contributes to the 3 percentage point change. The upper rate of VAT rose from 25 percent to 27 percent in 2012, and the public health product tax and the accident tax were introduced in the same year. The parts of the financial transaction levy, the insurance tax and the telecom tax that place a burden on households also appear as further sector-specific surtaxes in the effective tax rate on consumption. These measures are partly offset by targeted VAT cuts carried out in the past couple of years (pork, poultry, fish, egg, fresh milk, Internet services and restaurant services), which were also taken into account when calibrating the combined rate.

The **effective sales tax rate** for companies increased from 1.6 percent in 2010 to 2.1 percent, mainly as a result of the widening of the base of the local business tax and the introduction of new tax types. In the case of the local business tax that is imposed by local governments, the tax base can be reduced with the cost of goods sold and the value of mediated services only to a limited extent, which means a widening of the tax base. The part of the newly introduced sector-specific measures (financial transaction levy, insurance tax, telecom tax) that places a burden on companies belongs to the effective rate of sales taxes.

4 Results

The effects of the measures taken into account are presented from fiscal, labour market and macroeconomic aspects, divided into three groups according to the following categorisation. First we examine the effects of the tax, contribution and transfer measures affecting labour supply in the period between 2010 and 2017.[12] Then we analyse the effects of the policy changes that stimulate labour demand (typically targeted allowances and general tax breaks for employers). Finally, the real economic and fiscal consequences of other tax changes that do not concern the labour market are presented. These latter changes exert their effect through the macromodel part of the simulation: the content of changes in tax types is concentrated in the effective tax rates.

The tables in the present chapter consist of two parts. The upper part of the tables presents the impacts of the measures taken into account on the real economy through changes in key macroeconomic indicators. Using comparative statics, the simulation tool evaluates the transition between two long-term (neoclassical) equilibria. Accordingly, the percentage changes in the table depict the difference between two steady states.[13] Of the several indicators discussed, the interpretation of effective labour supply and disposable income may require some additional explanation. Effective labour supply translates to the labour supply weighted by individual level productivity and the number of intended working hours. Regarding disposable income, we used the simplifying assumption that households spend it completely, as consumption and savings decisions are not modelled. However, over the modelling time frame this estimation may provide acceptable approximation.

The lower parts of the tables show the budgetary implications of the individual measures expressed in HUF billion. The static and dynamic effects of economic policy measures on the general government balance are presented in a breakdown by tax and contribution types. The static values mean the direct general government revenue or expenditure that is immediately induced by the tax or transfer changes, without a behavioural adaptation response. By contrast, the dynamic values contain individuals' labour market adjustment and the ensuing macroeconomic spillover effects. Therefore, they are to be understood over the longer term, i.e. an 8 to 10-year time horizon. As the dynamic effects take into account labour market and capital market adjustments, when employment is growing, for example, all types of taxes on labour generate revenues, and in addition – as a result of the general balance effects – all other tax types also contribute to the budget balance with additional revenues.

The tables present the separated macroeconomic and labour market effects of the measures that were taken into consideration. The columns that depict several policy measures jointly, contain combined effects. These results do not simply depict aggregate impulses, but reflect non-linear consequences depending on the tax system and the parameter values of the modelled macro environment. The presentation of the effect mechanisms of certain measures is similar to the content of the programme evaluating studies by Benczúr et al. (2011), Benedek et al. (2012) and Bakó et al. (2014), although with somewhat different results.

4.1 PARTIAL EFFECTS OF THE MEASURES THAT AFFECT LABOUR SUPPLY

The first group of the measures under review comprises the different phases of the reform of the former progressive **personal income tax system**. The measures of Table 2 are in a chronological order in the sense that the measures in one column are considered to be already implemented in the subsequent columns.

[12] In terms of modelling, this period can be divided into two further phases as it is possible to compare the results from the model version updated by us and the from the original simulation in the period after 2014. The results of the related robustness checks are presented in detail in Chapter A.4 of the Appendix.

[13] The dynamic effects describe a transition starting from one equilibrium and heading to a different one, and thus the results of the model may also be considered the endpoint of a cumulative impulse response function that emerges at the time when the microsimulation wage adjustment iterates into a general equilibrium steady state.

The introduction of the 16 percent **flat rate income tax** replacing the previous 17 and 32 percent progressive rates represented a tax cut of nearly HUF 350 billion (at 2014 prices); in the long run, this fiscal effect may shrink to one fifth as a result of favourable economic spillovers. The tax cut increased effective labour supply by some 3 percent, most of which is explained by intensive side adjustment, while 0.6 percent is attributable to the expansion in employment (column one, Table 2). The increase in intensive labour supply is mainly significant in the case of those with higher income, because in the higher income category the elimination of the upper rate reduced the marginal tax rate considerably (and also because taxable income is smaller in the lower income categories); at the same time it has an effect in other income categories as well. It is important to note that intensive side adjustment is taken into account through the change in effective working hours. Nevertheless, the behavioural responses that result in an improvement in the quality of work and an increase in work intensity also belong here, however, we cannot take these factors into account during the analysis.[14] The long-term effect of the measure on GDP is +3 percent over the forecast horizon of the model, which is primarily attributable to the elevated labour supply.

Table 2
Partial macroeconomic and fiscal effects of the first part of supply side measures

	Labour supply I.					
	Flat personal income tax		Abolition of super grossing of incomes		Elimination of general tax credit scheme	
Macroeconomic effects (percent)	**static**	**dynamic**	**static**	**dynamic**	**static**	**dynamic**
Effective labour supply		3.2		1.7		–0.5
Employment		0.6		1.5		–1.9
Capital		2.7		1.4		–0.4
GDP		3.0		1.6		–0.4
Gross average wage		–0.3		–0.1		0.0
Disposable income		6.1		5.4		–4.8
Fiscal effects (HUF billion)						
Personal income tax	–433	–372	–484	–467	540	535
Employee's SSC	0	40	0	23	0	–6
Employer's SSC	0	82	0	44	0	–12
Taxes on consumption	87	128	97	118	–106	–110
Taxes on capital	0	23	0	12	0	–3
Taxes on sales	0	16	0	8	0	–2
Transfers	0	9	0	22	0	–20
Total	**–346**	**–74**	**–387**	**–239**	**433**	**383**

Note: 1. Reference tax year is 2010. The measures introduced in different years are uniformly assessed at constant 2014 prices. 2. For each measure, the separated (partial) effect is shown, assuming that the preceding measure has already been introduced. 3. Static effect: immediate effect, without adjustment; Dynamic: long-term effect quantifying the labour market adjustment.

The **super grossing of the income tax base was phased out** (second column) in several steps, but in the simulation it is evaluated as a single event. The abolition reduced the tax burdens by nearly HUF 400 billion. Taking up a job becomes more attractive in each income category as a result of the effective tax cut on employees' incomes, and thus the measure increased long term employment by 1.5 percent, and accordingly it raises GDP to a similar degree. In the long run, economic growth offset more than one third of the tax reduction.

[14] In addition, for each person, the stimulation of intensive side labour supply may be coupled with different instruments, such as the bonus system, the percentage of overtime bonus, performance orientation, chances of promotion and human capital accumulation, which may improve the efficiency of future (career path) income earning. Limited (and often only indirect) information is available about these selective incentives at individual level.

The **tax credit scheme** was a tax reducing item (third column) that lowered the taxes payable in the case of average and lower wage earners. Above a given threshold, the monthly amount of tax credit available declined gradually ('phase out' period). At the same time it increased the marginal tax rate in these income categories, and one could argue that its targeting capability was not adequate either, i.e. a significant part of the scheme increased the allowances for higher-income households (Benedek et al., 2006). The effect of the tax credit scheme's eliminiation on the labour market has several aspects on those with a lower income. On the one hand, net income from wages decline as a result of a rise in average effective tax rates, which reduces labour supply; on the other hand, actual disbursements of allowances that are taxed as wages (e.g. child raising and jobseeker's allowances) are also simulataneously decreasing, which in turn encourages employment growth. Finally, the termination of the tax credit also reduced the ensuing marginal tax rate, which effect also points to an increase in labour supply (primarily among those with low earnings that are already active in the labour market). Overall, the fiscal effect of the measure is favourable from a budgetary standpoint. It increased fiscal revenues by some HUF 400 billion both in the short run and in the long run, although according to our estimates the measure in itself reduced employment by 1.9 percent (which was offset by various other elements of the changes included in the system: the flat rate tax, the termination of the super grossing, the introduction of the Job Protection Action Plan as well as the institution of expected pay rise and the multiple minimum wage increases).

In Table 3, we examine the effects of recent years' tax measures and the parametric policy changes of welfare benefits. Some measures are presented combined in the relevant columns of the table. A common feature of these policy modifications is that in terms of their volumes they fall short of the macroeconomic effects of the tax reforms presented in Table 2. This is partly attributable to the parametric nature and the degree of the changes and partly to them being targeted in a social and demographic manner. Accordingly, in their case the primary goal is not necessarily the stimulation of labour supply and economic growth, but rather their welfare increasing and demographic role is significant.

Table 3
Partial macroeconomic and fiscal effects of the second part of supply side measures

	Labour supply II.									
	Introduction of a new child tax allowance		Raise in employee's SSC rates		PIT rate reduction (1pp)		Expansion of child tax allowances		Reorganisation of social transfers	
Macroeconomic effects (percent)	**static**	**dynamic**	**static**	**dynamic**	**static**	**dynamic**	**static**	**dynamic**	**static**	**dynamic**
Effective labour supply		0.1		–0.9		0.3		0.1		1.6
Employment		0.1		–0.4		0.2		0.2		2.7
Capital		0.1		–0.8		0.2		0.1		1.3
GDP		0.1		–0.9		0.3		0.1		1.5
Gross average wage		0.0		0.1		0.0		0.0		–0.1
Disposable income		2.2		–2.5		1.2		1.1		–0.1
Fiscal effects (HUF billion)										
Personal income tax	–230	–232	0	–13	–106	–102	–1	0	–18	0
Employee's SSC	0	2	223	207	0	5	–119	–118	–29	–4
Employer's SSC	0	3	0	–24	0	7	0	2	0	39
Taxes on consumption	46	48	–45	–56	27	31	27	28	–22	–3
Taxes on capital	0	1	0	–7	0	2	0	1	0	11
Taxes on sales	0	1	0	–5	0	2	0	1	0	8
Transfers	0	0	0	–5	0	1	0	4	158	176
Total	**–184**	**–177**	**178**	**97**	**–79**	**–55**	**–92**	**–84**	**89**	**227**

Note: 1. Reference tax year is 2010. The measures introduced in different years are uniformly assessed at constant 2014 prices. 2. For each measure, the separated (partial) effect is shown, assuming that the preceding measure has already been introduced. 3. Static effect: immediate effect, without adjustment; Dynamic: long-term effect quantifying the labour market adjustment.

The first column of the table shows the impact of the newly introduced **family tax allowance**. The measure is primarily of social policy nature; the model does not take account of the measure's increasing effect on fertility rate. The probability of employment increases among the families where the net earned income achievable with the tax allowance sufficiently encourages people to take up a job. The family tax allowance reduces budgetary income tax revenues by HUF 230 billion, while it may add nearly HUF 50 billion to consumption tax revenues as a result of the increase in household disposable income.

In 2012, the health insurance contribution and the pension contribution (both employee's SSC) increased by one percentage point and one half percentage point, respectively. As a result of the higher public dues, the **raise in employee's SSC rates** (second column) reduces employment slightly, both on the extensive and intensive margins. At the same time, as a result of the cancellation of the pension contribution ceiling, SSC payments are to be paid linearly even in the income bracket above gross annual earnings of HUF 7,942,200, unlike earlier. As a result, the elevated marginal tax rate of those with a high income reduces labour intensity in these income categories. According to our estimate, effective labour supply may decline by close to one percent in the long term. As a result, net earned incomes and the amounts spent on expenditures also decline, and thus the immediate fiscal effect of the employee's SSC changes represents a nearly HUF 200 billion budgetary surplus. At the same time, this impact may drop to one half as a consequence of labour market implications and the loss in consumption tax revenues.

The third column shows the further **1 percentage point reduction of the personal income tax rate** (assuming the implementation of previous measures), while the fourth column contains the joint results of the **family tax allowance increase** for the households with two children and the **family contribution allowance**. The effect mechanisms of the measures are explained in detail in the previous paragraphs; therefore, they are not repeated. These changes, which can be considered as fine-tuning of income taxation, represent a total tax easing of some HUF 170 billion in the short run, one quarter of which is offset by economy stimulating effects in the long term.

The last column presents the effect of individual measures that concern the **transfers** and of the tightening of jobseeker's allowances as well as the impact of the extension of the GYES (child care allowance) (until the child's 3 years of age). The possibility for parents to stay at home with their children for a longer time with the allowances (extension of the child care allowance (GYES)) functions as a family policy tool, and thus, stemming from its nature, it somewhat reduces the probability of taking up a job. The parametric changes that took place regarding jobseeker's allowances reduce the income of the inactive, and therefore they have a significant activity stimulating effect. According to our estimates, employment may increase by as much as 2.7 percent, but since labour productivity of new employees is lower than average, and thus the increase in effective labour supply and GDP growth may be lower, around 1.5 percent. The results, as mentioned in the study by Benczúr et al. (2011) as well, describe the most favourable scenario, as the relevant part of the simulation does not take into account the short-term, frictional imperfections of seeking and finding employment. The estimation procedure determines to what extent the loss of transfers increases the willingness to take up a job.[15] The ratio of those receiving jobseeker's aid declines, but eligibility is slightly higher in the case of social transfers. The immediate fiscal saving is estimated to amount to HUF 90 billion, in addition to which the employment stimulating effect may generate further tax revenues of nearly HUF 140 billion in the long run.

4.2 PARTIAL EFFECTS OF THE MEASURES AFFECTING LABOUR DEMAND AND OF OTHER TAX CHANGES

The inclusion of labour demand in the model is homogeneous, the change of which generates equilibrium effects through the production function of the representative firm. It is important to emphasise that in this framework the aggregate labour demand shock is summed up using the individual (heterogeneous) waging information gained from the household survey. Based on classical model assumption, the company's wage elasticity depends on the substitution elasticity of

[15] By shortening the disbursement period of the allowance (or, in other words, of the period that can be spent with jobseeking) and by the reduction of the amount of the allowance, the chances of finding a job may be reduced/impaired by the quality of the job found in the period, the number of vacancies and the (weakened) bargaining positions related to waging and working conditions. In addition, the model does not take into account that exiting from unemployment is gradual, and also does not take into consideration the decelerating pace of the expected further decline in unemployment as well as the unskilled, low-productivity, hopeless and immobile workforce's tendency to remain permanently unemployed. As a result of the measure, the expansion in employment expected over the modelling time horizon (approximately 8–10 years) is above 2 percent.

factors of production (capital and labour), the price elasticity of the final product, the ratio of labour costs within the total production cost and the price elasticity of the supply of the other factors of production.

Due to the long-term approach of the model, the 'one price principle' prevails in the case of final products, and thus – assuming constant substitution elasticity – labour demand is determined by the factor costs and employees' productivity. It is also a consequence of the time span of the modelling that the demand and supply sides of the labour market reach a steady state in the way mentioned above, without frictions, and this situation evolves from the shift in net wage on the supply side and from the shift in total labour cost on the demand side. Accordingly, wage taxes and subsidies exert their effect through the tax wedge, as a result of which measures concerning either employer's or employee's taxes and contributions are equivalent, and in the end, uniformly exert their effects in the equilibrium wage level and labour supply.

Table 4
Partial macroeconomic and fiscal effects of demand side and other tax and transfer measures

	Labour demand				Miscellaneous			
	Introduction of the Job Protection Action Plan		Reduction in employer's SSC rates		Effective implicit tax rates between 2010 and 2014		Effective implicit tax rates between 2014 and 2017	
Macroeconomic effects (percent)	**static**	**dynamic**	**static**	**dynamic**	**static**	**dynamic**	**static**	**dynamic**
Effective labour supply		0.5		0.7		–0.3		–0.1
Employment		0.7		0.6		0.1		–0.1
Capital		0.4		0.5		0.8		–0.8
GDP		0.5		0.6		0.1		–0.4
Gross average wage		1.3		3.6		0.5		–0.3
Disposable income		1.2		2.8		–3.5		–0.5
Fiscal effects (HUF billion)								
Personal income tax	0	26	0	69	0	2	0	–7
Employee's SSC	0	35	0	87	0	3	0	–9
Employer's SSC	–184	–140	–507	–403	0	4	0	–10
Taxes on consumption	0	27	0	72	319	322	22	15
Taxes on capital	0	3	0	4	–128	–125	12	8
Taxes on sales	0	2	0	4	130	130	32	30
Transfers	0	4	0	3	0	0	0	0
Total	**–184**	**–43**	**–507**	**–164**	**320**	**337**	**66**	**28**

Note: 1. Reference tax year is 2010. The measures introduced in different years are uniformly assessed at constant 2014 prices. 2. For each measure, the separated (partial) effect is shown, assuming that the preceding measure has already been introduced. 3. Static effect: immediate effect, without adjustment; Dynamic: long-term effect quantifying the labour market adjustment. 4. The changes in effective tax rates between 2010 and 2017 are presented in detail in Subchapter 3.3.

In the first column of Table 4 we examine the labour market and macroeconomic impact of the **Job Protection Action Plan**. This policy offers benefits in relation to the employment of disadvantaged groups where employment level is typically low. It specifically targeted social groups where willingness to take up a job is low but at the same time individuals adjust relatively flexibly[16] on the extensive margin. As a result of the measure, employment increases by some 0.7 percent, and thus the immediate loss of fiscal revenues (HUF 180 billion) is nearly completely recovered in the long run.

The second column contains the reduction of the **social contribution tax** rate from 27 percent to 22 percent as well as the **changing of the related tax breaks** available within the framework of the Job Protection Action Plan. The baseline scenario during the simulation was that the elements of the previously introduced Job Protection Action Plan are parts of the contribution payment system. Accordingly, the beneficiary's rates that changed as a result of the reduction of the

[16] When taking into account the targetedness, it is worth examining the overlap across the subsidised groups. In the case of common sets with relatively high number of people it is recommended to separate the groups.

social contribution tax is restrictive, as naturally, due to the declining rates, the labour cost subsidy available for the employers becomes lower. Consequently, compared to the tax cut, the adjustment has a contrasting effect on labour demand. The reduction of employers' general burdens (the lowering of the social contribution tax rate) results in the expansion of employment in the long run, as companies grasp the opportunity to produce their final products with cheaper production factors in a way that, as assumed, they do not face any market frictions. As a result of the measure, the budget loses significant revenues, but the around HUF 500 billion tax easing may decline to one third in the long run through the steadily increasing payments by employees as well as the growing consumption and sales tax revenues triggered by elevated labour supply. The major increase in gross wages is induced by the fact that according to the assumptions of the model, employees and employers 'share' the advantages of the tax cut during a series of wage negotiations.

The last two columns show, separated by distinct time periods, the economic effects of the measures that affect the **effective tax rates**.[17] In the period under review, the decline in the taxes on capital is attributable to the changing of the corporate tax system in 2010, followed by the reduction of the tax rates in 2017. At the same time, this effect is partly offset by the introduction of various sector-specific taxes, although the majority of which were either phased out by 2017 or their rate was reduced (bank levy, utility tax, energy suppliers' income tax, credit institutions' contribution etc.). The effective rate of consumption taxes was up primarily because the VAT was raised once and excise duties on several occasions, and the tax rate is raised by various sector-specific taxes as well (accident tax, public health product tax, insurance tax etc.). The increase in sales taxes was mainly attributable to the widening of the local business tax base, and at the same time sector-specific taxes on sales were also introduced (financial transaction levy, telecom tax etc.). The figures in the last two columns of Table 4 demonstrate that the calculated effective tax rates changed significantly in the period between 2010 and 2014 and, with the exception of the taxes on capital, they resulted in considerable additional fiscal revenues. The dynamic results show a substantially lower effect. The 3.5 percent decline in disposable income was the result of a rise in consumption taxes. The macroeconomic and fiscal size of the changes affecting the effective tax rates between 2014 and 2017 can be considered rather small.

4.3 CUMULATIVE RESULTS

Overall, structural changes in the tax system and parametric ones regarding transfers entailed significant fiscal and macroeconomic effects. The main features of the change in the tax system are the reduction of the taxes on labour and the raising of the sales and consumption taxes, while in terms of transfers, the benefits to individuals that are of active age but stay away from the labour market has declined. Both packages of measures resulted in an increase in labour supply stemming from both the previously inactive (by seeking employment) and from those who were already working (by increasing their effective labour supply, i.e. their number of working hours and work intensity). In addition, labour demand also increased because several measures (primarily the introduction of the Job Protection Action Plan and the reduction of employer's SSC in 2017) reduced mainly the liabilities of employers, although in the long run the benefits are expected to be shared with employees, i.e. they will be included in the gross wages. Upon interpreting the results it is important to emphasise that the immediate fiscal effect of the measures taken into account in the study, an amount of HUF 661 billion, obviously did not emerge in reality all at once, as the individual policy changes were introduced in a smoothed manner, over several years. The measures examined here mainly constitute tax relieves, but their significant macroeconomic and labour market impact reverses the sign in the long term, and according to our estimation they improve the budget balance by HUF 247 billion overall.

According to our findings, in the long run, the tax, contribution and transfer measures may contribute to GDP growth by some 6 percent in total.[18] This is primarily attributable to the more than 6 percent increase in effective labour supply, which includes the more than 4 percent expansion in employment (actual employment growth in reality was higher than that, but the measures presented in our study affect only the changes in taxes and transfers, and thus, for example, we do not take into account the impacts of the public work scheme). Gross average wages increase by 4.5 percent, and thus as a result of the rise in the average wages and employment, households' disposable income may grow by an average 8 percent in the long run.

[17] The individual changes in effective tax rates are presented in detail in Subchapter 3.3.
[18] See the table presenting the detailed, cumulative results in Chapter A.6 of the Appendix.

Table 5
Cumulative macroeconomic and fiscal effects of every measure

	Every policy change, combined	
Macroeconomic effects (percent)	**static**	**dynamic**
Effective labour supply		6.3
Employment		4.3
Capital		5.3
GDP		5.9
Gross average wage		4.5
Disposable income		8.0
Fiscal effects (HUF billion)		
Personal income tax	–762	–607
Employee's SSC	110	316
Employer's SSC	–653	–412
Taxes on consumption	439	624
Taxes on capital	–117	–72
Taxes on sales	162	202
Transfers	160	196
Total	**–661**	**247**

Note: 1. Reference tax year is 2010. The measures introduced in different years are uniformly assessed at constant 2014 prices. 2. The table shows the total (cumulative) effect, i.e. the joint effect of all the measures that were taken into account. 3. Static effect: immediate effect, without adjustment; Dynamic: long-term effect quantifying the labour market adjustment.

5 Conclusion

In our study we examined the macroeconomic and fiscal effects of the tax, contribution and transfer measures that were introduced between 2010 and 2017 using an adapted general equilibrium microsimulation model. We took into account the majority of the measures implemented in this period and classified them into three groups based ontheir impacts on labour market decisions.

We updated the model with the data of the latest household survey available at the time, and also expanded it with new methodological elements. A new feature compared to the previous model framework is that we expanded and determined more precisely the set of relevant measures taken into account, and a gross income calculation module was added to the model.

We found that in the long run the economic policy changes contribute to GDP growth by almost 6 percent, and employees' labour supply as well as households' disposable income grow dynamically as a result of the measures. Both the partial and cumulative effects of the measures are presented in the study. Of the changes affecting labour supply, the measures implemented until 2013 (the implementation of a flat personal income tax rate, the elimination of the tax credit scheme and the abolition of the super grossing) and the Job Protection Action Plan had the most significant macroeconomic and labour market effects. As a result of the reduction of taxes on labour in several steps, the budget loses significant revenues in the short run. In the long term, however, it is offset not only by the stimulating macroeconomic and labour market impacts of the measures, but also by the amendment of transfers, the increase in consumption and sales type taxes as well as the introduction of various sector-specific taxes.

Our results may be considerably affected by the modification of the macroeconomic model's calibrated parameters as well as the size of the intensive side elasticities. In order to address this, we carried out sensitivity and robustness checks from various aspects.

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Appendix

A.1 ROBUSTNESS CHECK OF THE USER COST OF CAPITAL AND THE CAPITAL–LABOUR SUBSTITUTION ELASTICITY

The analysis presents in the context of the user cost of capital and the substitution elasticity to how the level values of the key variables are affected by the pairwise values (elements crossed by rows and columns) in the tables. The user cost of capital fell to a historical low, and as for the dispersion of the parameter value of substitution elasticity is relatively high in the domestic literature (see Subchapter 2.4.4). Therefore, in the analysis the simultaneous changes in the parameters were used. During the simulation, we assessed the impact of a 1-percentage point income tax rate reduction, and the results are presented at 2017 prices. According to this sensitivity analysis, the size of substitution elasticity significantly influences the outputs of the model in relatively low range of user cost of capital along all the economic measures simulated.

Table A.1
The effect of substitution elasticity when the value of the user cost of capital is 0.1

User cost of capital	Macro variable	Elasticity of substitution					
		σ=0.8	σ=0.7	σ=0.6	σ=0.5	σ=0.45	σ=0.4
0.100	Effective labour	0.29	0.29	0.26			
	Employment	0.20	0.20	0.18			
	Capital	0.20	0.13	0.03			
	GDP	0.26	0.23	0.18			
	Gross wages	–0.04	–0.08	–0.14			

Note: in the case of missing elements, the results of the model converged slowly or not at all.

Table A.2
The effect of substitution elasticity when the value of the user cost of capital is 0.174
Estimation for the user cost of capital currently applied in the model

User cost of capital	Macro variable	Elasticity of substitution					
		σ=0.8	σ=0.7	σ=0.6	σ=0.5	σ=0.45	σ=0.4
0.174	Effective labour	0.29	0.29	0.29	0.26	0.25	
	Employment	0.20	0.20	0.20	0.18	0.17	
	Capital	0.22	0.21	0.17	0.07	0.01	
	GDP	0.26	0.26	0.25	0.19	0.16	
	Gross wages	–0.03	–0.04	–0.08	–0.14	–0.19	

Note: in the case of missing elements, the results of the model converged slowly or not at all.

Table A.3
The effect of substitution elasticity when the value of the user cost of capital is 0.25

User cost of capital	Macro variable	Elasticity of substitution						
		σ=0.8	σ=0.7	σ=0.6	σ=0.5	σ=0.45	σ=0.4	σ=0.3
0.250	Effective labour	0.29	0.29	0.29	0.29	0.29	0.27	0.23
	Employment	0.20	0.20	0.20	0.20	0.20	0.18	0.16
	Capital	0.25	0.23	0.22	0.19	0.18	0.14	0.03
	GDP	0.28	0.27	0.26	0.25	0.25	0.22	0.16
	Gross wages	–0.02	–0.03	–0.04	–0.07	–0.09	–0.12	–0.24

A.2 ANALYSIS OF THE PARTIAL EFFECTS OF BEHAVIOURAL RESPONSES

The upper part of Table A.4 analyses the effect of behavioural responses separately and jointly in the case of a 1-percentage point PIT reduction. Without taking into account the behavioural responses, the difference between the steady states is slight. As shown, the positive employment effect mainly stems from the adjustment at the extensive margin. Nevertheless, the expanding amount of workload (working hours) of the upper income quintile contributes to the change in effective labour supply is nearly the same.

Table A.4
Partial effect of behavioural responses

	Effective labour supply	Employment	Capital	GDP
	Dynamic	Dynamic	Dynamic	Dynamic
Overall effect	0.29	0.20	0.25	0.28
Without behavioural adj. (only macro)	0.00	0.00	0.00	0.00
Adjustment only on the extensive margin	0.15	0.20	0.13	0.14
Adjustment only on the intensive margin	0.13	0.00	0.11	0.12
Robustness check of adjustment on the intensive margin	**Effective labour supply**	**Employment**	**Capital**	**GDP**
	Dynamic	**Dynamic**	**Dynamic**	**Dynamic**
ζ=0.1 and ω=0	0.07	0.00	0.05	0.06
ζ=0.2 and ω=0 (baseline)	**0.13**	**0.00**	**0.11**	**0.12**
ζ=0.3 and ω=0	0.20	0.00	0.16	0.19
ζ=0.4 and ω=0	0.26	0.00	0.22	0.25
ζ=0.1 and ω=–0.25	–0.10	0.00	–0.08	–0.09
ζ=0.2 and ω=–0.25	–0.03	0.00	–0.03	–0.03
ζ=0.3 and ω=–0.25	0.04	0.00	0.02	0.03
ζ=0.4 and ω=–0.25	0.10	0.00	0.08	0.09
ζ=0.1 and ω=–0.5	–0.26	0.00	–0.22	–0.25
ζ=0.2 and ω=–0.5	–0.19	0.00	–0.17	–0.18
ζ=0.3 and ω=–0.5	–0.13	0.00	–0.11	–0.12
ζ=0.4 and ω=–0.5	–0.06	0.00	–0.06	–0.06

The lower part of the table contains the impact simulated with various marginal and average tax price elasticity coefficients at the intensive margin. It can be seen that if we disregard the income effect ($\omega = 0$), at higher ζ values are increasing, the labour market reaction and its indirect macroeconomic effect approaches these proportionally (see the equation in Chapter 2.1). Labour market adjustment gradually dilutes through the declining value of the elasticity coefficient of the average tax rate (ω). Besides, the effect of the measure under review on labour supply changes sign at sufficiently high parameter values. Nonetheless, it is important to note that there are no related (significant) robust estimation results in the domestic literature.

A.3 ROBUSTNESS CHECK OF THE CHANGE IN THE MARGINAL PRODUCT OF CAPITAL

The scenarios below describe the equilibrium and behavioural effects stemming from the change in the marginal product of capital. At the calibrated value of the capital elasticity ($\eta = 15$), the results thus obtained were similar to those having been generated by the highly elastic capital adjustment. The increase in the share of capital revenue within the whole national income dampens the adjustment process on the labour side; thereby, the employment and output effects are lower in this case.

Table A.5
Equilibrial and behavioural effects resulting from the change in the marginal product of capital

	Effective labour supply	Employment	Capital	GDP
	Dynamic	Dynamic	Dynamic	Dynamic
Overall effect	0.29	0.20	0.25	0.28
Perfectly elastic capital (η=15 replaced by η=999999)	0.29	0.20	0.29	0.29
Perfectly inelastic capital (η=15 replaced by η=0)	0.27	0.18	0.27	0.27
Income share of capital = 0.3 (instead of 0.36)	0.29	0.20	0.02	0.21
Income share of capital = 0.4 (instead of 0.36)	0.26	0.18	0.02	0.16

A.4 COMPARISON OF THE 2008 AND 2014 MODEL VERSIONS: THE EXTENSION AND RAISE OF FAMILY ALLOWANCES

The differences between the 2008 and 2014 model versions are described in Chapter 2.4. In spite of the differences, during the assessment of the measures regarding the years after 2014, we have not found any major differences between the predicted aggregate macroeconomic and fiscal effects. However, differences may occur between the two versions in the decomposition of the budget effect of the given measure, as described in this subchapter.

Table A.6 contains the partial effect of the extension and raising of the family tax allowance simulated on the two different versions of the model: the first and second columns show the results simulated on the model versions based on the 2008 and 2014 HBLS from left to right. In this case, the composition difference can be seen between the personal income tax and the employee's contributions, respectively. Due to the extension of the family tax allowance to employee's contributions and due to its raising in the case of families with two children, personal income tax revenues decline by HUF 37 billion in the long run on the basis of the 2008 model version, while based on the 2014 version the change in the rule has a moderate impact on PIT revenues. In the case of employee's contributions, the fall in revenue calculated in the 2008 and 2014 model versions amounts to HUF 84 billion and HUF 118 billion, respectively.

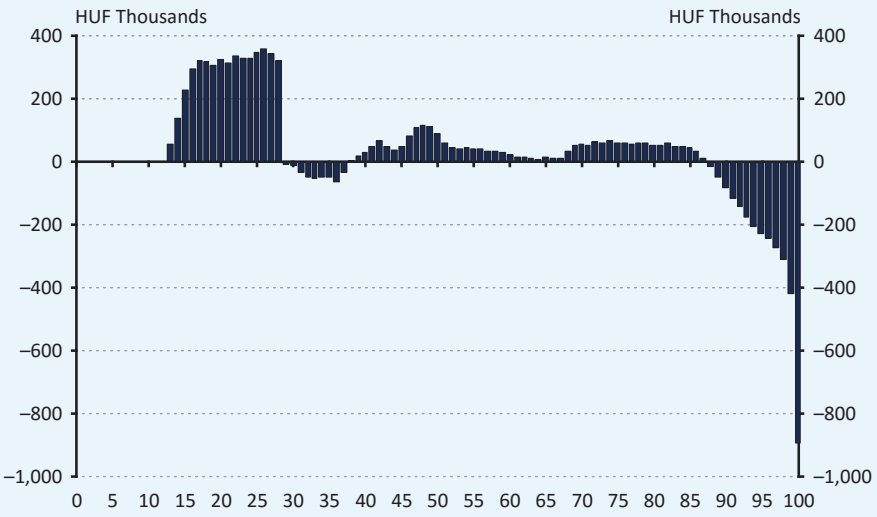
Table A.6
Partial effect of the extension of the family tax allowance to contributions and of the raising of the allowance in the two models

Model version	2008		2014	
Macroeconomic effects (percent)	**static**	**dynamic**	**static**	**dynamic**
Effective labour supply		0.0		0.1
Employment		0.0		0.2
Capital		0.0		0.1
GDP		0.0		0.1
Gross average wage		0.0		0.0
Disposable income		1.1		1.1
Fiscal effects (HUF billion)				
Personal income tax	–36	–37	–1	0
Employee's SSC	–83	–84	–119	–118
Employer's SSC	0	1	0	2
Taxes on consumption	23	24	27	28
Taxes on capital	0	0	0	0
Taxes on sales	0	0	0	1
Transfers	0	–1	0	4
Total	**–95**	**–96**	**–92**	**–84**

Note: at 2014 prices.

The difference between the two results is attributable to the wage corrections on the income distributions[19] (Chart A.1). Average incomes of the top 10 percentiles in the 2008 HBLS, that were multiplied by the average wage index of the period between 2008 and 2014, are much higher than the average incomes reported in the 2014 HBLS. It reflects that in these percentiles the increase in earnings was lower than the increase in the average wage between 2008 and 2014. Consequently, the taxpayers with two children in the upmost decile also claimed large portion of the additional family tax allowance from employee's contributions, whereas the result calculated with the previous model version suggests that this additional allowance is divided between the personal income tax and employee's SSC.

Chart A.1
Difference between the taxable incomes reported in the 2014 HBLS and the value of the 2008 earned incomes indexed to 2014 (W_{2014}/W_{2008})



[19] The model determines the wage percentiles before the wage correction step; in the version based on the 2008 HBLS and in the model version based on the 2014 HBLS the earned incomes reported in the survey were revised upwards from the 22nd and the 29th income percentiles, respectively.

A.5 DISREGARDED MEASURES

- **Minimum contribution of individual entrepreneurs and partnerships**: Entrepreneurial withdrawals result in a minimum contribution payment obligation for individual entrepreneurs and partnerships, which is linked to the minimum wage or the guaranteed wage minimum. Individual entrepreneurs are not modelled separately in the study; their behavioural responses are estimated through labour supply elasticity, which was used in the case of employees as well.

- **Lump sum tax of small entrepreneurs (KATA)**: for entrepreneurs achieving sales revenues of HUF 6 million previously and HUF 12 million as of 2017, in the form of lump sum (HUF 25,000 or HUF 50,000, depending on part- or full-time) this type of tax replaces various taxes and contributions, such as taxes on labour (personal income tax, employee's social security contributions, social contribution tax, vocational training contribution) as well as the dividend tax, corporate tax and healthcare contribution. Despite of the dynamic rise in the number of those who use this tax type (their number increased to above 200,000 by 2017 Q2), the entrepreneurs are not identified separately in the model, and thus this type of tax was not taken into account.

- **Healthcare contribution on interest income**: in addition to the personal income tax, there used to be a 6 percent healthcare contribution to be paid on interest incomes. It resulted in little revenue for the budget and was eliminated in 2017.

- **Healthcare contribution of tobacco industry enterprises**: following its introduction in 2014, referring to the strong progressivity of this contribution, its collection was suspended by the European Commission in 2015. Therefore, revenue originates only from the lower rate, which represents a negligible annual amount (around HUF 0.5 billion), and thus its effect is insignificant.

- **E-road toll**: although this item brings significant revenue for the budget, it does not belong to the contributions or taxes; it is fee income.

- **GYED extra**: within the framework of the measure, the beneficiary parent may take up a job without limitation after the child has reached the age of one, while remaining entitled to receive the full amount of GYED and GYES. Similarly to the study by Baksay–Csomós (2014), this measure was not taken into account due to the insufficiency of the estimations of labour supply elasticities.

- **START public work scheme**: the programme is on the boundary of transfers and wages, and in addition, it cannot be identified in the model, who and for how long participate in the START programme; therefore, we could not take account of it.

- **Change in pension rules**: of the measures taken since 2010 concerning pensions, only the changes related to the retirement age of old-age pensioners were directly included in the model, with regard to the limitations specified in Chapter 2.3. Due to the limits of the model, the possibility for women to retire after 40 years of service, the change in the indexation of pension calculation (inflation-indexed following hybrid indexing) and the changes concerning early retirement could be taken into account only in a limited manner, by applying an effective retirement age.

F.7. táblázat

	Labour supply side														Labour demand side				Miscellaneous			
	Flat personal income tax		Flat PIT and **abolition of super grossing**		Every preceding measure and **elimination of the tax credit scheme**		Every preceding measure and **introduction of child tax allowance**		Every preceding measure and **raise in employee's SSC rates**		Every preceding measure and **PIT reduction of 1 pp**		Every preceding measure and **expansion of child tax allowance**		Every preceding measure and **reorganisation of transfers**		Every preceding measure and **Intoduction of Job Protection Action Plan**		Every preceding measure and **reduction in employer's SSC rates**		Every preceding measure and **changes in effective tax rates 2010–2014**		Every preceding measure and **changes in effective tax rates 2014–2017**	
Macroeconomic effects (percent)	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn	static	dyn
Effective labour supply		3.2		4.9		4.6		4.7		3.7		4.1		4.1		5.7		6.2		7.0		6.4		6.3
Employment		0.5		2.0		0.2		0.3		–0.1		0.2		0.2		2.9		3.7		4.2		4.3		4.3
Capital		2.7		4.1		3.8		3.9		3.1		3.4		3.4		4.7		5.2		5.6		6.1		5.3
GDP		3.0		4.6		4.3		4.4		3.5		3.8		3.8		5.3		5.8		6.5		6.3		5.9
Gross average wage		–0.3		–0.4		–0.4		–0.4		–0.3		–0.3		–0.3		–0.4		0.9		4.3		4.8		4.5
Disposable income		6.1		11.8		6.6		8.9		6.0		7.2		8.4		8.3		9.6		12.8		8.6		8.0
Fiscal effects (HUF billion)																								
Personal income tax	–433	–372	–918	–848	–376	–308	–607	–541	–607	–556	–708	–655	–744	–692	–762	–692	–762	–664	–762	–599	–762	–600	–762	–607
Employee's SSC	0	40	0	64	0	60	0	62	222	285	222	292	140	208	110	204	110	241	110	327	110	325	110	316
Employer's SSC	0	82	0	127	0	119	0	121	0	95	0	105	0	105	0	145	–186	1	–653	–399	–653	–401	–653	–412
Taxes on consumption	87	128	184	248	77	139	123	188	79	127	99	152	122	176	100	174	100	202	100	268	417	609	439	624
Taxes on capital	0	23	0	35	0	33	0	34	0	26	0	29	0	29	0	40	0	44	0	49	–128	–78	–117	–72
Taxes on sales	0	16	0	24	0	22	0	23	0	18	0	20	0	20	0	28	0	30	0	34	130	171	162	202
Transfers	0	9	0	31	0	13	0	13	0	8	0	12	0	11	160	187	159	191	160	195	160	196	160	196
Total	**–346**	**–75**	**–734**	**–318**	**–300**	**79**	**–484**	**–100**	**–307**	**4**	**–388**	**–47**	**–482**	**–143**	**–392**	**85**	**–579**	**45**	**–1046**	**–126**	**–726**	**220**	**–661**	**247**

Note: 1. Reference tax year is 2010. The measures introduced in different years are uniformly assessed at constant 2014 prices. 2. The table shows the total (cumulative) effect, i.e. the joint effect of the measures that were taken into account. 3. Static effect: immediate effect, without adjustment; Dynamic: long-term effect quantifying the labour market adjustment.

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