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Expenditure responses, policy interventions and heterogeneous welfare effects in Hungary during the 2000s

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Expenditure responses, policy interventions and heterogeneous welfare effects in Hungary during the 2000s

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Abstract

VAT rates have changed multiple times and to a relatively great extent in Hungary during the past years. We use the resulting price changes in estimating the price- and income-elasticity of households' expenditures. As a novelty, we introduce an interaction term in estimating the demand system and show that the own price elasticity of food is increasing with increasing production for own consumption. Based on the estimation results, we compute the average welfare effect of the changes and describe also its heterogeneity within the population. We find that the VAT-reforms in 2006 and 2009 have both decreased the welfare of those in the first income quintile. We also look at the welfare effect of multiple hypothetic reforms such as the decrease of the VAT rate of food and a decrease of utility prices as well as a subsidy to production for own consumption. We find that the best targeted measure is an income-transfer to the low-income unemployed either directly or through participation in the public works scheme.

JEL: D12, H20, H31

Keywords: QUAIDS model, household expenditures, consumer behaviour, compensating variation, simulation, welfare effect, production for own consumption

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Fogyaszói reakciók, szakpolitikai beavatkozások és heterogén jóléti hatások Magyarországon a 2000-es években

Cseres-Gergely Zsombor–Molnár György–Szabó Tibor

Összefoglaló

Magyarországon az elmúlt években többször és viszonylag nagy mértékben változtak az általános forgalmi adó kulcsai. Az ebből adódó árváltozásokat kihasználva megbecsüljük a háztartások kiadásainak ár- és jövedelemrugalmasságát. A teljes keresleti rendszer becslése során új elem, hogy egy interakciós tényező beiktatása révén megmutatjuk: a saját termelésű fogyasztás növeli az élelmiszer-kiadás sajátár-rugalmasságát. A becslési eredmények alapján kiszámítjuk a változások átlagos jóléti hatását, bemutatva a népességen belüli heterogenitását is. Számításaink szerint az áfa 2006-os és 2009-es reformjai egyaránt csökkentették az alsó jövedelmi negyedbe tartozók jólétét. Több hipotetikus reform lehetséges jóléti hatását is megvizsgáltuk, ilyenek az élelmiszerek áfakulcsának, illetve a rezsiköltségeknek a csökkentése vagy a saját termelés támogatása. Az alacsony jövedelmű munkanélkülieket érintő – akár támogatásnövelés, akár közfoglalkoztatás keretében megvalósuló – jövedelemtranszfer bizonyult a legjobban célzottnak.

JEL: D12, H20, H31

Tárgyszavak:

QUAIDS modell, háztartási kiadás, fogyasztói magatartás, kompenzációs változás, szimuláció, jóléti hatás, saját termelésű fogyasztás

1. Introduction

Several recent economic policy interventions have had a direct effect on the volume and structure of household expenditure in Hungary. As a result of changing the VAT rates, the middle and highest VAT rates in Hungary are now the highest among the member states of the European Union (EC [2015a]). These reforms were mainly introduced in order to balance the national budget, while their welfare effect was considered to a lesser extent. Conversely, the scheme of cutting utility prices (in Hungarian: rezsicsökkentés), which fixed the maximum retail price of utilities at a level lower than the market price, primarily aimed at increasing welfare.

Consumer responses to price changes may significantly reduce expected revenues from the tax increase if households rearrange their expenditures to buy products that have become relatively cheaper. Similar behavioural effects may reduce the efficiency and targeting of welfare-increasing measures implemented through price changes. When examining the adaptation to price changes, it must be taken into consideration that households of varying types and income respond differently to such changes.

Research on the impacts of spontaneous price changes and government interventions on demand mainly focus on impacts made on those living in poverty, and the analysis is usually accompanied by a *simulation* test of interventions compensating for the negative welfare effects. When examining the impact of food price increases in Mexico between 2006 and 2008, *Attanasio et al* [2013] finds that the targeting of the 'Oportunidades' programme, which compensated for these and provided conditional income transfer is better than that of a hypothetic price rebate. *Abramovsky et al* [2015] reached a similar conclusion when assessing the impacts of a Mexican government package of 2010 reforming income and value added taxes: a conditional income transfer is better targeted than reducing the value added tax on foodstuff. *Ackah–Appleton* [2007] analysed the food price rises in Ghana in the 1990s, which especially had an adverse impact on the urban poor, and found that the liberalisation of imports implemented through the reduction of customs tariffs would compensate for the negative effects affecting the poor. *Chaaban–Salti* [2009] used a linear model quantifying demand reactions to estimate and later a simulation based on it to reveal that the planned value added tax increase of the Lebanese government would increase the burdens of the poor.

The simulation procedure based on elasticities derived from a linear or quadratic estimation of the complete demand system is also applied in developed countries. Both *Bach et al* [2012] and *Gaarden* [2014] calculate the compensating variation to analyse the welfare effects of several earlier German tax reforms and the increase of Norwegian VAT on food respectively. *Alexandri et al* [2014] as well as *Janský* [2014] provide findings for Central and

Eastern Europe. The former also investigated the heterogeneity of elasticities, including rural poor households, while the latter quantified the impacts of submitted and adopted reforms on expenditures and tax revenues.

The present study belongs to this research trend. Relying on Hungarian data, we have estimated the complete demand system and, based on the parameters obtained, we compute the welfare and budget effects of the VAT changes in 2006 and 2009 as well as the decrease in some home maintenance costs, taking into account consumer adaptation. The welfare analysis focuses on those in the lowest income quintile.

In addition to analysing the implemented VAT reforms, we have also examined the impacts of two hypothetic changes: the introduction of the flat-rate VAT, which has no effects on the revenues of the national budget on the one side, and the decrease of VAT on food to 5 per cent on the other side, which is a frequently proposed suggestion. Since foodstuff accounts for 20-30 per cent of household expenditure, and it increases with the deterioration of the financial situation, decreasing the VAT on food is considered a welfare measure targeting the poor.

In addition to the measures that have direct impact on prices, we also simulate the effects of two hypothetic reforms aiming at improving the welfare of the poor. The first is the additional income provided for the unemployed, which may be implemented in two ways: either by direct income transfer (e.g. increasing the unemployment benefits or introducing a basic income as it is piloted in Finland from 2017 January) or by the expansion of the public works scheme[1]. In terms of their effect on household expenditure, the two methods of implementations are similar. Secondly we quantify the effects of subsidies to production for own consumption based on the amendment of regulations supporting backyard husbandry in 2012. Our paper is linked to the aforementioned studies of similar scope and at the same time is a follow-up to earlier Hungarian research projects (*Cseres-Gergely–Molnár* [2008]).

Our analysis is empirically based on the Household Budget Survey of the Hungarian Central Statistical Office. As a starting point, we estimated the parameters of the Quadratic Almost Ideal Demand System (QUAIDS), developed by *Banks et al* in [1997]. In Hungary, expenditure on foodstuff also depends on the extent of production for own consumption. This factor so far has only been considered, if at all, by including its proportion to total expenditure as an exogenous variable in the QUAIDS model. During the model estimations, we also accounted for price effects resulting from production for own consumption. A similar

[1] Public works participants receive wages that are higher than the level of social benefits, therefore spending more time in public works increases income.

method was applied by *Tekgüç* [2012] in a linear model describing demand for foodstuff. To our knowledge we have been the first to apply this procedure in the QUAIDS model in order to account more precisely for the role of production for own consumption.

The structure of the study is as follows. First we present the data used, the major recent VAT and price changes as well as changes in the expenditure patterns of households over time. Then we introduce the QUAIDS model and the method of taking into account production for own consumption as well as the income and price elasticities obtained through the model. In the following section the impact of VAT changes is described and evaluated, followed by the examination of various welfare measures. Finally, the paper is summarised and possible further research trends are suggested. The technical details and the detailed estimation results are provided in the *Annex*.

2. Data, tax changes and stylised facts

DATA

We have performed the calculations using cross-sectional data from 2003 to 2011 from the Household Budget and Living Conditions Survey (HBLS) of the Hungarian Central Statistical Office.[2] The data set was consolidated by the Databank of the Centre for Economic and Regional Studies of the Hungarian Academy of Sciences. The survey involves about 8-10 thousand households annually, each of which keep a detailed logbook about the expenditures, revenues and production for own consumption of the month concerned. The participating households are spread evenly throughout the months of the year. At the end of the year of the record keeping, the households also provide aggregate data on their total income, and in case of many products also on their total expenditure, for the year concerned, except for foodstuff, alcohol & tobacco and production for own consumption. We only included the monthly figures in our calculations because these are more consistent than the annual figures and may be linked to monthly price indices.

The expenditures of the households are recorded as more than 300 variables according to the three-digit *Classification of Individual Consumption by Purpose (COICOP)*. We grouped these items into nine categories: foodstuff, eating out, alcohol & tobacco, clothing, household energy, medicines, other products, utilities and other services. Foodstuff and alcohol & tobacco only include the costs of purchases for consumption but not production for

[2] The starting date is set by the Central Statistics Office starting afresh with a new sampling frame in 2003.

own consumption. In case of other products – except for firewood, whose value is negligible – there is no production for own consumption.

When estimating demand, we rely on the above items of expenditure, i.e. current expenditures are examined; however, when analysing the proportions of consumption and evaluating tax revenues, we also refer to a tenth category of durables. Two criteria received special focus in the course of the aggregation: items of very different nature were not placed in the same category and the items established have to be linked to the monthly price index published by the CSO.

The data cleaning performed on the data set involved the following steps. We excluded households that:

- Had unrealistically low levels of total monthly expenditure including production for own consumption or the extent of food consumption,
- The proportion of energy costs did not reach 2 per cent,
- Foodstuff and energy costs accounted for 90 per cent of the total expenditure,
- The total monthly income was negative (this was possible if agricultural expenses exceeded incomes but the source of these is not provided).

Based on these criteria, a total of 9,490 households were excluded[3] and the estimation was performed on a sample of 69,532 households. As further data cleaning, expenditure proportions lower than 1 per cent were considered 0, in order not to distort the estimation of elasticities. This affected alcohol & tobaccos, clothing and other products as well as medicines, services and utilities in a total of 21,812 households.

The prices we used for the estimation were provided by the price indices collected and produced by the CSO. We relied on monthly chain indices, which are linked to the database according to the month of keeping a log-book. The VAT rates applicable to the various expenditure types were collected from the effective legal regulations and, after matching them to the items of the HBLS, we supplemented the database according to the month of log-book keeping.

[3] Such households differ from those remaining in the sample: the share of the unemployed, those with secondary highest education, the younger is larger and larger families are more frequent. Dropping them has distorted the sample to some extent, but less than using them for the estimates with the modelling framework, as we explain later.

CHANGES IN THE VALUE ADDED TAX

After the millennium, the legal regulations on value added tax have changed several times. From 2003 on there have been four major reforms. The impacts of two of them, the ones introduced in 2006 and 2009, will be examined more closely below, but this subchapter will briefly review all four of them.

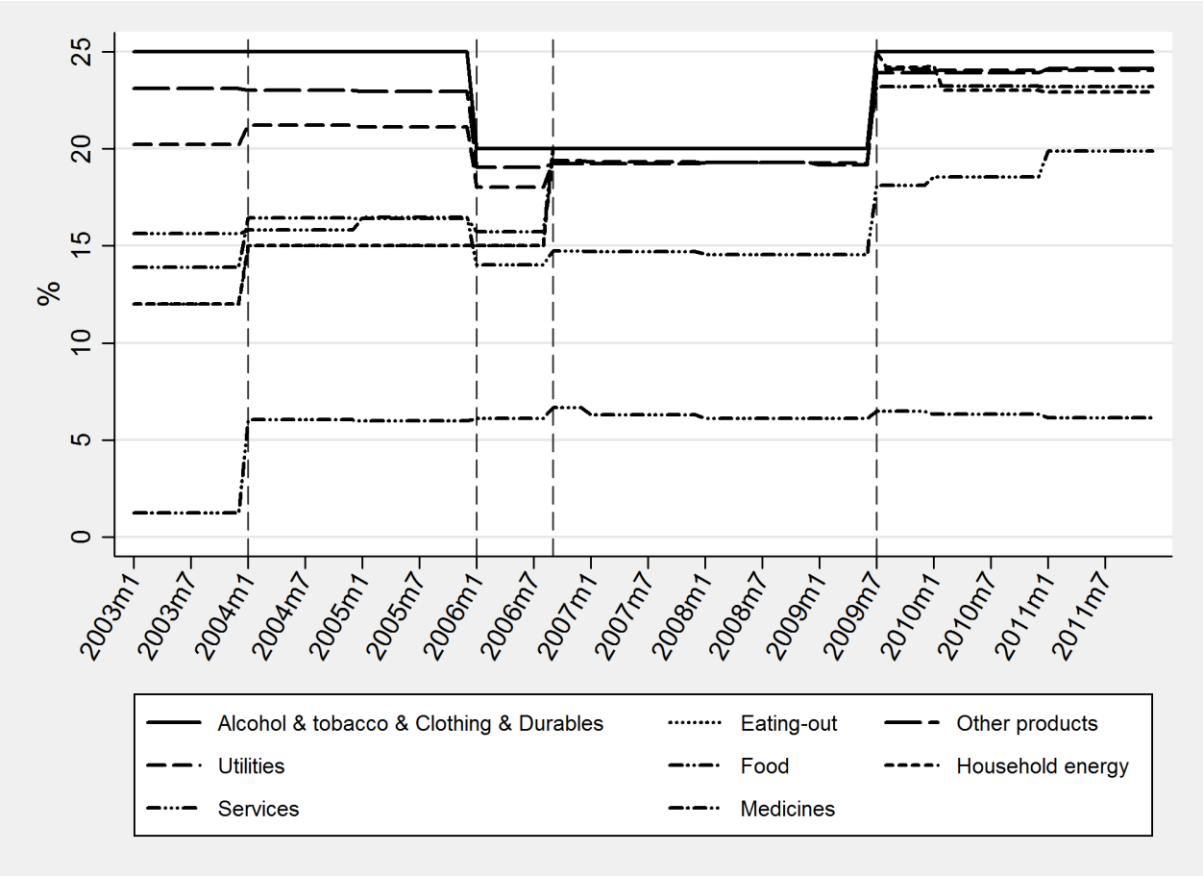
Before joining the European Union, there were two rates of the value added tax: in addition to a higher rate of 25 per cent, there was a reduced rate of 12 per cent applicable to foodstuff, services, and the majority of household energy. On 1 January 2004, at the time of the accession, a third rate of 5 per cent was introduced, applicable to medicines, books and newspapers. At the same time, the middle rate of 12 per cent was raised to 15 per cent.

In 2006, the difference between the mid and highest rates gradually disappeared (in fact the former was eliminated). In January 2006, the highest rate was lowered by 5 per cent to stand at 20 per cent again. Following the elections in the spring, the 15 per cent rate was abolished in September and a dual-rate system was established again along with a significant increase in the average VAT rate.

In July 2009, the higher rate was raised to 25 per cent again and middle rate was re-introduced, this time at 18 per cent. It was applicable to certain dairy and bakery products. At the beginning of 2012, the highest rate increased to 27 per cent and has been left unchanged since that. The time series of the weighted VAT rates of the expenditure categories included in the research as well as the date of the tax changes are presented in *Figure 1*.

Figure 1

The time series of the weighted VAT rates



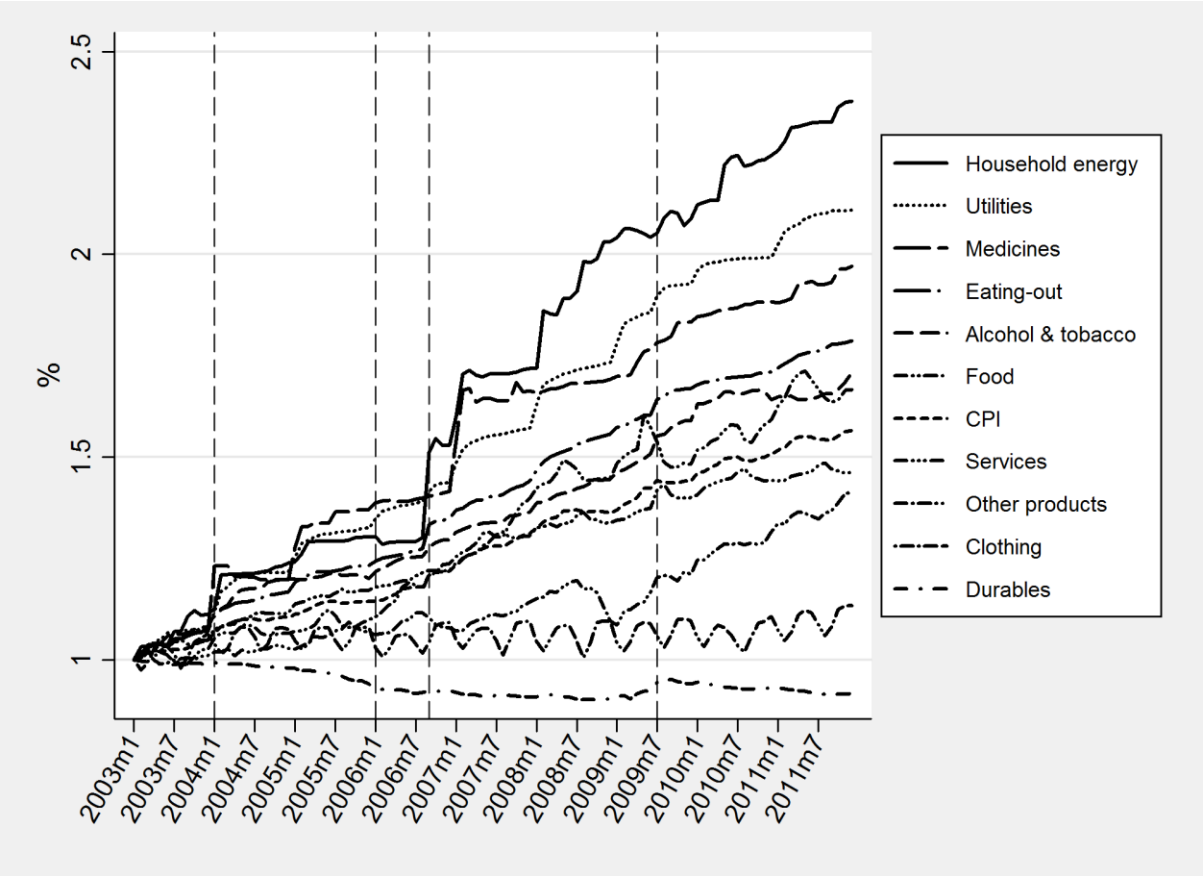
Note: the proportions of products and services within a category were used as weights. The order of the keys in the legend follows the order of magnitude of VAT rates at the end of 2011.

VAT changes do not immediately result in price changes (*Figure 2*); their pass-through depends on the elasticity of demand and supply.[4] The VAT increase at the time of the EU accession had a significant effect on household energy, utilities, medicines, eating-out and alcohol & tobaccos. Reducing the highest rate in 2006 had no appreciable effect but the modifications during the second half of the year accelerated the price increases of household energy and utilities.

[4] The pass-through is both asymmetric and imperfect as shown by Gábriel – Reiff [2010] in a detailed analysis, but we shall abstract from this. Further details on pass-through in Hungary are available in Karádi – Reiff [2014] in a Calvo-type price setting modelling framework.

Figure 2

The time series of price indices



Note: The order of the keys in the legend follows the order of magnitude of price indices at the end of 2011. Authors' calculations, based on the weights and price indices published by the CSO.

PROPORTIONS OF EXPENDITURE – STYLISED FACTS

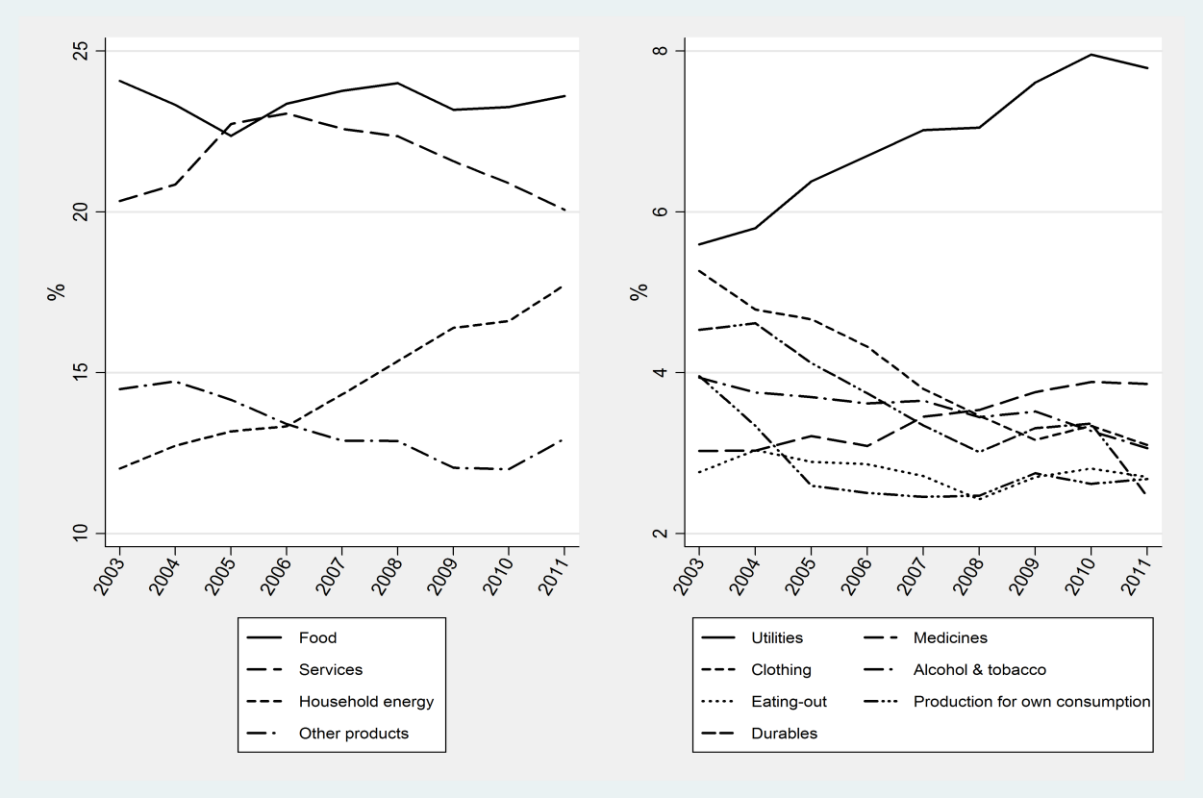
Changes in the proportions of expenditures over time are presented in *Figure 3*. Households spent on food and services in the highest proportion but the share of the latter started to decrease from 2005 on. At the same time, the share of household energy and utilities increased, while the share of clothing, alcohol & tobacco, and other goods as well as durables fell. The proportion of production for own consumption went down from 4 per cent at the beginning of the period to 2.5 per cent at the middle of decade and it has been stagnating since then.

Since the effect of production for own consumption on consumption patterns will be analysed below, some more data are presented in this field. Decrease in the relative significance of production for own consumption resulted from the decrease in the number of backyard farms: their share between 2003 and 2011 decreased from 42 per cent to 29 per cent of households and in case of those living in villages, from 69 per cent to 55 per cent. Among those undertaking backyard farming, there has been no change in the share of

production for own consumption in the total expenditure. It fluctuates around 9 per cent, covering about a quarter of their total food consumption and 5-6 per cent of alcohol & tobacco consumption.

Figure 3

The time series of the proportions of expenditure



Note: The order of the keys in the legend follows the order of magnitude of expenditure proportions at the end of 2011. The reference is the total expenditure supplemented by the amount of production for own consumption.

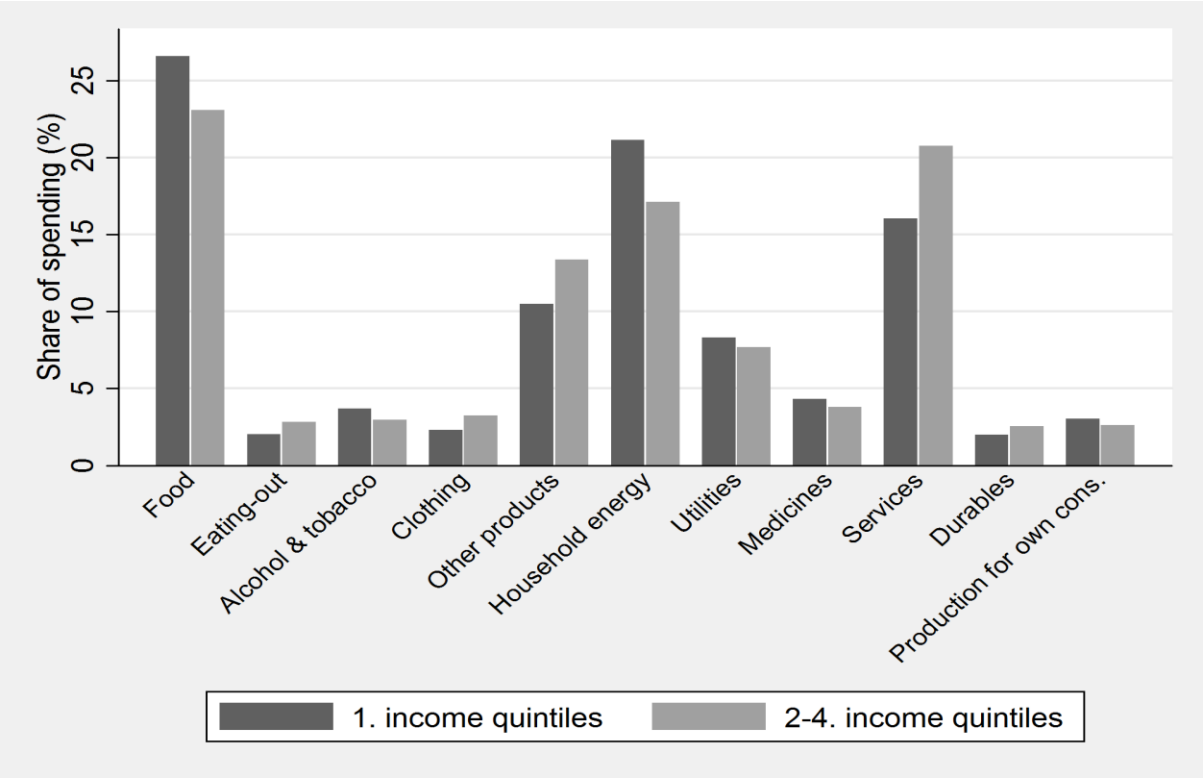
The consumption from own production is measured in the month of the consumption and not of the production, consequently there is such consumption even during the winter month. However, the fruit and vegetable consumption from own production is higher in the summer month. When only the four months between June and September are considered, the share of households consuming from backyard farming is 48 per cent at the beginning of the period between 2003 and 2011 and 34 per cent at the end of it, by a maximum of 5-6 percentage points higher than the average of the whole year. Among households undertaking backyard farming the proportion of production for own consumption in the total expenditure

is only 1-2 percentage points higher during the summer months than during the rest of the year. This does not have an influence on trends.

As mentioned in the introduction, our analysis pays special attention to those in the lowest income quintile,[5] who will be briefly referred to as "the poor". The poor spend an even higher proportion of their income than the others on fulfilling their basic needs, such as food, household energy, and utilities and spend a significantly lower proportion on other goods and especially services *(Figure 4)*.[6]

Figure 4

The spending patterns of the households of the lowest and the three highest income quintiles, 2011



The proportion of those producing for own consumption is on average equal among the poor and the others but it is owing to a special composition effect. Only 45 per cent of the poor living in villages undertake backyard farming, while the same is true for 59 per cent of the non-poor (living in villages). However, a relatively higher proportion of those living in

[5] Income quartiles are defined using equivalised annual household income levels. We have used the square root of household size as an equivalence scale.

[6] Differences observed in 2011 can be treated as being constant during the years we are looking at.

villages is poor: one-third of villagers belong to the lowest (national) income quintile. Among those undertaking backyard farming, there is no significant difference in the relative weight of production for own consumption between the poor and the rest of the population.

3. Estimation results

THE ESTIMATION METHOD

In order to estimate the parametric demand system, we rely on the widely used QUAIDS model (*Banks et al* [1997]), which is a generalisation of the Deaton and Muellbauer AIDS model (*Deaton–Muellbauer* [1980*a*]). It includes also the quadratic function of the logarithm of total expenditure, which resolves the conflict in the AIDS model of regarding a good either as a necessity or a luxury for everyone.

We have to make several assumptions for the model to be valid. We exclude the temporality of the decision on consumption versus saving and we assume that, as a first step, households divide their income into amounts for saving as well as durables and non-durables and then they allocate their expenditures to maximise utility *(Deaton–Muellbauer* [1980*b*]: 119–126.). As a result of this assumption, it is sufficient for us to include current expenditure instead of incomes in the model.

The QUAIDS model is derived from the (1) indirect utility function:

$$\ln V = \left\{ \left[\frac{\ln m - \ln a(\mathbf{p}, \mathbf{z})}{b(\mathbf{p})} \right]^{-1} + \lambda(\mathbf{p}) \right\}^{-1} \qquad (1)$$

where $\mathbf{p}$ is the logarithm of prices, m is the volume of expenditure of the household, $\mathbf{z}$ is the vector of taste shifters (demographic, regional, etc. variables) and $\lambda(\mathbf{p})$ is the sum $\sum_{i=1}^{k} \lambda_i \ln p_i$. The terms $\ln a(\mathbf{p}, \mathbf{z})$ and $b(\mathbf{p})$ are defined in equations (4) and (5).

The QUAIDS demand system is derived from the indirect utility function by the application of Roy's identity (1). This model links the proportions of expenditure, prices, taste shifters and total expenditure as follows:

$$w_{\mathrm{i}} = \alpha_i(\mathbf{z}) + \sum_{j=1}^{k} \gamma_{\mathrm{ij}} \ln p_j + \beta_i(\ln m - \ln a(\mathbf{p}, \mathbf{z})) + \lambda_i \frac{(\ln m - \ln a(\mathbf{p}, \mathbf{z}))^2}{b(\mathbf{p})}, \qquad (2)$$

where

$$\alpha_{\mathrm{i}}(\mathbf{z}) = \alpha_{\mathrm{i}} + \sum_{j=1}^{l} \alpha_{ij} z_{\mathrm{j}}, \qquad (3)$$

$$\ln a(\mathbf{p}, \mathbf{z}) = \alpha_0 + \sum_{i=1}^{k} \alpha_{\mathrm{i}} \ln p_i + \sum_{i=1}^{k} \sum_{j=1}^{l} \alpha_{ij} z_{\mathrm{j}} \ln p_i + \frac{1}{2} \sum_{i=1}^{k} \sum_{j=1}^{k} \gamma_{ij} \ln p_i \ln p_j, \qquad (4)$$

$$b(\mathbf{p}) = \exp\left[\sum_{i=1}^{k} \beta_i \ln p_i\right] \tag{5}$$

We included the taste shifters in ln $a(\mathbf{p}, \mathbf{z})$ following on *Browning–Meghir* [1991].

The above demand system is restricted by several factors. The total of the expenditure proportions has to be 1, therefore:

$$\sum_{i=1}^{k} \alpha_i = 1, \sum_{i=1}^{k} \alpha_{ij} = 0, \sum_{i=1}^{k} \gamma_{\mathrm{ij}} = 0, \sum_{i=1}^{k} \beta_i = 0, \sum_{i=1}^{k} \lambda_i = 0 \tag{6}$$

Homogeneity of degree zero also has to apply: when expenditures and prices increase to the same extent, demand remains unchanged. This is true if

$$\sum_{j=1}^{k} \gamma_{ij} = 0 \tag{7}$$

The Slutsky matrix containing the Hicksian price responses is symmetric, i.e.

$$\gamma_{ij} = \gamma_{ji} \tag{8}$$

In the following, equation (2) is estimated by applying definitions (3)–(5) and conditions (6)–(8).

Our iterative method is a slightly modified version of the one developed by *Blundell–Robin* [1999]. It is based on the idea that, knowing ln $a(\mathbf{p}, \mathbf{z})$ and $b(\mathbf{p})$, the model may be simplified into a linear system, thus by re-calculating these terms in every step, the problem may be treated as the estimation of a linear system. Although today the direct non-linear estimation of the system (*Poi* [2012]) is feasible, its computational requirements are excessively large and some steps of the estimation are technically cumbersome and potentially non-robust, therefore we have opted for the iterative method.

The baseline value of the parameters are provided as customary in literature: ln $a(\mathbf{p}, \mathbf{z})$ is aligned with the Stone price index $\sum_i w_i p_i$, while $b(\mathbf{p})$ equals 1. The α_0 in the term ln $a(\mathbf{p}, \mathbf{z})$ is interpreted – as customary and in accordance with the logic of the model – as the expenditure required for achieving a minimum standard of living and defined it as the logarithm of the smallest expenditure of the reference period (*Deaton–Muellbauer* [1980*a*]). Because of the potential endogeneity of total expenditure – which may be caused by measurement errors, distortion due to an excluded variable, expenditure proportions censored at 0 or compromising the theory of multi-level budgeting (*Dhar et al* [2003]) – we applied instrumental variable estimation in each iteration, during which the monthly incomes of households were considered exogenous. The standard errors and other statistics of the estimation results are based on the bootstrap method, with 500 replicates.

Following the estimation, using the parameters obtained, we computed the income, the compensated (Hicksian) and the uncompensated (Marshallian) price elasticities as well as

the compensating variations related to the price changes, which resulted from economic policy interventions. (This is described in detail in *Annex 1*.) In case of economic policy interventions not leading to price changes (e.g. direct income transfer), by definition there is no point in calculating compensating variation. In these cases, the impact of the intervention is measured by the changes in utility, based on equation (1).

THE IMPACT OF TASTE SHIFTERS

Taste shifters capture the effect of preferences and the characteristics of household production, which also depend on sociological and geographical backgrounds. We have included several of these variables in our model; the estimated coefficients ere provided in *Table F1 of Annex 3*. The impact of expenditure and price variables may be better described by elasticities, which is presented in the next subchapter.

Characteristics of the household structure and the members of the household

The effect of economies of scale of the household is present in the coefficient of the logarithm of the number of household members. Larger households spend a relatively smaller share of their income on food, household energy, utilities, and medicines, and more on every other category, especially services.

Since consumption data are only available for households, consumption differences between men and women can only be inferred from the number of adult females in the household. Along with the increasing proportion of females in the household, the proportion of eating-out decreases significantly. The negative coefficient of alcohol & tobacco indicates that women consume less alcohol and tobacco products. The consumption of alcohol & tobacco also decreases with the number of children aged 0–14, while the share of other products grows.

The impact of educational attainment was measured by the proportion of those with certain levels of qualification within potential *heads of households*[7]. Among those with lower educational attainment, the share of spending on food, alcohol & tobacco and household energy is higher, while the share of spending on services, eating-out, clothing, and other products is lower.

[7] We have labelled couples, lone parents as well as 18 and older, working "children" as a potential head of household. If such person was not present in the household, those over 18 were labelled as such. This approach has proved to be more useful during estimation than the traditional one.

The average age of potential heads of households as well as its squared value are also significant in nearly all spending equations: they are used for identifying the minimum and maximum points of consumption according to age. The proportion of spending on food increases with age in a household and then it starts to decrease around the age of 60. The age-related trends of alcohol & tobacco consumption and spending on services are similar but the maximum is at age 40 and 50 respectively. In contrast, the proportion of eating out peaks at a young age, after that it decreases and then it increases again around the age of 50. The minimum of consuming medicines is at the age of 25–30. The share of household energy consumption grows, while the share of utilities and clothing falls with age.

Our model also contains the distribution of the economic activity of potential heads of households. The share of foodstuff, medicines, household energy, and utilities decreases with the increasing proportion of those in employment, while spending on eating-out and services rises. With the increase of the share of those not in employment and not in retirement, that is, those excluded from the labour market, the proportion of spending on food, alcohol & tobacco and utilities grows significantly due to the deteriorating financial situation. The share of household energy and medicines increases proportionately with the share of old-age pensioners.

We have classified households according to four types: single-member households, households where (in addition to other members) there is a couple, single-parent families with a child aged 18 or younger and those not belonging to any of the other categories. There are relatively significant differences in the share of spending on alcohol & tobacco: it is single-parent households that spend the least on this item even if the effect of the number of children is accounted for.

Regional and temporal differences

We differentiate between 4 types of locations – Budapest, county towns, other towns and villages – and 7 regions (Budapest is part of the region of Central Hungary). Starting from Budapest and towards the villages the share of household energy increases, while the share of utilities decreases.

In order to eliminate seasonal effects, we use variables indicating the month of the data collection. As for spending on food, the most significant seasonal effect is seen in the summer months and in December, when the consumption of alcohol & tobacco is also outstanding. Food purchases are considerable in the summer months, in spite of the peak of production for own consumption being also in summer. It is only partly explained by the low energy consumption of the summer season, which exerts its effect by having the sum of the coefficients 0. In case of clothing and other products, there is a peak period in October-

December and a low in January. The outstanding food and alcohol & tobacco consumption in December as well as the shopping peak period before Christmas is primarily balanced by lower spending on services.

Production for own consumption – sensitivity analysis

In the aforementioned version of the model, the share of production for own consumption in expenditure is included as one of the taste shifters. Production for own consumption is a substitute for food purchase: it reduces the proportion thereof. To a lesser extent, it also decreases the share of eating-out and alcohol & tobacco. When households spend a smaller proportion of their income on these categories, they necessarily spend a larger share on others, especially on other products and services. This treatment is analogous to how labour supply is treated in demand systems, making demand conditional on them as in *Browning-Meghir* [1991].

It is also possible, that the effect of production for own consumption on the consumption of food and alcohol & tobaccos depends not only on the extent of household production but also on total expenditure and the price of food, eating-out and alcohol & tobacco. Such a relationship might exist due to deep nonseparabilities between these types of goods. The already seen correlation between the type of food production and presence of women in the household is a good indication. We are not aware of solutions including the supply of domestic work and the resulting decisions on backyard farming and related investments in the QUAIDS model. One of the approaches to tackle this problem is to include the interaction of the share of production for own consumption with expenditure and expenditure squared as well as with the price of the three products directly affected by production for own consumption (food, eating-out and alcohol & tobacco) among the taste shifters. *Tekgüç* [2012] adopted a similar solution in the course of a linear AIDS model containing not the complete demand system but only foodstuff. To our knowledge, we have been the first to integrate this solution in a QUAIDS model. The formal description of the amended model is provided in *Annex 2*.

Using the amended model substantially modified the elasticities (see the following section); however, it did not have a significant impact on demographic, spatial, and temporal variables, which indicates the stability of the model applied.

ELASTICITIES OF PRICE AND INCOMES

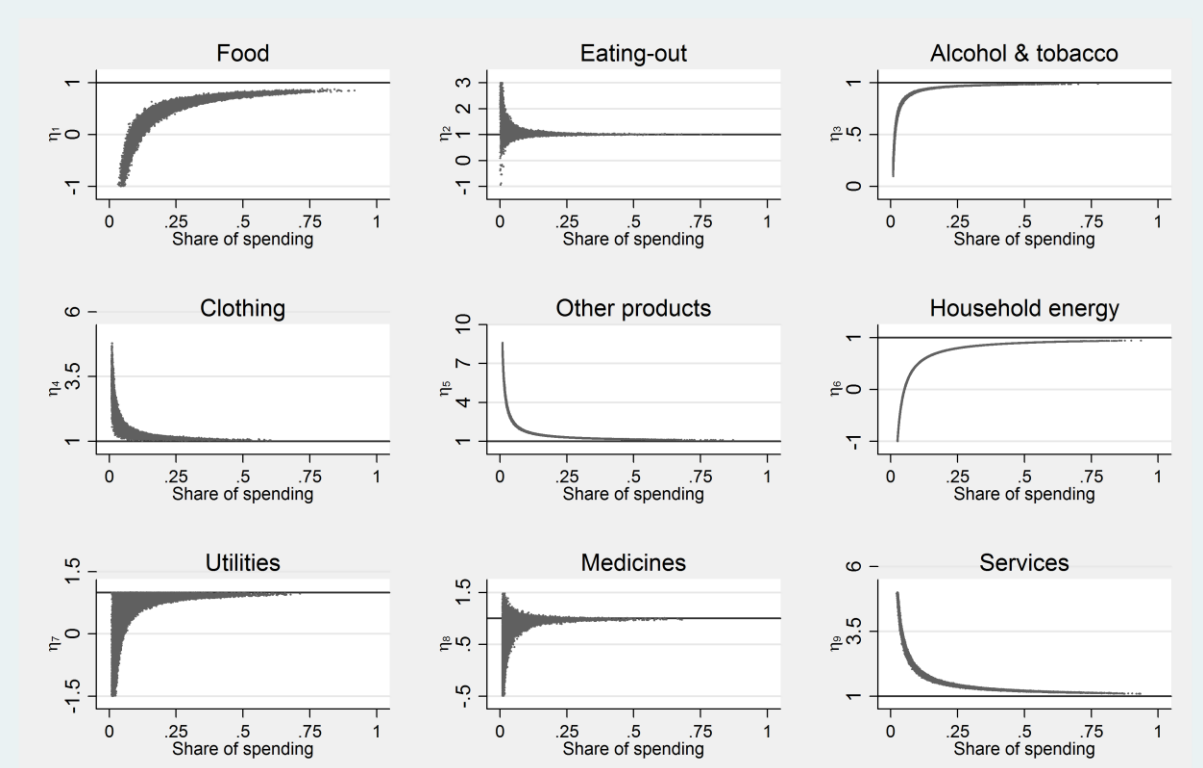
When calculating elasticities (see *Annex 1*), we only included households, which had expenditures in the given month in the category examined. First the heterogeneity of income

and uncompensated price elasticities is presented as a function of expenditure proportions (*Figures 5* and *6*).

Food proved to be a basic necessity for the majority of households, but its income elasticity is negative at low shares of expenditure, that is, it behaves as an inferior good. This phenomenon is due to the nature of the model,[8] which is not striking in case of average elasticities characterising the whole population but it is in case of examining heterogeneity. Eating out is a luxury for slightly more than half of the households examined and a normal good for the rest. Besides the income effect, this difference may partly be due to the fact that eating-out contains both eating at kindergarten, school, and office canteens as well as eating in a restaurant.

Figure 5

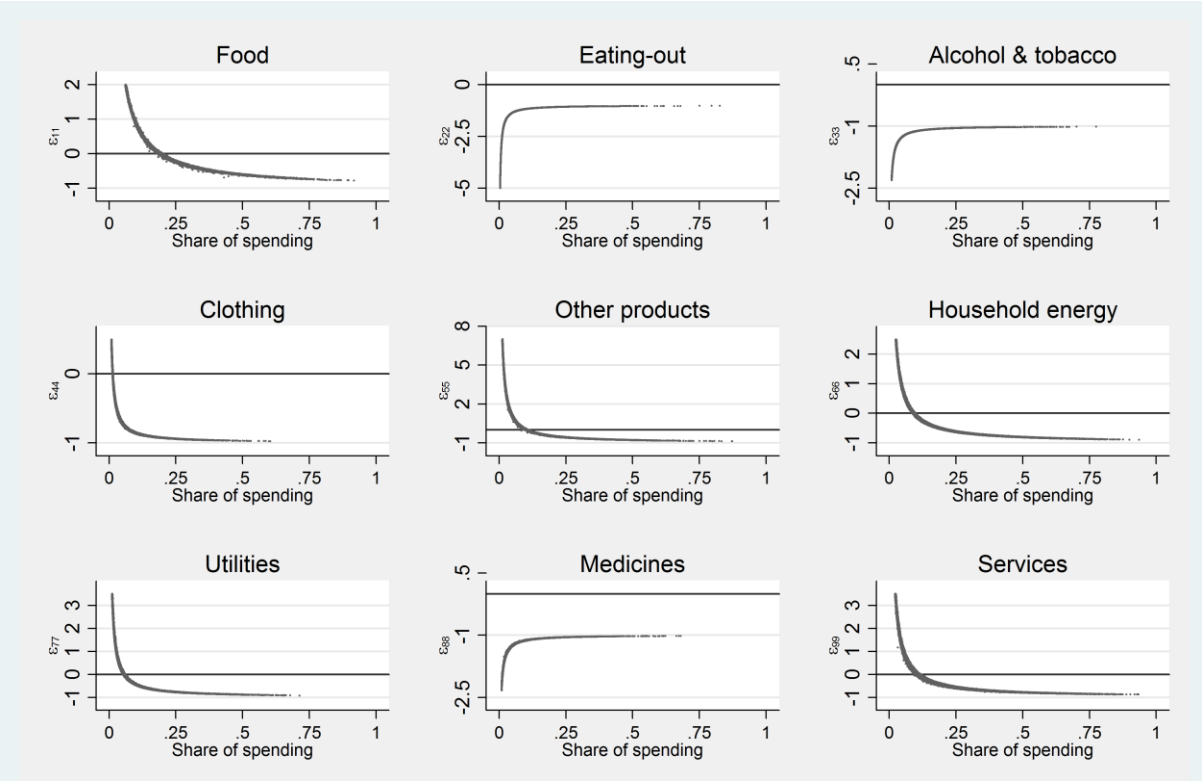
Income elasticities of expenditure categories



[8] It is easy to see the root cause in the model for this effect by looking at the formula for the elasticities: small expenditure shares magnify the second element of the sum, thus generating values of extreme magnitude.

Figure 6

Uncompensated own-price elasticities as a function of expenditure shares



The income elasticity of alcohol & tobacco varies to a large extent but they proved the be necessities for all of the households spending on them[9], while clothing and other products are luxuries for them. For 95 per cent of the households, household energy is a normal good, and a basic necessity in particular, but – similarly to foodstuff – in a lower spending range it behaves as an inferior good. Utilities and medicines may be both inferior goods and luxuries according to the (extreme) ranges of spending but they are basic necessities for the majority of households. Services are definitely luxuries.

Based on the values of own-price elasticities, the products consumed turned out to be normal goods for most of the households; however, if constituting a smaller proportion of expenditure, foodstuff, clothing, other products, household energy, utilities, and services are seen as Giffen goods. This is not necessarily due to the behaviour observed but may be because of the restrictions the model puts on the elasticities, making them a decreasing function of the elasticities. On the other hand, the absolute value of the aforementioned negative elasticities increases proportionately to the share in expenditure, that is, the larger

[9] 40% of the household has not purchased alcohol & tobacco in the given month. This proportion has grown from 38 to 44 percent during the observation period.

share of their income is spent on a certain good, the more sensitively households react to price changes. The demand for products purchased by a relatively few households – eating-out, alcohol & tobacco and other products – is more elastic among households that spend a lower proportion of their income on them. By increasing expenditure, the point cloud of each good approaches –1, and in the range of large expenditure share, demand becomes almost completely elastic. The usual analysis focussing on averages masks these shortcomings of the model, but they are fully revealed if we look at heterogeneity.

The aggregated elasticities are provided in *Table 1*. In order to ensure robustness, we have calculated median elasticities. Each of the aggregates examined behaves as a normal good; food, alcohol & tobacco, household energy, utilities and medicines are basic necessities. Services are characterised by the highest income elasticity.

All own-price elasticities are negative and, apart from the compensated price elasticity of services, they are statistically significantly different from zero. The products that cannot be or can hardly be dispensed with in everyday life, such as food, utilities and household energy, have the lowest price elasticity. Services are substitutes for clothing and other products (the trends indicating it have already been described during the analysis of the December spending pattern) and household energy, while they are complements for eating-out, utilities, and medicines. There is practically no substitution between food and eating out. This is somewhat counterintuitive and may be due to the limited substitution possibilities for kindergarten and school meals and to office meals covered by employee benefits (lunch vouchers). The price increase of utilities mainly reduces food consumption, which suggests that many households cannot turn to other resources to cover their basic housing expenditures.

Table 1

Income and price elasticities

Category	Food	Eating-out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medicines	Services
Income elasticity									
Average	0.58***	1.08***	0.87***	1.36***	1.51***	0.66***	0.62***	0.84***	1.42***
Median	0.62***	1.04***	0.91***	1.25***	1.40***	0.72***	0.73***	0.90***	1.35***
Uncompensated median price elasticity									
Food	−0.32***	−0.05	−0.08**	0.02	−0.05	−0.06*	−0.19***	−0.06**	0.17***
Eating-out	−0.19	−1.19***	0.54***	0.15	−0.21***	0.01	−0.06	−0.13	0.01
Alcohol & tobacco	−0.29**	0.59***	−1.14***	0.22***	−0.09	0.09	−0.23*	−0.09	0.04
Clothing	−0.05	0.13	0.16**	−0.87***	0.29***	−0.13**	−0.26***	−0.18***	−0.35***
Other products	−0.26***	−0.12***	−0.07*	0.18***	−0.43***	0.08**	−0.05	−0.04	−0.69***
Household energy	−0.11**	0.02	0.05	−0.04	0.17***	−0.50***	0.15***	0.13***	−0.58***
Utilities	−0.57***	−0.04	−0.21*	−0.26***	−0.01	0.29***	−0.42**	−0.03	0.54***
Medicines	−0.22**	−0.15	−0.1	−0.23***	−0.05	0.29***	−0.04	−1.16***	0.77***
Services	0.00	0.00	−0.01	−0.13**	−0.44***	−0.48***	0.14**	0.20***	−0.63***
Compensated median price elasticity									
Food	−0.1***	−0.04	−0.07*	0.04	0.02	0.02	−0.15**	−0.04*	0.29***
Eating-out	0.02	−1.09**	0.57***	0.21*	−0.08	0.14	0.00	−0.11	0.24
Alcohol & tobacco	−0.06	0.62***	−1.06***	0.26**	0.00	0.23**	−0.18	−0.07	0.21
Clothing	0.23***	0.17*	0.21***	−0.70***	0.49***	0.00	−0.19**	−0.15***	−0.09
Other products	0.06	−0.09***	−0.03	0.25***	−0.17***	0.25***	0.02	−0.02	−0.37***
Household energy	0.06	0.03	0.07	−0.03	0.27***	−0.34***	0.21***	0.16***	−0.44***
Utilities	−0.39***	−0.03	−0.19	−0.24***	0.06	0.41***	−0.35*	−0.02	0.70***
Medicine	0.00	−0.14	−0.08	−0.21***	0.03	0.46***	0.00	−1.09***	0.94***
Services	0.29***	0.01	0.01	−0.08*	−0.24***	−0.30***	0.22***	0.23***	−0.22

Note: Significant at a level of *** 1 per cent. ** 5 per cent. * 10 per cent. The significances and standard errors are based on bootstrap method with 500 replicates. When aggregating, household elasticities are weighted with the share of spending on the product concerned in total expenditure. Expenditures are deflated at the same date.

Table 2

The median income and uncompensated own-price elasticities of households belonging to the lowest income quintile

	Food	Eating-out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medicines	Services
Income elasticity									
Poor households	0.66***	1.01***	0.92***	1.23***	1.45***	0.78***	0.81***	0.94***	1.43***
Poor households with a majority of unemployed members	0.68***	1.01***	0.93***	1.25***	1.59***	0.81***	0.81***	0.95***	1.53***
Price elasticity									
Poor households	−0.41***	−1.16***	−1.12***	−0.86***	−0.37***	−0.60***	−0.52***	−1.14***	−0.55***
Poor households with a majority of unemployed members	−0.44***	−1.11***	−1.10***	−0.84***	−0.16**	−0.65***	−0.54***	−1.11***	−0.43**

Note: see previous table.

Elasticities in poor households

Income elasticity of the major expenditure categories is higher in poor households than in all households in general (*Table 2.*) The most significant differences are seen in household energy, utilities, and services. The income elasticity of other products and services is even higher in poor households with a larger proportion of unemployed potential head, compared to the others.

Low income households react more sensitively to the price changes in food, household energy, and utilities than the average household. In households with a majority of unemployed members, the price elasticity of other products is nearly 0, and the price elasticity of services is also the lowest among them. Comparing this with the findings of analysing income elasticities, we conclude that these households do not consume any more of these categories other than what is absolutely necessary and therefore they are not sensitive to their price.

Cross-price elasticities for poor households are not provided in a Table. Among them the price elasticity of all products in the column of foodstuff is negative, indicating that they primarily compensate for price increases by reducing food consumption. *This trend is especially informative for calculating subsistence income based on multiplying* the quantity of *food consumption:* with increasing home maintenance costs, the food consumption of poor families may be relatively lower than that of somewhat wealthier families.

Production for own consumption – sensitivity analysis

Elasticities obtained from the model estimated using modified own consumption are presented in detail in *Table F2*. In this section only the most important changes are highlighted.

The median income elasticity of food increased by 3 percentage points, while that of utilities and medicines decreased. The most important change, confirming our intuition, is that the uncompensated and compensated own-price elasticity of foodstuff increased by 7 and 9 percentage points respectively, that is, the new model reflects on it more precisely that households undertaking backyard farming are able to react more flexibly to changes in food prices. The own-price elasticity of services and the cross-price elasticity of food with services also increased although to a somewhat lesser extent. On the other hand, there are no changes in the elasticities of eating-out or alcohol & tobaccos.

4. The welfare and budget effects of VAT reforms

In addition to presenting the impacts of the VAT changes introduced in 2006 and 2009 on welfare and the national budget, we also examine the welfare consequences of the introduction of a hypothetical flat-rate VAT, which would leave budget revenues unchanged. (The two phases of VAT amendments in 2006 are merged). The simulated price effects are summarised in *Table 3*.

Table 3

The extent of VAT changes (percentage point)

Expenditure category	2006	2009	Flat-rate VAT
Food	3.5	3.2	–1.0
Eating-out	5.0	5.0	–2.8
Alcohol & tobacco	–5.0	5.0	–2.8
Clothing	–5.0	5.0	–2.8
Other products	3.7	4.7	–1.9
Household energy	5.0	5.0	–0.7
Utilities	–1.7	4.8	1.8
Medicines	0.7	0.4	16.7
Services	–1.7	3.6	2.3

Note: The difference in the values of weighted average VAT rates before and after the reforms.

In case of the actual VAT changes, the simulation was undertaken using the sub-sample of the latest year that did not yet show the impacts of the measure concerned. We assumed that the reforms immediately result in price increases or decreases equivalent to the extent of VAT changes. This is probably not true in the short run but is a plausible assumption in the long-run.

As a result of the changes in 2006, household energy, other products, and foodstuff became significantly more expensive among the products having a major share in the expenditure of households. Utilities and services became cheaper, although to a smaller extent. In 2009, on the other hand, the price index of all expenditure categories increased – that of foodstuff, services, and medicines to the smallest extent.

The hypothetical flat-rate tax regime leaves state revenues unchanged as computed on the basis of the household sample of the year 2011. This is achieved at a VAT rate of 22.2 per cent – the VAT rate changes of the various product categories are presented in the final column of *Table* 3. The VAT rate of most products would decrease, while those of utilities, services, and medicines would increase – that of the latter to an excessively

large extent. The flat VAT rate calculated on the basis of the same principles was 16.2 per cent for the year 2011 in Germany (*Bach et al* [2012]).

We are going to present the changes taking place in the average expenditure proportions as a result of price changes in two ways. In a static case we only consider the direct changes arising from the effects of price changes. The expenditure proportions accounting for the spending reactions for price changes were calculated on the basis of parameters gained from the estimated equation. To ensure comparability, the proportions dating back prior to the reforms are also provided using the model (*Table 4*).

Table 4

Predicted average expenditure proportions (percentage)

	Food	Eating -out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medi-cines	Ser-vices
2006									
Prior to changes	27.8	3.1	4.3	4.0	12.7	16.5	7.6	4.4	19.8
Static	28.6	3.2	4.0	3.7	12.1	17.1	7.4	4.4	19.4
With adjustment	28.4	2.7	4.5	3.8	12.2	16.9	7.6	4.4	19.6
2009									
Prior to changes	28.0	2.6	3.9	3.1	11.8	18.3	8.2	4.5	19.5
Static	27.8	2.7	3.9	3.2	11.9	18.5	8.3	4.4	19.5
With adjustment	28.2	2.7	4.0	3.1	11.7	18.6	8.4	4.5	18.7
Flat-rate VAT									
Prior to changes	28.1	2.4	3.6	2.7	11.4	20.5	8.9	4.6	17.7
Static	27.8	2.4	3.5	2.6	11.2	20.3	8.8	5.3	18.1
With adjustment	28.1	2.2	3.4	2.2	10.8	20.4	9.1	4.7	19.1

As a result of the VAT changes of 2006, the share of food and household energy in expenditure increased. However, the static calculation method slightly overestimates the increase in both cases. The share of other products and eating-out decreased relatively considerably. The static method overestimates the share of eating-out and underestimates the share of alcohol & tobacco.

Since the reform in 2009 resulted in a price increase of most products, no significant changes in expenditure proportions can be observed. The only exception is services, the share of which falls almost 1 percentage point as a result of behavioural effects. As services are complements for household energy, clothing, and other products if these become even more expensive, we could expect the transfer of spending to this

category but this effect is below the reducing effect of the bigger price increase of the other products. Since the price increase of food was below the average, the static estimation shows a decreasing, while the one also accounting for behaviour effects an increasing share.

The lower section of *Table 4* shows the spending pattern following the introduction of the flat-rate VAT. The largest differences between the values of the static and adaptation-based models are seen in services.

Figure 7 presents the simulated effects of the three VAT changes on a unified scale through the extent of *compensating variation* as a function of total expenditure. The compensating variation indicates at what income (or total expenditure) change the utility level of the household prior to the price change would remain unchanged. In case of the VAT changes of 2006, the compensating variation is negative among wealthier households with more expenditure, that is, their welfare had increased. This means in other words that their income should be reduced in order for their utility not to increase as a result of the tax changes. In the lower expenditure range households should have been compensated for, in order for the utility achievable by them not to decrease. Food and household energy represent a larger share of their spending, while wealthier households benefitted from the price decrease of services, alcohol & tobacco and utilities.

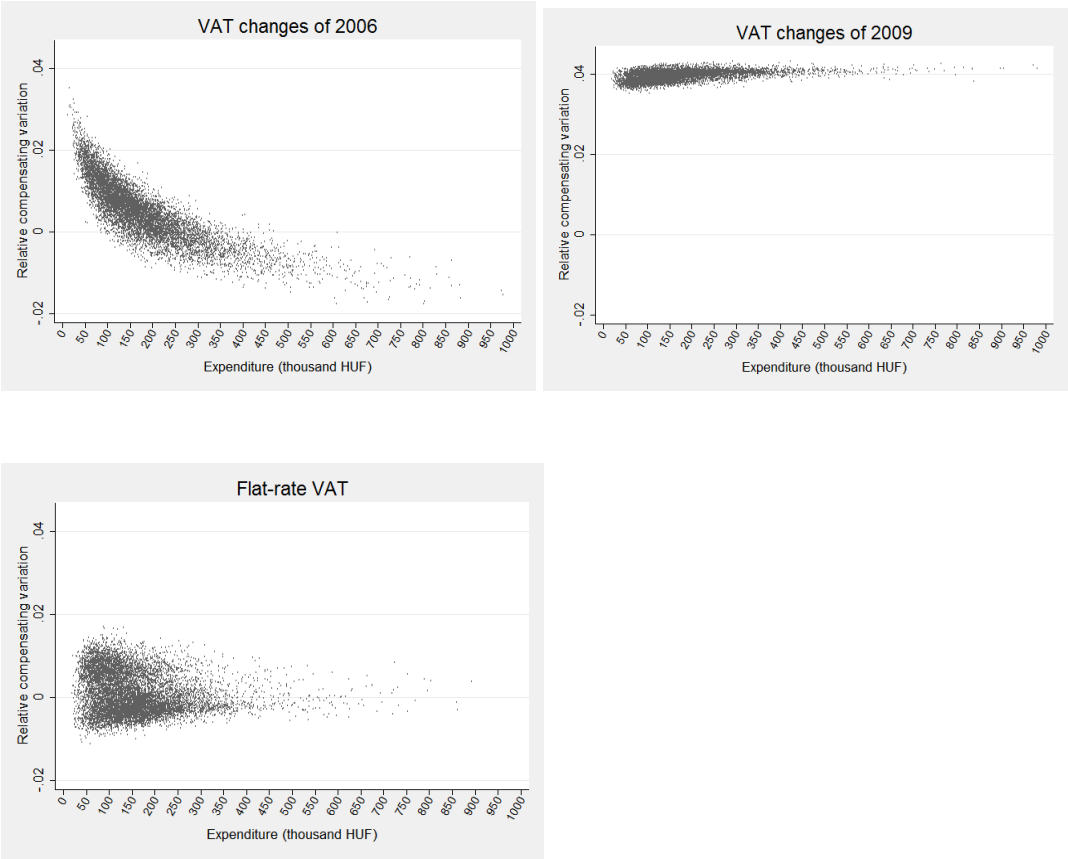
During the tax changes of 2009, all prices increased except for medicines and therefore we have only observed a minimum heterogeneous effect as a function of expenditure and the variance is also relatively low. Based on the compensating variation, the households can be divided into two groups. Those in the lower section of the point cloud spend a larger share of their income on food and energy and the compensated own-price elasticity of these categories is higher among them. Because of their more sensitive price reaction, in their case already a smaller expenditure compensates for the effects of the changes. On the contrary, the less price sensitive households do not significantly adjust their consumption, therefore most of the price increase implies a cost increase for them, which requires a larger, but still relatively small compensation.

The impact of introducing the flat-rate VAT is hardly related to the level of total expenditure. The figure does not reveal this, but such a solution would shift some of the tax burden from the middle classes to both the poor and the wealthy. Because of the significant price increase of medicines, the impact of the introduction of the flat-rate VAT depends on the share of spending on these: the welfare of – typically older –

households, spending a higher proportion on them (7 per cent on average) decreases, while the welfare of those spending less on them increases.

Figure 7

Compensating variation



We have calculated the budget revenues both on the basis of raw data and the model *(Table 5.)*.[10] The change taking effect in 2006 increases the total budget revenue by 1.4 per cent. It is revenues from food, eating-out and household energy that increase, while revenues from alcohol & tobacco, clothing and other products decreased significantly. Because of effects mutually cancelling one another out, there is no significant difference in total revenue between revenues predicted statically and with adjustment.

[10] We have calculated budget revenues based on predicted proportions, using original total expenditure figures. To calculate VAT revenues prior to the change, we have predicted expenditure shares using initial prices, for those expected after the change, we have used post-reform price indices. We have calculated government revenues using pre- and post-reform VAT rates, respectively. Static figures are obtained by allocating total expenditure with post-reform prices using pre-reform shares. Doing wo we assume no change in quantites and thus adjustment only through savings.

Table 5

VAT revenues (billion HUF, at 2014 years' prices)

	Prior to changes	Static	With adjustment	Prior to changes	Static	With adjustment
	2006			2009		
Food	27.6	34.9	34.4	35.1	42	41
Eating-out	3.3	4.6	3.9	3.9	5.1	4.9
Alcohol & tobacco	6.8	5.2	5.7	5.0	6.6	6.5
Clothing	8.2	6.2	6.3	5.4	7.0	6.7
Other products	22.9	18.5	18.6	18.1	23.6	22.4
Household energy	14.1	19.7	19.3	22.1	29.1	28.2
Utilities	9.7	8.8	8.9	9.9	13.0	12.7
Medicines	1.4	1.5	1.5	1.5	1.6	1.7
Services	25.6	22.5	22.7	22.5	29.0	26.9
Total[a]	126.9	127.7	128.8	128.8	162.3	156.4

[a] Including revenues arising from the purchase of durables.

During the reform in 2009 tax revenues grew significantly, by about 21 per cent. Revenues from eating-out, alcohol & tobacco, clothing, other products, household energy, utilities and buying services increased by over 20 per cent. The static method in this case overestimates the expected tax revenues by about 6 billion HUF, that is, by nearly 5 percentage points. This highlights the importance of accounting for adaptation.

5. The effect of hypothetic welfare measures

PRESENTING THE MEASURES EXAMINED

We are going to analyse reforms that may be suitable for improving the situation of households belonging to the lowest income quintile. The impacts of four kinds of measures are assessed:

- administrative reduction of home maintenance costs (reducing utility prices),
- reducing the VAT on foodstuff,
- income transfer for the unemployed,

– supporting backyard farming.

Of these, reducing utilities prices is not hypothetic; it was in fact implemented in 2013 and 2014 in several phases. The prices of gas, electricity, district heating, water and sewage, wastewater disposal and waste collection decreased. As a result, using our categories of products, the amount payable for household energy fell by 21.1 per cent and for utilities by 6.2 per cent. In order to ensure comparability, we have applied these price changes to the household expenditure data collected in 2011.

In the case of foodstuff, we are looking at the reduction of the average VAT rate of 23.2 per cent effective in 2011 to 5 per cent, an option often arising in public discourse. This kind of intervention is not unknown: the Romanian government decreased the VAT rate of foodstuff from 24 per cent to 5 per cent in 2015 (*EC* [2015*b*]).

As for the income transfer for the unemployed, we assume that all unemployed potential heads of households living in poor households are granted an amount equivalent of the wage of public works participants, effective since September 2011, which is lower than the minimum wage. In respect of the issue observed, and not considering other effects, it is irrelevant whether they receive this amount because they are employed as public works participants or because social benefit is increased to this level. The number of public works participants rose from 75 thousand in 2011 to 230 thousand in 2015 and the main function of this scheme, which was originally intended as a labour market measure, became providing social benefit for the long-term unemployed (*Cseres-Gergely-Molnár* [2014]; the source for the data for December 2015 is *BM* [2016]). Our scenario is thus the generalisation of an actual measure. Since we examine households which do not have savings according to the household survey, we assume that they spend any extra income on increasing their expenditure.

It is a frequent suggestion that supporting backyard farming would facilitate the decrease of rural poverty. In the absence of appropriate data, we make the strongly simplified assumption that those living in villages and small towns have a garden suitable for agricultural production for own consumption, while the others do not have one. In this scenario we have supplemented the own production of all households belonging to the lowest income quintile and living in a small town or village to 10 thousand HUF,[11] if it was below that. We also assumed three-quarters of this subsidy increases spending and the rest covers production costs. This intervention may be

[11] This sum is slightly more than the 2011 average for households in the lower quartile with nonzero own production.

regarded as the continuation of the government measure in 2012 supporting backyard animal husbandry.

CALCULATION RESULTS

We have performed the above thought experiment using the data of the HBLS survey collected in 2011. The expenditure components or price variables of the QUAIDS model were modified according to the measure examined and, in case of the subsidy to production for own consumption, the share thereof in expenditure. We have also examined both this version and the VAT reduction using the model that accounts for the price effects of production for own consumption (*Annex 2*).

As a result of the measures, the spending patterns of poor households change *(Table Table 6)*. When reducing the VAT rate of food, the average share of food in total expenditure diminishes by 3.5 percentage points, while that of every other product grows, especially that of other products and utilities. In case of the income transfer granted to the unemployed, the share of food decreases by 1.3 percentage points and the share of household energy to a lesser extent, while that of other products and services increases. The reduction of utility prices lowers the share of household energy in total expenditure by 2.4 percentage points and that of utilities by nearly 1 percentage point, while spending on services expands by 3 percentage points. To a small extent, spending on food also increases.

Table 6

The average predicted expenditure proportions among poor households (percentage)

	Original	Reduction of VAT on food	Income transfer for the unemployed	Reduction of utility prices	Production for own consumption
Foodstuff	32.2	28.7	30.9	32.9	30.8
Eating-out	2.2	2.6	2.2	2.2	2.0
Alcohol & tobacco	4.3	4.8	4.2	4.3	4.2
Clothing	2.0	2.1	2.2	2.5	2.2
Other products	8.7	9.6	9.6	8.5	9.7
Household energy	23.1	23.5	22.5	20.7	22.8
Utilities	9.3	10.5	9.1	8.4	9.2
Medicines	4.9	5.3	4.9	4.5	5.0
Services	13.1	12.9	14.3	16.1	14.2

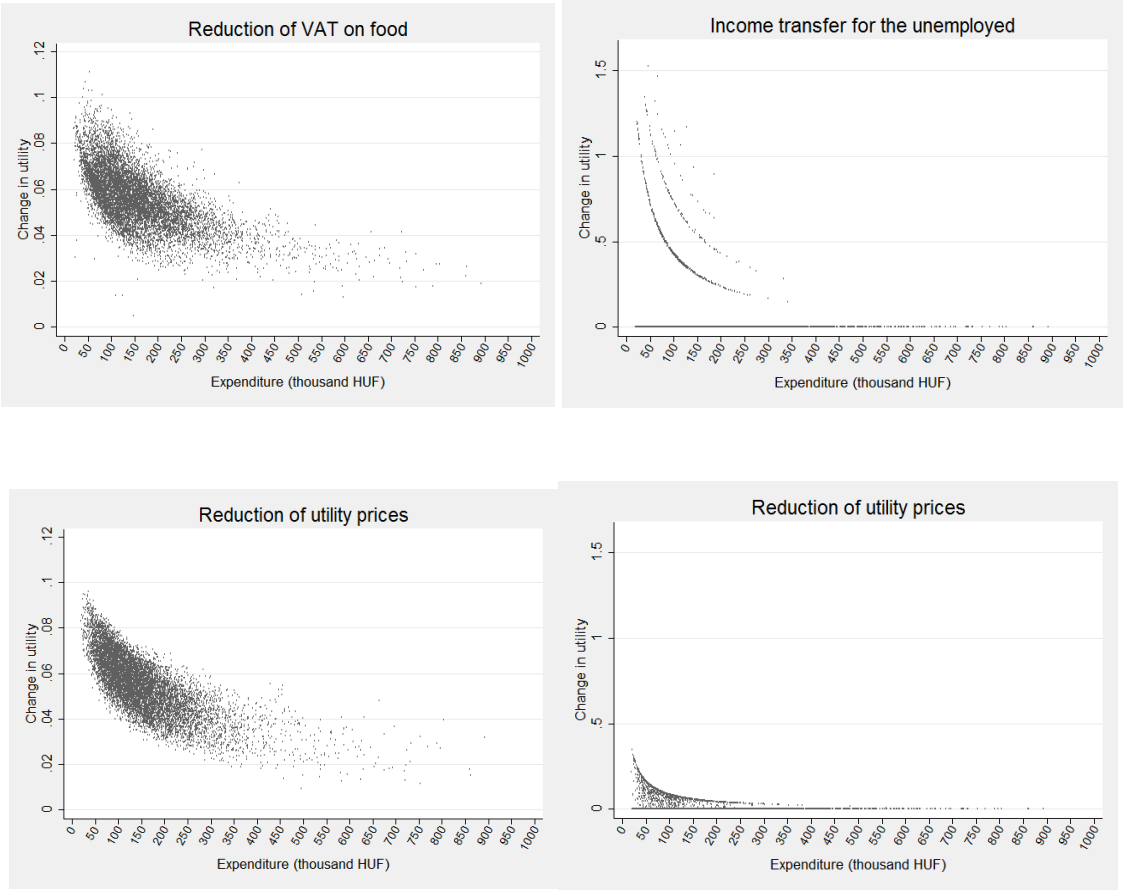
As a result of subsidising production for own consumption, the share of spending on food falls by 1.4 percentage points. Similarly to the transfers granted for the

unemployed, it is also the proportion of consuming services and other products that grows. The two measures behave similarly in modifying expenditure proportions because both target low-income groups directly, while the other two measures affect the whole population.

In case of the currently examined welfare measures, compensating variation may be produced technically but is difficult to interpret – except for the reduction of VAT on foodstuff. Therefore, instead of this, we measure welfare effect by the change in the utility specified in equation (1). Since the value of the index may arbitrarily be altered by the monotone transformation of the function, please note that *the values presented have no relevance in themselves; only their relationship is of interest*. (We have also made the calculations using compensating variation and obtained substantially the same results.)

Figure 8

Changes in utility as a result of welfare measures



Changes in utility as a function of total expenditure are presented in *Figure 8,* while the average change in utility for the poor and for the total population is provided in *Table*

7. It is the income transfer granted to the unemployed that enhances the utility of poor households to the greatest extent. The Figure reveals that the gain in utility differs according to the number of family members obtaining the extra income (participating in public works). However, this measure only concerns poor households with at least one unemployed member.

Table 7

Average change in utility

	Reduction of VAT on food	Income transfer for the unemployed	Reduction of utility prices	Production for own consumption
Poor households	6.4	12.0	6.1	5.3
Every household	5.6	3.0	5.4	1.3

Reducing the VAT rate of food and the government regulation of utility prices influences the welfare of both poor households and all households in general. The two reforms affect poor, low-spending households to a similar extent but the VAT reduction does so slightly more efficiently, provided that it results in price reductions equalling the extent of the VAT reduction. The measures are not sufficiently targeted: the welfare of the poor improves only slightly more than that of the total population. Of the measures reviewed, it is the subsidy for backyard farming, which improves welfare to the smallest extent. When the price effect-interactions of production for own consumption are also accounted for in the demand model, the predicted welfare effect of neither this measure nor that of the reduction of VAT on food is altered.

In order to illustrate the heterogeneous effects of the reforms, the balance of the VAT revenues arising from the reforms and the related costs is compared to the revenues computed with the VAT rates effective in 2011 *(Table 8).*

The reduction of utility prices does not diminish the budget revenues through VAT revenues: the minor decrease observed is due to consumer responses. The model does not account for the losses of state-owned or municipal utility companies and potential future social costs, thus our estimation is fairly naïve in this respect. Since it affects each income quintile identically, tax liability decreases to the same extent. The largest loss in revenues is observed in case of the similarly targeted reform of the VAT on food. This solution enables the rich to retain a larger amount of extra income than the poor.

Table 8

Changes in the budget balance as a result of the reforms (in billion HUF), comparison to revenues in 2011 are given in brackets (percentage)

Income quintile	Simulated VAT revenues in 2011	Reduction of VAT on food	Income transfer for the unemployed	Reduction of utility prices	Production for own con-sumption
1. quintile	24.2	19.0	27.2	24.2	25.0
	–	(–21.5%)	(12.3%)	(–0.1%)	(3.4%)
2. quintile	27.8	22.2	27.8	27.8	27.8
	–	(–20.2%)	(0.0%)	(–0.1%)	(0.0%)
3. quintile	36.6	30.0	36.6	36.6	36.6
	–	(–18.0%)	(0.0%)	(–0.1%)	(0.0%)
4. quintile	51.5	43.8	51.5	51.5	51.5
	–	(–15.0%)	(0.0%)	(–0.1%)	(0.0%)
Total revenue from VAT less costs	140.1	115.0	129.6	140.0	132.6
	–	(–17.9%)	(–7.5%)	(–0.1%)	(–5.3%)

The income transfer granted for the unemployed cuts tax revenues by nearly 8 per cent but this is the best targeted programme. Due to the increased consumption of poor households, the lowest income quintile generates larger budget revenues but because of its costs, the programme has a negative impact on the budget balance. The revenues of the national budget from VAT would also moderately decrease, by about 5 per cent, but this measure is the least beneficial in terms of welfare enhancement.

6. Conclusions

We have estimated the QUAIDS demand model using Hungarian data in our study. Compared to the first decade after the change of the regime in the early 1990s, demand for food, alcohol & tobacco, clothing, household energy and medicines became more price-elastic, while the price elasticity of demand for other products, utilities and services declined (cf. *Cseres-Gergely–Molnár* [2008]). The aggregated responses to changes in incomes are stable over time; income elasticities have hardly changed as compared to earlier findings.

It is a new trend, that among poor households the cross-price elasticity of all products are negative with respect to food, which indicates that these households can primarily compensate for price increases by reducing their food consumption. This may be especially informative for the method of calculating subsistence income based on multiplying the quantity of food consumption: with increasing home maintenance

costs, the food consumption of poor families may be relatively lower than that of somewhat wealthier families.

We have further developed the QUAIDS model to account more precisely for the role of production for own consumption: we have integrated the interaction of production for own consumption with food and alcohol & tobacco prices in the model. The modified model generates results as expected; the modifications revealed that production for own consumption increases the own-price elasticity of demand for food.

We have also evaluated the welfare and budget effects of the two major VAT changes of recent years. While the reform in 2009 had an adverse impact on all households, the changes of 2006 only affected low-income households negatively. As for the VAT changes in 2009, we have found – taking account of the behaviour of demand implied in our model – that the revenues expected from the VAT increase are significantly overestimated when calculated statically, assuming no change in the quantity of demand. Our estimations are only illustrative inasmuch as our calculation results for VAT revenues are considerably below the level of the actual revenues. This is due to the difference between the macro- (system of national accounts) and micro- (household and individual) data, which may be due to differences in definitions and the sampling specificities of the survey.

Finally, we have reviewed reforms that would be able to improve the situation of low-income households. Of the measures examined, increasing the income of the unemployed living in poor families – either through direct income transfer or participation in public works – proved to be the best targeted and relatively inexpensive, considering its effect enhancing the welfare of the poor. The reduction of VAT on food improves the utility of households in all income quintiles but mainly reduces the tax burdens of wealthy families. Budget revenues of the *status quo* are influenced the least adversely by the reduction of utility prices. This reform does not rearrange tax revenues collected from the different income quintiles; nevertheless, it is capable of improving the welfare of households – especially of low-expenditure households. Please note, that our model is not able to account for costs incurred in the long run. Subsidising production for own consumption for the poor seems to be less efficient in this model.

REFERENCES

Abramovsky, L.–Attanasio, O.–Phillips, D. [2015]: Value Added Tax policy and the case for uniformity: Empirical evidence from Mexico. Institute of Fiscal Studies Working Paper W15/08. http://www.ifs.org.uk/uploads/publications/wps/WP201508.pdf.

Ackah, C.–Appleton, S. [2007]: Food Price Changes and Consumer Welfare in Ghana in the 1990s. CREDIT Research Paper 2007/03, University of Nottingham.

Alexandri, C.–Cupák, A.–Luca, L.–Pokrivčák, J.–Rizov, M. [2014]. Economic Development and Food Demand in Central and Eastern European Countries: The Case of Romania. Presentation at 142nd EAAE Seminar Growing Success? Agriculture and rural development in an enlarged EU, május 29–30. BCE, Budapest, http://ageconsearch.umn.edu/bitstream/168929/2/paper_Cupak_Pokrivcak_Rizov_Alexandri_Luca.pdf.

Attanasio, O.–Di Maro, V.–Lechene, V.–Phillips, D. [2013]: Welfare consequences of food prices increases: Evidence from rural Mexico. Journal of Development Economics, Elsevier, Vol. 104. 136–151. o. http://dx.doi.org/10.1016/j.jdeveco.2013.03.009.

Bach, S.–Beznoska, M.–Ochmann, R. [2012]: The Retrospective Evaluation of Elements of the VAT System: The Case of Germany. DIW Berlin, German Institute for Economic Research, Vol. 63. https://www.diw.de/documents/publikationen/73/diw_01.c.405673.de/diwkompakt_2012-063.pdf.

Banks, J.–Blundell, R.–Lewbel, A. [1997]: Quadratic Engel Curves and Consumer Demand. The Review of Economics and Statistics, Vol. 79. No. 4. 527–539. o.. http://dx.doi.org/10.1162/003465397557015.

Blundell, R.–Robin, J. M. [1999]: Estimation in Large and Disaggregated Demand Systems: An Estimator for Conditionally Linear Systems. Journal of Applied Econometrics, Vol. 14. No. 3. 209–232. o. http://dx.doi.org/10.1002/(SICI)1099-1255(199905/06)14:3<209::AID-JAE532>3.0.CO;2-X.

BM [2016]: Monthly informative on public works (in Hungarian: *Havi tájékoztató a közfoglalkoztatás alakulásáról*). 2015. december, Ministry of Interior, State Secretariate for Public Works and Waterworks http://kozfoglalkoztatas.kormany.hu/download/3/3a/41000/Havi%20t%C3%A1j%C3%A9koztat%C3%B3_2015_dec.pdf.

Browning, M.–Meghir, C. [1991]: The Effects of Male and Female Labor Supply on Commodity Demands. Econometrica, Econometric Society, Vol. 59. No.4. 925–951, o. http://dx.doi.org/10.2307/2938167.

Chaaban, J.–Salti, N. [2010]: The Poverty And Equity Implications Of A Rise In The Value Added Tax: A Microeconomic Simulation For Lebanon. Middle East Development Journal. Vol. 2. no. 1. 121–138. o. http://dx.doi.org/10.1142/S1793812010000174.

Cseres–Gergely Zsombor–Molnár György [2008]: Household consumer behaviour and welfare in Hungary since the change of system. (In Hungarian: *Háztartási fogyasztói magatartás és jólét Magyarországon*). Közgazdasági Szemle, 55. évf. 2. sz. 107–135. o.

Cseres–Gergely Zsombor–Molnár György [2014]: Public works, social aid, primary- and secondary labour market. (In Hungarian: *Közmunka, segélyezés, elsődleges és másodlagos munkaerőpiac*). In: Kolosi Tamás–Tóth István György (eds.): Social Report, 2014. 204–225. o. http://www.tarki.hu/adatbank–h/kutjel/pdf/b331.pdf.

Deaton, A. S.–Muellbauer, J. [1980a]: An Almost Ideal Demand System. American Economic Review, Vol. 70. No. 3. 312–326. o.

Deaton, A. S.–Muellbauer, J. [1980b]: Economics and Consumer Behavior. Cambridge Books, Cambridge University Press, http://dx.doi.org/10.1017/CBO9780511805653.

Dhar, T.–Chavas, J.-P.–Gould, B.W. [2003]: An Empirical Assessment of Endogeneity Issues in Demand Analysis for Differentiated Products. American Journal of Agricultural Economics, Vol. 85. No. 3. 605–617. o. http://dx.doi.org/10.1111/1467-8276.00459.

EC [2015a]: VAT Rates. Applied in the Member States of the European Union. Situation at 1st January 2016. European Commission, Brussels, http://ec.europa.eu/taxation_customs/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf.

EC [2015b]: Assessement of the 2015 Convergence Programme for Romania. European Commission, Brussels,

http://ec.europa.eu/economy_finance/economic_governance/sgp/pdf/20_scps/2015/23_ro_scp_en.pdf.

Gábriel, P. and Reiff, Á. [2010], Price setting in Hungary – a store-level analysis. Manage. Decis. Econ., 31: 161–176. doi:10.1002/mde.1479

Gaarden, I. [2014]: Incidence and Distributional Effects of Value Added Taxes. In Essays in Applied Microeconomics. Doctoral dissertation.

Janský, P. [2014]: Consumer Demand System Estimation and Value Added Tax Reforms in the Czech Republic. Czech Journal of Economics and Finance (Finance a uver), Charles University Prague, Faculty of Social Sciences, Vol. 64. No. 3. 246–73. o.

Karádi, P AND Reiff, Á. [2014]: Menu Costs, Aggregate Fluctuations, and Large Shocks. London, Centre for Economic Policy Research. http://www.cepr.org/active/publications/discussion_papers/dp.php?dpno=10138

Poi, B. P. [2012]: Easy demand-system estimation with quaids. Stata Journal, Vol. 12. No. 3. 433–446. o.

Tekgüç, H. [2012]: Separability between own food production and consumption in Turkey. Review of Economics of the Household, Vol. 10. No. 3. 423–439. o. http://dx.doi.org/10.1007/s11150-011-9126-5.

7. Annexes

ANNEX 1. COMPUTING ELASTICITIES AND COMPENSATING VARIATION

Consumers' price responses may be described by uncompensated and compensated price elasticities, while the impact of changes in incomes is described by income elasticity (in fact in the QUAIDS model by spending elasticity). The income elasticity is given as:

$$\eta_i = 1 + \frac{\left(\beta_i + 2\lambda_i \frac{\ln m - \ln a(\mathbf{p},\mathbf{z})}{b(\boldsymbol{p})}\right)}{w_i} \qquad (F1)$$

Compensated (F2) and uncompensated (F3) elasticities of demand are as follows:

$$\varepsilon_{ij}^{u} = \frac{\left[\gamma_{ij} - \left(\beta_i + 2\lambda_i \frac{\ln m - \ln a(\mathbf{p},\mathbf{z})}{b(\mathbf{p})}\right)\left(\alpha_j + \sum_{m=1}^{l} \alpha_{jk} z_k + \sum_{m=1}^{k} \gamma_{jm} \ln p_m\right) - \lambda_i \beta_j \frac{(\ln m - \ln a(\mathbf{p},\mathbf{z}))^2}{b(\mathbf{p})}\right]}{w_i} - \delta_{ij} \qquad (F2)$$

$$\varepsilon_{ij}^{c} = \varepsilon_{ij}^{u} + \eta_i w_j \qquad (F3)$$

The term δ_{ij} of the equation is the Kronecker delta. If the outcome is optimal in the sense of the model, theory predicts the Slutsky matrix containing the price reactions to be negative semidefinite, consequently all of the compensated own-price elasticities are necessarily non-positive. Provided that our model functions properly, this condition must be fulfilled.

One of the possibilities for measuring the welfare effects of price changes is to define the compensating variation. It indicates the amount of income change a household would need to retain its initial utility level after a certain change in prices. The definition of compensating variation may also be extended for situations when not prices but taste shifters change.

The compensating variation is calculated as follows. Based on the estimated parameters, the utility level of the household prior to the change is calculated using equation (1). Applying the duality theorem of consumption theory, we express the extent of the previously calculated utility from indirect utility and the expenditure in the new situation. In case of price changes:

$$\ln m' = \left[\frac{1}{\ln V} - \lambda(\mathbf{p}')\right]^{-1} b(\mathbf{p}') + \ln a(\mathbf{p}', \mathbf{z}),$$

while in case of changes in taste shifters

$$\ln m' = \left[\frac{1}{\ln V} - \lambda(\mathbf{p})\right]^{-1} b(\mathbf{p}) + \ln a(\mathbf{p}, \mathbf{z}').$$

The difference between the hypothetic and the actual expenditure signifies the extent of compensating variation.

ANNEX 2. THE MODIFIED MODEL TAKING ACCOUNT OF PRODUCTION FOR OWN CONSUMPTION

In the original version of the model, the share of production for own consumption in current expenditure is included among taste shifters, or omitted altogether. However, it is presumable that the impact of this factor is also influenced by the prices of products whose purchase it may substitute. Therefore, in addition to the share of production for own consumption, we also include its interaction with the price of certain products (food, eating-out and alcohol & tobacco) among taste shifters.

We apply the version of the indirect utility function described in equation (1) of the main text; however, the $w_{\mathbf{op}}$ proportion of production for own consumption relative to total expenditure is included in the deflators applied:

$$\ln a(\mathbf{p},\mathbf{z}) = \alpha_0 + \sum_{i=1}^{k} \alpha_{\mathrm{i}} \ln p_i + \sum_{i=1}^{k}\sum_{j=1}^{l} \alpha_{ij} \mathrm{z_j} \ln p_i + \frac{1}{2}\sum_{i=1}^{k}\sum_{j=1}^{k} \left(\gamma_{ij} + \theta_{ij}^{p} w_{\mathrm{op}}\right) \ln p_i \ln p_j$$

$$b(\mathbf{p}) = \exp\left[\sum_{i=1}^{k} \left(\beta_i + \theta_i^{e} w_{\mathrm{op}}\right) \ln p_i\right]$$

$$\lambda(\mathbf{p}) = \sum_{i=1}^{n} \left(\lambda_i + \theta_i^{ee} w_{\mathrm{op}}\right) \ln p_i$$

Based on the above, using Roy's identity, we get

$$w_i = -\frac{\frac{\partial \ln V}{\partial \ln p_i}}{\frac{\partial \ln V}{\partial \ln m}},$$

where

$w_{\mathrm{i}} =$

$$\alpha_i(\mathbf{z}) + \sum_{j=1}^{k} \left(\gamma_{\mathrm{ij}} + \theta_{ij}^{p} w_{op}\right) \ln p_j + \left(\beta_i + \theta_i^{e} w_{op}\right)(\ln m - \ln a(\mathbf{p},\mathbf{z})) + \left(\lambda_{\mathrm{i}} + \theta_i^{ee} w_{op}\right) \frac{(\ln m - \ln a(\mathbf{p},\mathbf{z}))^2}{b(\mathbf{p})}.$$

The following restrictions apply:

▪ the sum of expenditure proportions is 1:

$\sum_{i=1}^{k} \alpha_i = 1$, $\sum_{i=1}^{k} \alpha_{ij} = 0$, $\sum_{i=1}^{k} \theta_{ij}^{p} = \sum_{i=1}^{k} \theta_i^{e} = \sum_{i=1}^{k} \theta_i^{ee} = 0$, $\sum_{i=1}^{k} \gamma_{\mathrm{ij}} = 0$, $\sum_{i=1}^{k} \beta_i = 0$, $\sum_{i=1}^{k} \lambda_i = 0$.

▪ zero degree homogeneity:

$$\sum_{j=1}^{k} \gamma_{ij} = \sum_{j=1}^{k} \theta_{ij}^{p} = 0$$

▪ Slutsky-symmetry:

$$\gamma_{ij} = \gamma_{ji},$$
$$\theta_{ij}^{p} = \theta_{ji}^{p}.$$

The income elasticity is given as:

$$\eta_i = 1 + \left[\left(\beta_i + \theta_i^e w_{\text{op}} \right) + \frac{2\left(\lambda_i + \theta_i^{ee} w_{op} \right)}{b(\mathbf{p})} ln\left(\frac{m}{a(\mathbf{p}, \mathbf{z})} \right) \right] \frac{1}{w_i}$$

The uncompensated price elasticity is given as:

$$\varepsilon_{ij}^{u}$$
$$= \left[\left(\gamma_{ij} + \theta_{ij}^{p} w_{op} \right) \right.$$
$$- \left\{ \left(\beta_i + \theta_i^e w_{op} \right) + \frac{2\left(\lambda_i + \theta_i^{ee} w_{\text{op}} \right)}{b(\mathbf{p})} ln\left(\frac{m}{a(\mathbf{p}, \mathbf{z})} \right) \right\} \left(\alpha_{\text{j}} + \sum_{m=1}^{l} \alpha_{jk} z_{\text{k}} \right.$$
$$\left. \left. + \sum_{m=1}^{k} \left(\gamma_{jm} + \theta_{jm}^{p} w_{op} \right) \ln p_m \right) - \frac{\left(\lambda_i + \theta_i^{ee} w_{op} \right)\left(\beta_j + \theta_j^e w_{\text{op}} \right)}{b(\mathbf{p})} \left\{ \ln\left(\frac{m}{a(\boldsymbol{p}, \boldsymbol{z})} \right) \right\}^2 \right] \frac{1}{w_i} - \delta_{ij}$$

The compensated price elasticity is given as:

$$\varepsilon_{ij}^{c} = \varepsilon_{ij}^{u} + \eta_i w_j$$

The results of calculations using this model are presented in *Table F2*.

ANNEX 3. TABLES

Table F1

Estimated coefficients (*N* = 69 532)

Variable	Food	Eating-out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medicines	Services
Expenditure	−0.130***	−0.008	−0.009	0.017	0.076***	−0.059***	−0.006	0.003	0.117***
Expenditure squared	0.009	0.004	0.000	0.004	−0.001	0.002	−0.008**	−0.004**	−0.006
log(relative price of food)	0.130***	−0.017	−0.030***	0.005	−0.013	−0.044***	−0.066***	−0.018**	0.053***
log(relative price of eating-out)	−0.017	−0.017	0.052***	0.015	−0.019***	0.002	−0.005	−0.012	0.002
log(relative price of alcohol & tobacco)	−0.030***	0.052***	−0.013	0.019**	−0.008	0.006	−0.022*	−0.007	0.004
log(relative price of clothing)	0.005	0.015	0.019**	0.014*	0.033***	−0.007	−0.025***	−0.018***	−0.035**
log(relative price of other products)	−0.013	−0.019***	−0.008	0.033***	0.104***	0.034***	−0.001	−0.005	−0.124***
log(relative price of household energy)	−0.044***	0.002	0.006	−0.007	0.034***	0.078***	0.022***	0.020***	−0.110***
log(relative price of utilities)	−0.066***	−0.005	−0.022*	−0.025***	−0.001	0.022***	0.052***	−0.005	0.051***
log(relative price of medicines)	−0.018**	−0.012	−0.007	−0.018***	−0.005	0.020***	−0.005	−0.013**	0.058***
Composition of households									
log(number of household members)	−0.026***	0.009***	0.008***	0.023***	0.026***	−0.052***	−0.033***	−0.013***	0.057***
Number of adult females	−0.001	−0.009***	−0.017***	0.000	−0.002***	0.010***	0.004***	0.007***	0.008***
Number of children aged 0–14	0.003***	0.004***	−0.011***	0.003***	0.010***	0.000	−0.004***	0.001***	−0.007***
Number of potential heads of households without a secondary school leaving qualification	0.023***	−0.013***	0.021***	−0.006***	−0.012***	0.019***	0.002**	0.001	−0.036***
Number of potential heads of households with a (general or	0.004**	−0.009***	0.007***	−0.007***	−0.001	0.009***	0.007***	−0.003***	−0.007***

Variable	Food	Eating-out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medicines	Services
vocational) secondary school leaving qualification									
Average age of potential heads of households	0.002***	−0.003***	0.002***	−0.001***	0.000*	0.002***	−0.003***	−0.001***	0.002***
Average age of potential heads of households squared	−2.00e−5***	2.59e−5***	−2.47e−5***	1.01e−5***	−5.0e−7	−1.37e−5***	1.81e−5***	2.04e−5***	−1.56e−5***
Share of those in employment among potential heads of households[a]	−0.011***	0.018***	0.002**	0.004***	0.001	−0.009***	−0.004***	−0.029***	0.027***
Share of those not in employment or retirement among potential households[a]	0.008**	−0.004***	0.013***	−0.001	0.003	−0.008***	0.004**	−0.022***	0.007*
Types of households (Reference category: belonging to none of the categories below)									
Single	−0.001	0.009***	−0.009***	0.006***	−0.015***	0.002	0.005***	−0.004***	0.007***
Household containing exactly 1 couple	0.004***	−0.005***	−0.011***	−0.003***	0.014***	0.001	−0.002**	0.003***	−0.002
Single parent with a child aged less than 19	0.003	0.004***	−0.021***	0.011***	−0.009***	0.009***	0.001	0.001	0.000
Region (Reference category: Western Transdanubia)									
Central Transdanubia	−0.003**	0.001	0.002***	−0.002**	−0.013***	0.019***	−0.004***	0.004***	−0.004**
Southern Transdanubia	0.001	0.007***	0.003***	0.001	−0.002	0.006***	−0.011***	0.003***	−0.008**
Central Hungary	0.019***	−0.004***	0.003***	−0.008***	−0.016***	0.020***	0.002	0.002**	−0.015**
Northern Hungary	0.007***	0.001	0.007***	0.002***	−0.012***	0.013***	−0.011***	0.001*	−0.009***
Northern Great Plain	0.009***	0.000	0.001*	0.003***	−0.006***	0.016***	−0.021***	0.006***	−0.010***
Southern Great Plain	0.013***	0.009***	0.001	0.003***	−0.001	0.017***	−0.020***	0.003***	−0.024***
Types of municipalities (Reference category: Budapest)									
County towns	0.025***	−0.003***	−0.007***	−0.001	0.003*	0.010***	−0.015***	0.000	−0.013***
Other towns	0.016***	0.000	−0.007***	0.002**	0.012***	0.027***	−0.036***	0.001	−0.014***
Village	0.008***	−0.001	−0.002***	0.000	0.017***	0.040***	−0.053***	0.001*	−0.011***

Variable	Food	Eating-out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medicines	Services
The month of data collection (Reference category: January)									
February	0.003*	0.000	0.001	0.004***	0.002*	0.008***	−0.004***	0.000	−0.013***
March	0.009***	0.000	0.002**	0.004***	0.000	−0.006***	0.006***	−0.003***	−0.012***
April	0.016***	−0.002*	0.006***	0.009***	0.006***	−0.020***	0.001	−0.002**	−0.015***
May	0.017***	0.002**	0.007***	0.014***	0.017***	−0.042***	−0.001	−0.001	−0.013***
June	0.027***	−0.003**	0.007***	0.014***	0.015***	−0.057***	0.001	−0.001	−0.002
July	0.035***	−0.004***	0.009***	0.010***	0.020***	−0.064***	−0.002*	−0.004***	0.001
August	0.029***	−0.005***	0.010***	0.017***	0.029***	−0.062***	−0.002**	−0.003***	−0.012***
September	0.017***	0.001	0.003**	0.014***	0.018***	−0.055***	0.004***	−0.002**	0.000***
October	0.018***	0.000	0.002	0.014***	0.022***	−0.042***	0.000	−0.002***	−0.012***
November	0.014***	0.000	0.000	0.018***	0.010***	−0.020***	−0.001	−0.003***	−0.018***
December	0.033***	−0.008***	0.014***	0.017***	0.016***	−0.020***	−0.005***	−0.005***	−0.043***
Household economics									
Did they spend on durables in the month of keeping the logbook	−0.006***	−0.005***	−0.002***	0.002***	0.012***	−0.008***	−0.003***	0.002***	0.007***
Production for own consumption/ expenditure	−0.144***	−0.035***	−0.020***	0.012**	0.101***	0.000	−0.014***	0.011***	0.089***
Constant	0.357***	0.101***	0.029***	0.039***	0.018	0.167***	0.229***	0.059***	0.001
R^2	0.303	0.082	0.097	0.136	0.201	0.238	0.212	0.286	0.283

[a] The sum of the two rows is the opposite of the coefficient of the share of old-age pensioners.

Note: Significant at a level of *** 1 per cent, ** 5 per cent, * 10 per cent. The p values serving as a basis for the significances are based on bootstrap standard errors with 500 replicates. The sum of the row 'Constant' is by definition 1, while the sums of the other rows are 0.

Table F2

Income and price elasticities after modified consideration of production for own consumption

Category	Food	Eating-out	Alcohol & tobacco	Clothing	Other products	Household energy	Utilities	Medicines	Services
Income elasticity									
Average	0.59***	1.08***	0.87***	1.36***	1.51***	0.65***	0.61***	0.83***	1.42***
Median	0.64***	1.05***	0.91***	1.25***	1.40***	0.70***	0.70***	0.89***	1.35***
Uncompensated price elasticity, median									
Food	−0.37***	−0.05	−0.09***	0.02	−0.04	−0.07***	−0.2***	−0.05***	0.21***
Eating-out	−0.2*	−1.17***	0.56***	0.16	−0.22***	0.01	−0.05	−0.12	−0.01
Alcohol & tobacco	−0.30***	0.61***	−1.14***	0.21***	−0.09	0.08	−0.25***	−0.08	0.06
Clothing	−0.05	0.13	0.16***	−0.88***	0.28***	−0.11***	−0.25***	−0.17***	−0.34***
Other products	−0.24***	−0.12***	−0.06*	0.17***	−0.45***	0.10***	−0.05	−0.04	−0.72***
Household energy	−0.11***	0.02	0.05	−0.04	0.19***	−0.51***	0.14***	0.12***	−0.56***
Utilities	−0.57***	−0.04	−0.23***	−0.26***	0.01	0.27***	−0.42***	−0.03	0.57***
Medicine	−0.19***	−0.15	−0.09	−0.23***	−0.05	0.27***	−0.05	−1.16***	0.75***
Services	0.03	−0.01	0.00	−0.13***	−0.45***	−0.47***	0.15***	0.19***	−0.67***
Compensated price elasticity, median									
Food	−0.19***	−0.04	−0.07***	0.03	0.04	0.01	−0.16***	−0.04	0.34***
Eating-out	0.01	−1.07***	0.60***	0.21*	−0.09	0.13	0.00	−0.11	0.21
Alcohol & tobacco	−0.08	0.63***	−1.06***	0.25***	0.00	0.22***	−0.20	−0.07	0.24
Clothing	0.22***	0.18*	0.20***	−0.72***	0.48***	0.01	−0.18***	−0.14***	−0.08
Other products	0.08*	−0.09***	−0.03	0.24***	−0.19***	0.27***	0.03	−0.02	−0.39***
Household energy	0.05	0.02	0.07	−0.02	0.29***	−0.35***	0.20***	0.15***	−0.42***
Utilities	−0.39***	−0.03	−0.21*	−0.23***	0.08	0.39***	−0.36*	−0.02	0.73***
Medicines	0.03	−0.13	−0.07	−0.2***	0.03	0.44***	0.00	−1.09***	0.93***
Services	0.33***	0.00	0.02	−0.08*	−0.25***	−0.29***	0.23***	0.23***	−0.26*

Note: See previous table.