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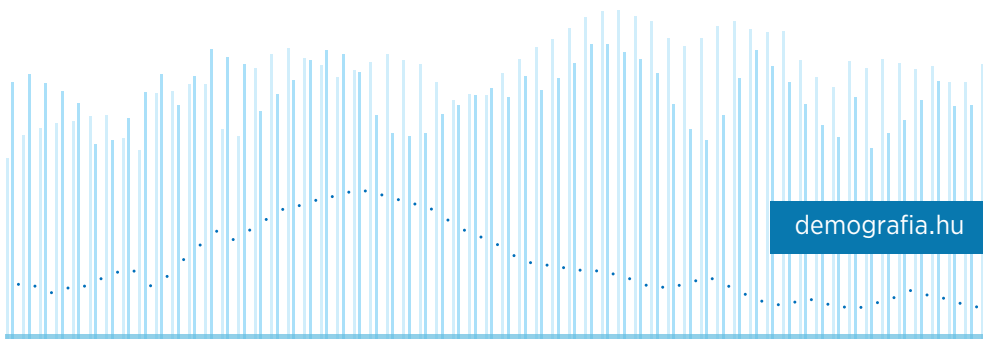
WORKING PAPERS

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ABSTRACT

In a simple cohort model we carry out a projection based on current per capita age profiles of labour income and consumption and combine them with Hungary's expected future age composition. We use 2012 Hungarian data. Due to a shrinking and ageing population this exercise predicts a growing gap between labour income and consumption in Hungary, which will have to be covered by asset-based revenues. We apply two balancing items: a windfall capital endowment in the base year, and gradual capital accumulation through higher savings. We also quantify how much the household economy, an integral but unregistered part of a modern economy, can absorb the effects of ageing. In addition, we test against a model using demographic data from 1995. The two decades between the mid-1990s and the mid-2010s offered a special demographic opportunity for Hungary and coincided with the botched pre-funding experiment in the public pension system. We demonstrate the potential of this missed opportunity.

Keywords: macroeconomic consequences of demographic trends, National Transfer Accounts, unpaid household labour, pension reform

Journal of Economic Literature (JEL) codes: J11, E21, E27

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Nokia Solutions and Networks

CONTENTS

List of Figures	4
List of Tables	4
1 MOTIVATION	5
2 BACKGROUND	8
2.1. The ageing process in Hungary	8
2.2. What is 'old age'?	9
2.3. Financing old age with asset-based income	10
2.4. Hungary's experiment with mandatory pre-funding	11
3 PROJECTIONS	12
3.1. Point of departure	12
3.2. Assumptions	14
3.3. Results	15
4 CONCLUSIONS	17
REFERENCES	18
List of Working Papers	19

LIST OF FIGURES

- Figure 1: Per capita age profiles in the Hungarian tax/transfer system, national economy and total economy
- Figure 2: Current and projected age composition in 2000, 2050 and 2100
- Figure 3: The age limit between active age and old age in Hungary – two different approaches, 2012
- Figure 4: Current per capita age profiles of labour income and consumption combined with current and expected future populations, and the aggregate lifecycle deficit resulting from population ageing
- Figure 5: Balancing reserves generated by a capital endowment or savings, billion euros
- Figure 6: Current per capita age profiles of value of household labour produced and consumed combined with current and expected future populations

LIST OF TABLES

- Table 1: Current and projected average age of older cohorts
- Table 2: Income composition of the elderly
- Table 3: Summary results of projections for three different scenarios

1 MOTIVATION

Ageing, the changing age composition of society as a result of decreased fertility and increased longevity, is known to put pressure on public transfer programmes.¹ The age profiles of taxpayers and beneficiaries and the age profiles of future populations suggest growing conflict between revenues and expenditures. This applies particularly to programmes financed by labour-related contributions and mostly consumed by older people, such as public healthcare and pensions. These systems will have to adjust to the new demographic reality, either through higher taxes, longer working lives, by replacing labour-related taxes with taxes levied on consumption and assets, or through the provision of fewer or less generous benefits in old age.

However, we know less about how ageing will affect consumption and labour income. Consumption is, after all, the most important component affecting people's material well-being. It is financed by labour income, and to a lesser extent by accumulated assets. Since age composition is also involved, it is somewhat surprising that the question of the sustainability of current patterns of consumption and labour income has so far invoked little attention.

In order to make our point we present three pairs of age profiles in *Figure 1*. In the left-hand panel we show per capita taxes paid and transfers received.² The transfers include all public programmes in cash or in kind; both taxes and transfers are consistent with National Accounts.³ Per capita figures are related to entire cohorts and not only taxpayers and beneficiaries. Thus, the age profile of labour-related taxes, for example, reflects age-specific employment as well as wages and tax rules. Taxes are mostly paid by people of working age; beneficiaries are typically older cohorts and people with young children.⁴ Assumptions on the incidence of taxes and transfers are detailed by Gál *et al.* (2005). The figure arrived at shows that Hungarian public programmes are generous to parents. This is partly due to family benefits being assigned to parents, not children. An alternative assumption on transfer incidence, which assigns family benefits to children, would actually find that children receive more resources from society than from their parents (excluding unpaid household labour). Either way, the dashed line of net transfers (transfers received less taxes) shows that net payers are active aged whereas net beneficiaries are those in the inactive period of their lifecycle – mostly children and the elderly.

Public programmes make up roughly half of national income.⁵ In the central panel of *Figure 1* we repeat the calculation including all items of national income. Here, the equivalent of outflows is labour income and that of inflows is consumption. The netting factor, which is the equivalent of net transfers, is the difference between consumption and labour income. This is called a lifecycle deficit when negative or a lifecycle surplus

¹ This paper also appeared in the Netspar Academic Series (DP 07/2015-020). Permission from Netspar for republication is gratefully acknowledged. Further, we are grateful for contributions by Márton Medgyesi and Krisztián Tóth. The authors thank the Central Administration of the National Pension Insurance, Budapest, for their co-operation. This paper is a result of the EU-funded MOPACT project. MOPACT received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement number 320333.

² Data are obtained from the Hungarian National Transfer Accounts project, which is part of similar international (www.ntaccounts.org) and European projects (<http://europe.ntaccounts.org/web/nta/show/> and <http://www.agenta-project.eu/en/index.htm>).

³ More specifically, with the categories D.2-D.3 (indirect taxes less subsidies), D.5 (taxes on income and wealth), D.61 social contributions, D.62+D.63 (social benefits in cash and in kind) and D.7 (other current transfers).

⁴ Values in *Figure 1* and related figures throughout this paper are normalised on the per capita labour income of persons aged 30-49. This is standard practice in National Transfer Accounts (see below) and proved to be the most stable basis for normalisation, as it facilitates cross-country as well as over-time comparisons.

⁵ We use as a reference national rather than domestic macro-economic categories because the former is more relevant for financing the lifecycle. Age profiles of exchanges with the rest of the world are usually unknown and to a large extent irrelevant in the analysis of inter-age resource flow. The only exception is intra-familial cross-border transfers (remittances), which were marginal in Hungary in the years discussed here, but which have gained rapidly in significance since then.

when positive (LCD/LCS in short) in National Transfer Accounts (NTA) terminology.⁶ LCS in the inactive periods of the lifecycle is financed from the LCD of the active aged. Channels of the flows of resources are varied and include households, the government and the corporate sector. Transfers can take the form of pay-as-you-go pensions, mortgages, student loans, public healthcare and consumption goods bought by parents, just to name a few. Aggregate LCD/LCS across all cohorts is usually negative, since labour income is not the only source of financing for consumption. Asset-based revenues are also involved. Asset-based revenues made up to eight per cent of national income in the reference period of *Figure 1*; in 2012, the base year of our main projections, it was nine per cent.⁷

The central panel of *Figure 1* depicts a consumption age profile which is smoother and more uniform than the age profile of public transfers. This reveals the importance of private intra-household transfers, mostly parents financing their children's consumption. The resulting lifecycle deficits are also more balanced between the two inactive generations than is the case for net public transfers. Public programmes are more biased towards the elderly than the national economy. In other words, public channels are relatively more important in financing old age than childhood.

Finally, we extend NTA to the household satellite account. In the same way as NTA introduces age into national accounts, we draw age profiles of the production and consumption of unpaid household labour and add it up to the NTA age profiles of labour income and consumption.⁸ In the right-hand panel of *Figure 1* we present the combined value of labour and consumption in the total economy, including both the national and the household economy. Some important changes can be observed compared to the central panel of the figure. Firstly, the value of the labour profile remains positive well into old age and reveals the important contribution of labour to the total economy by people in retirement, which remains unaccounted for in standard national accounts. Secondly, the lifecycle surplus for children far exceeds that of the elderly, which suggests quite a different story from that of the over-consuming old.

In short, the age profiles of the three panels are quite different. Most of the literature concentrates on one of them – age profiles of taxes and public transfers. Here we shift the focus and extend the usual tests for sustainability to the national and the total economy.⁹ Below, we extend simple projection techniques – frequently used to analyse future public budgets – to labour income and consumption. Other than demonstrating obvious unsustainability, we measure the extent to which consumption has to be reduced and resources saved in order to counterbalance the effect of demography. The effect of higher savings is twofold. First, it decreases aggregate lifecycle deficit. Second, it increases growth in the form of higher investments. This additional growth diminishes the need for consumption reduction.

6 The method of National Transfer Accounts was established by Lee (1994a, b). An NTA manual was published by Mason *et al.* (2009) and the Population Division of the United Nations published a revised manual (United Nations 2013). A comprehensive introduction to the method, including theoretical foundations, comparative results and a wide range of country studies can be found in Lee and Mason (2011) and in the NTA Special Issue of the *Journal of the Economics of Ageing* (Patxot, Lee and Mason 2015).

7 This paper is based on 2012 data projections. However, calculations involving unpaid household labour are based on data from 2000. Figures on the value of produced and consumed unpaid household labour come from the household satellite account, which is a product of the time-use survey updated once every decade in Hungary. The 2010 household satellite account was not yet available at the time of writing.

8 This is called National Time Transfer Accounts (NTTA). NTTA methodology was created by Donehower (2014; earlier version from 2011). For a recent survey see Vargha, Gál and Crosby-Nagy (2015). For details of the Hungarian NTTA see Gál, Szabó and Vargha (2015).

9 There are notable precedents for such projections. Khoman and Weale (2006) created synthetic cohorts from projected cross-sectional age profiles in order to measure the sustainability of current consumption patterns and estimate the savings gap in the UK. Khoman and Weale (2008) extended calculations to France, Italy and Spain. Patxot *et al.* (2013) combined Spanish NTA age profiles with the generational accounting methodology. Lee, Mason *et al.* (2014) used fertility as a balancing item to calculate fertility rates necessary to maintain the current public transfer system as well as consumption patterns.



In Section 2 we present relevant contextual background information about Hungary. We describe the peculiarities of the ageing process, provide an empirically driven definition of old age other than the frequently used but *ad hoc* 65 years, show the current share of asset-based revenues in financing old age, and briefly summarise the experiences of Hungary's experiment with pre-funding in the mandatory pension system between 1998 and 2011. In Section 3 we describe our method of projection and present the results. Conclusions are drawn in Section 4.

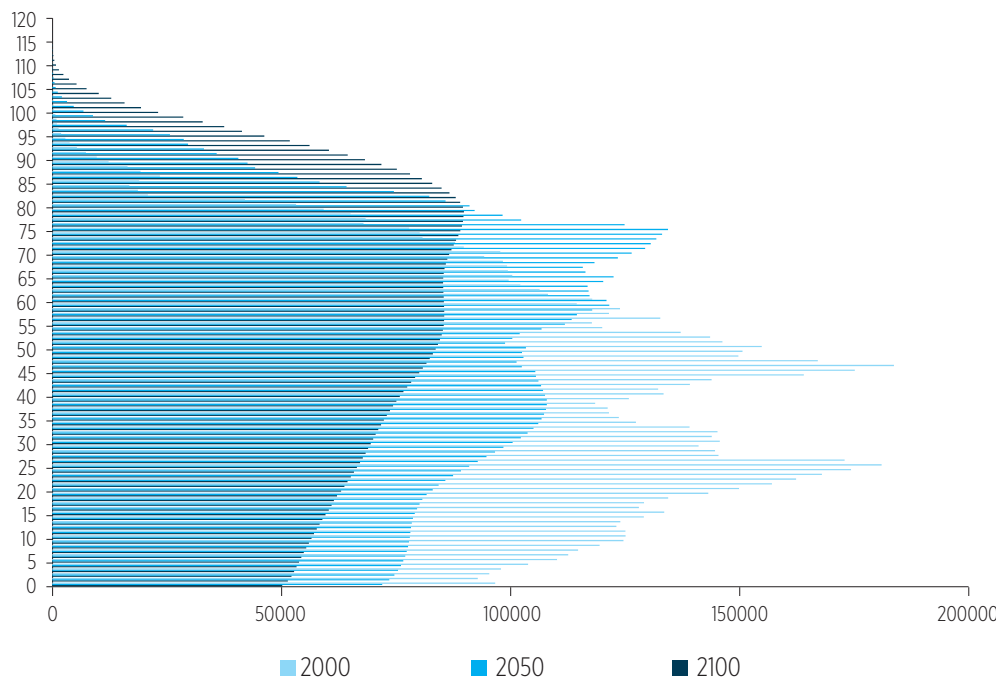
2 BACKGROUND

2.1. THE AGEING PROCESS IN HUNGARY

The population of Hungary, which currently stands at 9.9 million, reached 10 million in 1960, peaked at 10.7 million in 1980, and fell below 10 million once again in 2010. It is expected to decrease to 7.3 million by 2100. This population shrinking is (and will be) accompanied by a changing age composition. The average age of the population, which stood at 41.0 years in 2012, was 33.3 years in 1960, 38.7 years in 2000, and according to the Hungarian Demographic Research Institute's projection (medium variant) will increase to 52.1 years by 2100.¹⁰

In short, Hungary was among the first nations to face a shrinking population. This makes it comparable to neighbouring countries such as Austria and Germany. However, the pace of the process is not as rapid as expected further to the east, for instance in Russia or Ukraine. Similarly, the ageing of the Hungarian population started quite some time ago but is slower and less dramatic than in Mediterranean countries such as Italy or Spain, or East Asian countries such as Korea or Japan.

In *Figure 2* we present recent projected population pyramids where the two sexes are combined. The figure reveals further details of the ageing process relevant for a projection exercise. The age composition in 2000 includes two large generations of active age, the baby boomers born in the mid-1950s and their children born in the mid-1970s. In colloquial Hungarian the older generation is referred to as 'Ratko's children', named after the then-minister of social affairs who enforced a strict no-abortion policy between 1953 and 1956 which increased fertility up for a short while. Accordingly, their children are 'Ratko's grandchildren'. Two relatively large cohorts among net taxpayers and none



Source: Hungarian Demographic Research Institute.

Figure 2
Current and projected age composition in 2000, 2050 and 2100

¹⁰ The latest HDRI population projection has a time horizon to 2060. Since our projection exercise requires a longer horizon we applied a previous population projection.

among net beneficiaries indicates a window of opportunity for economic growth and capital accumulation. This window opened in the second half of the 1990s with the entrance of Ratko's grandchildren to the labour market and closed in the first half of the 2010s with the retirement of their parents' generation. This period corresponds with the country's experiment with the extension of its universal, national pay-as-you-go pension scheme with a pre-funded pillar.

Another striking feature of the population pyramids concerns what is missing: the lack of an echo in the 1990s or later. The 2050 pyramid sees the echo generation as septuagenarians; their children form a much smaller wave. This predicts a wave of ageing in the early 2040s even stronger than the current one in the mid-2010s.

Finally, a further attribute of projected demographic developments relevant to labour income and consumption age profiles is the improvement in mortality, which translates in practical terms as 'the ageing of the old'. The average age of the 60-year-old population (or older) is expected to grow by 7.2 years over the course of this century. If we raise the age limit we also find significant improvements: 5.7 years among the 70-year-olds or older, 4.5 years among the 80-year-olds or older, and 2.5 years among the 90-year-olds or older. This is particularly relevant if the projected age patterns are high in old age, such as the profiles of pensions and public healthcare.

Table 1

Current and projected average age of older cohorts

	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
60+	71.1	71.4	72.8	72.9	74.1	75.7	76.9	77.0	77.5	78.3
70+	77.7	78.1	78.5	79.8	79.6	80.8	82.3	82.8	82.7	83.4
80+	84.4	85.3	85.4	86.0	86.8	86.6	87.9	88.7	88.8	88.9
90+	92.8	92.8	93.2	93.3	93.9	94.0	94.1	95.0	95.3	95.3

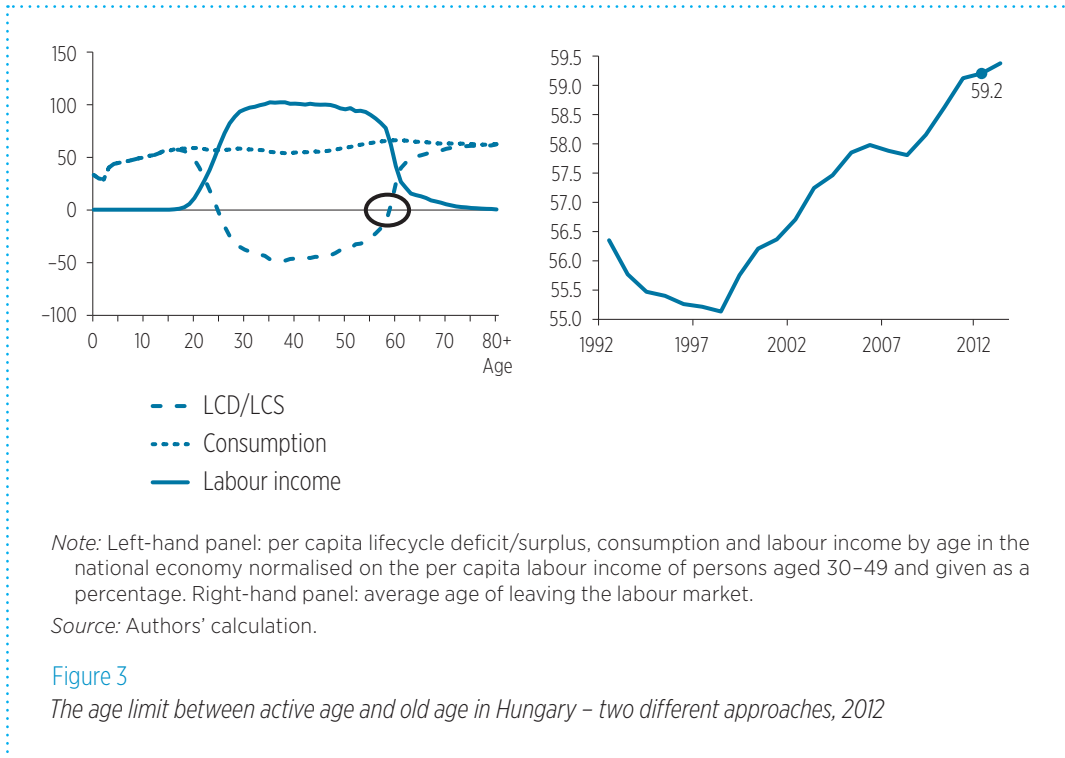
Source: Authors' calculations based on projections by the Hungarian Demographic Research Institute.

2.2. WHAT IS 'OLD AGE'?

The demarcation between active age and old age is typically given exogenously, both in cross-country comparisons and in projections. Currently, the usual age limit applied is 65 years. Distortions to both types of analysis are obvious. In the cross-section labour market activity seems low, whereas pension systems seem generous unless actual age limits are applied. In particular, if a lower age limit corresponds with lower life expectancy, as in Hungary, a cross-country comparison based on the demarcation of 65 years results in misleading conclusions. In addition, projections based on a fixed-age limit, known to be changing over time and known to be dependent on education and health, adds unjustified pessimism to the expected future.

In this paper we apply an empirically driven entry age for becoming 'old' for the base year of the projection. However, we do not make efforts to adjust it to expected future levels of education and health, as that would be beyond the scope of the simple projection presented here. Neither do we manipulate the age limit as a balancing item between future levels of labour income and consumption. The focus of the present exercise is exclusively on savings.

In *Figure 3* we present two measures of entry to old age in the base year (2012) of our main projection exercise. The two panels of the figure are separate but they both point to the same age, 59 years, making a case for selecting this as the age limit. The left-hand panel shows the same per capita age profiles of lifecycle deficit/surplus, consumption



and labour income in the national economy as the central panel of *Figure 1*, but based on more recent data. The cross-cutting age, circled in the figure, is 59 years: it shows when the lifecycle deficit becomes a lifecycle surplus (or when people change from being a net wage earner to a net consumer). This borderline is empirical and reveals both cross-country variation and changes over time. It was 58 in Hungary in 2000; 56 in Slovenia in 2004, and 63 in Sweden in 2003.¹¹

The right-hand panel of the figure provides an estimation of the average age of labour market exit¹². It is related to the cross-cutting age from LCD to LCS but the two measures are not fully correlated. In 2012 both ages were 59 years. Their concurrence is partly coincidental but together they make a strong case for choosing the age of 59 instead of the usual age of 65 as the entry to old age.

2.3. FINANCING OLD AGE WITH ASSET-BASED INCOME

Asset-based income, that is revenue drawn from past saving, plays a marginal role in financing old age in Hungary. In *Table 2* we present data on income composition of the elderly in Hungary based on the 2012 wave of EU-SILC. EU-SILC contains information on gross income but we can deduce taxes from the various sources of income based on knowledge of Hungarian tax regulations. We apply three definitions of old age: 59 years as our default choice (see above), 62 years, which was the standard retirement age in

¹¹ These data are from the International NTA Database (<http://www.ntaccounts.org>).

¹² The estimation, based on five year OECD cohort data on population and labour market participation, follows a formula by Latulippe (1996), which defines the average age of labour market exit as:

$$\overline{RA} = \frac{\sum_{x=40,45}^{75} {}_5R_{x,x+4}^z \cdot (x+5)}{\sum_{x=40,45}^{70} {}_5R_{x,x+4}^z}$$

The function ${}_5R_{x,x+4}^z$ represents the number of people in a particular age group, x to $x+4$, expected to retire within the next five years in year z : ${}_5R_{x,x+4}^z = (A_{x,x+4}^z - A_{x+5,x+9}^z) \cdot P_{x,x+4}^z$, where $P_{x,x+4}^z$ = number of individuals of cohort x to $x+4$ alive in calendar year z , and $A_{x,x+4}^z$ = the average participation rate in cohort x to $x+4$ in calendar year z .

Hungary in 2012, and 65 years, which is the regularly applied public statistics definition of old age. Results are presented in the upper panel of *Table 2*.

The table reveals the overwhelming dependence of old age consumption on public transfers. At the age of 59 about three-quarters of net income (mostly pensions) consists of public cash transfers. If old age starts at higher ages the transfer share is even higher. Asset-based revenues are marginal; they represent a mere 1.1 per cent. This is low even in a European comparison; the lower panel of *Table 2* contains such a comparison. Since we could not apply taxes for all countries we compare gross rather than net figures.

Table 2

Income composition of the elderly

	Sources of income in old age after taxation under different definitions of old age, %				
	Labour income	Asset-based income	Transfer income	<i>of which pensions</i>	Total
59+	24.7	1.1	74.2	68.3	100.0
62+	17.7	1.1	81.2	77.2	100.0
65+	14.4	1.1	84.5	81.4	100.0

	Share of asset-based income before taxation in HU and the EU under different definitions of old age, %		
	HU	EU28 unweighted	EU28 weighted
59+	1.4	4.5	6.5
62+	1.5	4.8	6.8
65+	1.6	5.0	7.1

Note: National figures weighted by population.

Source: Calculations by Márton Medgyesi using the 2012 wave of EU-SILC within the framework of the Social Situation Monitor of the European Commission.

In this panel we only present shares of asset revenues. Hungarian figures are compared to unweighted and population weighted EU averages. The results show that asset-based income is significantly less important in Hungary than in the EU. If Hungary is compared to other countries the relative importance of asset-based income in the portfolio of the elderly is about one-third of the EU average; if its population is compared to the aggregate EU population the relative importance of asset-based revenues is less than one-quarter of that elsewhere in the EU. Any effort to increase the asset-based income share in old age revenues will have to start from a low base.

2.4. HUNGARY'S EXPERIMENT WITH MANDATORY PRE-FUNDING

In 1998 the national pension system, which had been based on the pay-as-you-go principle and characterised by nearly universal coverage, was extended with a privately managed, mandatory, pre-funded scheme. The reform created a mixed system. Members paid part of their mandatory contributions to a fund of their choice; the rest was transferred to the first pillar. In exchange, they gave up part of their future claims in the pay-as-you-go scheme. New entrants to the labour market were obliged to join the mixed system, while people with established accruals could choose between sharing their contribution between the two pillars or paying their full contribution to the pay-as-you-go pillar. By June 2011 the number of fund members reached 3.1 million, about three-quarters of the labour force. Reserves grew to the equivalent of about 12.5 per cent of GDP, but this build-up reversed rapidly. The government elected the year before created conditions that made 97 per cent of members of the mixed system return to the full pay-as-you-go

system. These conditions included the restoration of accruals in the first pillar, which had been lost at the time of opting out of the mixed scheme. The number of members of the mixed system had dropped to 0.1 million by September 2011; since then, this number has further decreased to 0.06 million. The pre-funding experiment can therefore be considered a closed chapter in the history of Hungarian public pensions.

The maturation of the funded pillar was to create a limited double-burden problem: while pensions that were being paid needed to be financed, a proportion of the contributions was saved in order to pre-fund future pensions. The resulting deficit of the National Pension Insurance Fund had to be financed from public sources. This transition cost was to be covered from reduced public spending in other parts of the budget rather than debt.

This could have been achieved at a relatively low cost in terms of foregone consumption. As shown in *Figure 2*, the period between the late 1990s and mid-2010s, when the funds were building up, coincided with favourable demographic trends. As mentioned above, the current Hungarian age pyramid has two ‘humps’ or relatively large generations: those born in the mid-1950s and their children born 20 years later in the mid-1970s. The entry of the latter to the labour market in the late 1990s resulted in two large taxpayer generations and no similarly large cohorts of dependent age.

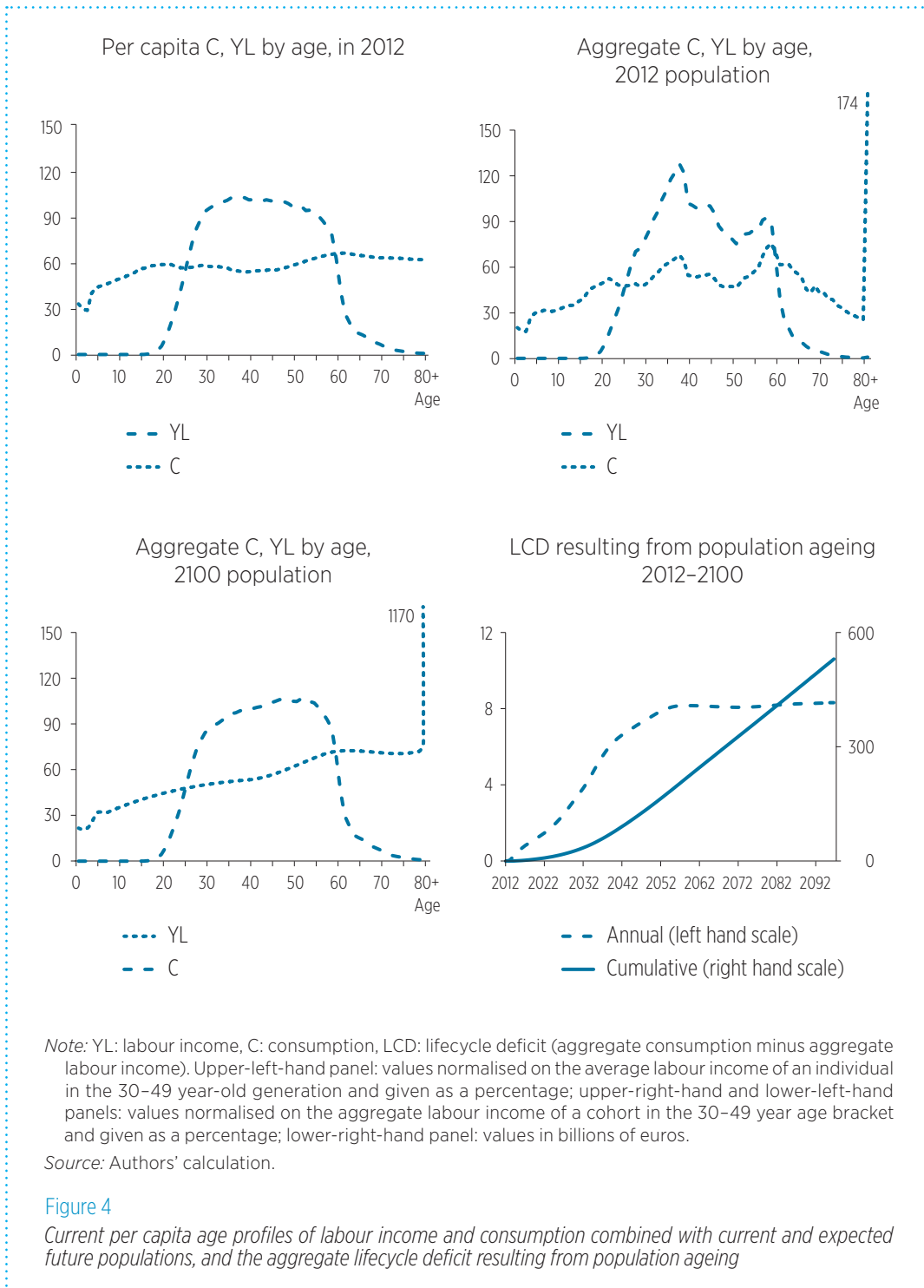
Unfortunately, this opportunity was not exploited. Although no special pensions-related flows were earmarked and the exact extent of debt financing cannot be determined, it is safe to say that the transition was financed from future revenues (e.g. see an OECD report by Égert, 2012). Indeed, trends in public spending on other parts of the budget and the rapid increase in government debt over this period imply a debt-financed transition. As a result, the reserves accumulating in the second pillar were more illusory savings than net wealth. In parallel with the build-up of the funds, government debt of a similar size was accumulating. The pre-funding experiment, which should have increased the share of asset-based revenues in old-age income, failed. We will return to this subject in the next section.

3 PROJECTIONS

Below we present the results of a projection made on a simple cohort model. As a counterfactual, we fix current age profiles of labour income and consumption and combine them with expected changes in the age composition of the population. We apply two balancing items and ask how much additional savings and/or how large an initial capital endowment would keep up with the current account balance until 2100 in light of the increasing mismatch between labour income and consumption. We repeat the exercise with 1995 as the base year in order to demonstrate the significance of the opportunity offered by the demographic window between the mid-1990s and mid-2010s, and missed as a result of the mismanagement of the pre-funding experiment in the pension system. In addition, we feed an alternative set of age profiles into the model. This is to show how the savings and/or capital have to change if we extend the national economy to the total economy by incorporating the household economy. The rationale for such an exercise is the fact that consumption and labour in the household are less exposed to the effects of population ageing.

3.1. POINT OF DEPARTURE

In *Figure 4* we show the age patterns of labour income and consumption per capita in 2012 (upper-left-hand panel) and in aggregate (upper-right-hand panel). The per capita figure depicts the general pattern of relatively uniform consumption across all ages but the concentration of labour income in active age. As before, figures in the upper-left-



hand panel are normalised on the average per capita labour income of the 30-49 year-old generation. By contrast, aggregates in the upper-right and the lower-left panels are normalised on the aggregate labour income of an average cohort between the ages of 30 and 49 years instead of the average member of the cohorts involved. In the upper-right-hand panel, the curves of current aggregates show the two relatively large generations described in the section above. The asymmetry between the two curves – the fact that labour income peaks among people in their mid-30s while consumption is higher among the original baby boomers – is a consequence of retirement of the latter age-group that had already started. Aggregate consumption is highest among octogenarians and their older contemporaries combined here as one single cohort; it comprises as much as 174 per cent of the aggregate labour income of the average prime working years cohort.

A projection of current age patterns reveals the unsustainable imbalance between consumption and labour income if they are combined with the expected future age composition. The mechanics of population ageing dictate that the 174 per cent will grow to as much as 1170 per cent. The resulting lifecycle deficit is shown in the lower-right-hand panel. It grows from zero to €8 billion over the course of 40 years, and remains at that level for the rest of the century. In cumulative terms, this reaches €540 billion by the end of the century. As mentioned in Section 1 (Motivation), aggregate consumption exceeds aggregate labour income even in the base year. This initial gap, equivalent to €6.6 billion or nine per cent of national income, is covered by asset-based revenues.¹³ The lower-right-hand panel does not include this lifecycle deficit. It only shows outstanding LCDs on top of the original level generated by population ageing.

3.2. ASSUMPTIONS

In our simple projection exercise we calculate the additional savings needs or required initial capital endowment to keep the consumption/labour balance at the initial level. We calibrate the model to current Hungarian conditions but make a number of simplifying assumptions. We model a small, open, export-oriented economy in which interest rates, output and growth are exogenously determined. Savings are assumed to have no specific age characteristics, so we reduce the consumption of all cohorts by the same proportion. Savings have a double effect on the balance of consumption and labour income. They directly reduce the gap because savings are created from consumption and they also induce additional growth which diminishes the need for consumption cuts.

We introduce a windfall capital endowment in the base year and see how much this windfall would mitigate the need for consumption reduction. Such an endowment serves as a reserve through the demographic transition, but its returns also accelerate growth. These returns could be taken as the stylised equivalent of structural and cohesion funds from richer EU member states.

The definition of consumption follows NTA standards (United Nations, 2013), which is consumption net of taxes. It includes public and private individual consumption expenditures (category P.31 in national accounts) and collective consumption expenditures (P.32) minus the consumption share of taxes on products (D.2). In net terms, Hungary consumed €56.2 billion in 2012, about three-quarters of national income. Net savings were equivalent to €1.8 billion, 2.36 per cent of national income and, more importantly, 3.17 per cent of consumption.¹⁴

In the base case productivity (g) grows by 1.5 per cent. We apply this rate for discounting, so in practice we set aside the effect of growth coming from increases in productivity. Our focus is the capital requirements of balancing the effect of shrinking and ageing population. The rate of return (r) is set 1.5 per cent higher than g , three per cent. There is no inflation in the model. Capital produces returns, by assumption fully used as additional investments, which in turn induces additional growth (g_2). We calibrate this component so that the effect is roughly comparable to the additional growth generated by EU funds in Hungary.¹⁵

¹³ In reality, some of asset-based income is drawn from debt. In our simplified projection we set this fact aside and focus on the consequences of population ageing.

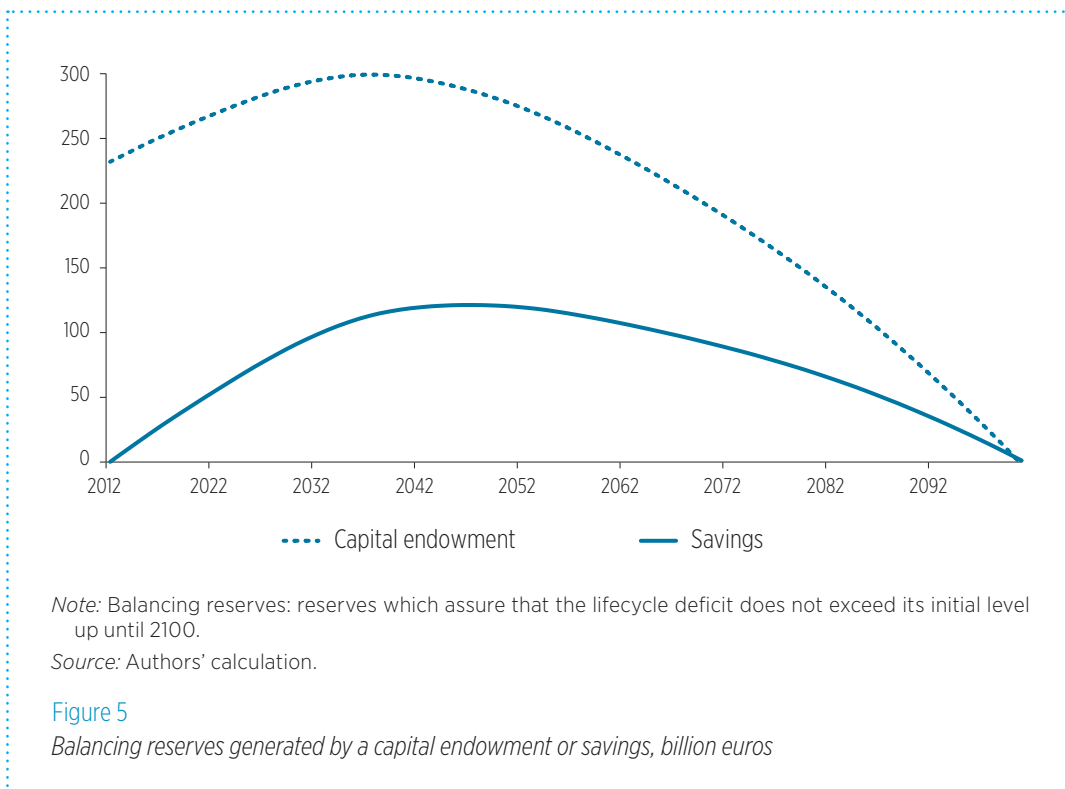
¹⁴ The gap between national income and the sum of net savings and consumption are made of taxes on products (€16.6 billion, 22 per cent of national income) and net transfers (categories D.5+D.61+D.62+D.7) to the rest of the world (€0.8, 1.1 per cent).

¹⁵ See Borkó and Oszlay (2007) and Nyikos (2013) for the effect of EU funds on growth in Hungary.

3.3. RESULTS

The main purpose of this projection was to determine how much capital is needed to maintain the original level of aggregate lifecycle deficit up until 2100. We examined two ways of accumulating the capital in question, through additional savings and through a windfall of capital in the base year. These two alternatives can be combined. Here we present the two extreme scenarios. The first keeps savings rates fixed at the original level, but adds a balancing capital endowment. The second excludes any such windfall but raises the savings rate to a level that keeps the consumption/labour income balance at the 2012 level up until 2100. Results are shown in *Figure 5*.

The projection reveals that under conditions set in the previous sub-section a capital endowment worth €232 billion (307 per cent of national income in 2012) is required to offset the effect of population ageing on the consumption/labour balance. This reserve grows by a further €65 billion in the first 40 years before it starts decreasing, provided that the original savings rate of the base year does not change over the entire period. The alternative scenario – without any capital injection – requires a savings rate of 8.07 per cent of net consumption against an actual rate of 3.17 per cent in 2012. Such an effort would produce net wealth of about €120 billion by 2047, only to be consumed by the end of the century.



The key results of the base case scenario are summarised in the first column of *Table 3*. In the two other columns we show the outcome of two alternative model settings. In the first we replace the age profiles of consumption and labour income of the national economy with their equivalents in the total economy, which consists of the national as well as the household economy. We demonstrated in *Figure 1* that the age profile of household labour peaks among young adults (parents, mostly women, caring for their children) and again after retirement. We take a closer look at this in *Figure 6*. In the left-hand panel we draw current per capita age profiles, which we combine with current and then with expected future populations in the other two panels in the same way as we did above with age profiles of the national economy. Results are normalised by labour market income, which itself is expected to decrease due to the shrinking number of workers. So a seemingly similar aggregate consumption of household labour by children in 2100 in fact represents hardly

more than half its current level. By contrast, the value of household labour produced by the oldest old is increasing, up to 285 per cent of the aggregate labour income of an average cohort in the reference generation, a development unparalleled in the national economy where labour market income practically disappears above the age of 60 years. Another difference is consumption. Although the sheer mechanics of population ageing would make consumption of octogenarians and their older contemporaries soar, this would not be as sharp as in the national economy: it would go up to only 563 per cent of the aggregate reference labour income in contrast to the 1170 per cent for the national economy. In short, the household economy, though exposed to the effects of changing age composition, is less vulnerable to the demographic transition than the national economy.



Note: HH_YL: value of household labour produced, HH_C: consumption of household labour. Left-hand panel: values normalised on the average labour income of an individual in the 30-49 year-old generation and given in per cent; central and right-hand panels: values normalised on aggregate labour income of an average cohort in the 30-49 year age bracket and given as percentage.

Source: Gál, Szabó and Vargha (2015); authors' calculation.

Figure 6

Current per capita age profiles of value of household labour produced and consumed combined with current and expected future populations

This affects the results of our projections, for which we applied age profiles from 2000 and adjusted them to 2012 macro aggregates. As shown in the second column of *Table 3*, the initial requirement for a balancing capital endowment is 259 per cent of national income against 307 per cent in the base case scenario. Alternatively, the necessary saving rate (including both the additional balancing savings and the original saving rate in 2012) is 7.21 per cent against 8.07 per cent above. We also estimate how

long the base case endowment of 307 per cent of national income would last if added to this revised pair of age profiles: it would be depleted after 120 years, later than the 88 years projected in the base case scenario.

Table 3

Summary results of projections for three different scenarios

	Base case	Household economy included	Demographic window opens
If gap is balanced exclusively by capital endowment it takes ... % of national income	307	259	209
If gap is balanced exclusively by capital endowment it is depleted in ... years	88	120	beyond the projection horizon
If gap is balanced exclusively by savings total saving rate is ... %	8.07	7.21	6.31

Note: Base case: 2012 age profiles of the national economy; household economy included: age profiles of the total economy (including the household economy); demographic window opens: projection starts in 1995. Source: Authors' calculation.

Finally, we demonstrate the demographic window of opportunity, which, as shown in *Figure 2*, was open between the mid-1990s and the mid-2010s. We apply 2012 age profiles and macro aggregates but start the projection with demographic data from 1995 in order to focus on the effect of an initial period favourable to capital accumulation. Results prove that the expectation was correct. If based solely on savings then a rate of 6.31 per cent would be required to stabilise through the entire projection period of 88 years (see the third column in *Table 3*). If stabilisation had been based on windfall capital a sum of 209 per cent of the 2012 national income would have been enough against the 307 per cent in the base case. These results support the view that the opportunity to accumulate net wealth was real. The timing of the pre-funding pension reform was right. If proper tools, such as an earmarked tax on fund members or dedicated reductions in the public budget, had been introduced then net wealth might have been accumulated at a relatively low consumption cost.

4 CONCLUSIONS

We applied simple projection techniques frequently used to analyse the sustainability of welfare systems in order to measure the sustainability of current consumption patterns. We investigated how much more savings or how large a windfall capital endowment is needed to assure that consumption does not exceed labour income in Hungary in 2100 more than it does today. We also examined how much the results would change if the projected age profiles of consumption and labour income included unpaid household labour as well. Finally, we repeated the base case projection starting in 1995 instead of 2012, in order to demonstrate the demographic window that was open between the mid-1990s and mid-2010s.

We found that base case savings should more than double from the current 3.2 per cent to 8.1 per cent of net consumption – or that the economy needs to receive a windfall capital equivalent of about three times national income. We also found that despite its exposure to population ageing the household economy is less vulnerable than the national economy. Finally, we showed that the demographic opportunity was real: if started in the mid-1990s preparations for the demographic transition would have been less painful. Since this period coincides with the botched pre-funding experiment in the public pension system the mismanagement of this reform proves to be a particularly apparent missed opportunity.

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