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From pro-natalist rhetoric to population policies in Turkey? An OLG general equilibrium analysis

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ABSTRACT

We build an overlapping generation (OLG) general equilibrium model of Turkey with survival rates and endogenous labour supply to simulate the economic, fiscal, welfare, and intergenerational redistribution impacts of the medium and high fertility demographic scenarios projected by the United Nations. We assume that the high fertility variant is a realistic demographic proxy for pro-natalist policies in Turkey. Our results show that on a purely economic basis, a higher fertility scenario in Turkey appears open to criticisms as it cannot offset the social security pressures of ageing, and it also involves intergenerational welfare redistributions so that current young adults are unlikely to endorse natalist rhetoric and policies.

1. Introduction

Until recently Turkey was typically viewed as a relatively young economy when compared to an ageing Europe. Indeed, the fertility rate was around 4.0% in early 1980s, and even recently (2013), with a rate of around 2.0%, Turkey remains one of OECD members where the fertility rate is the highest, albeit in sharp decline from the 1980s and at the brink of minimum level required for reproduction of one generation. As elsewhere, the decline in fertility in Turkey has been attributed to the social and economic changes. Demographic transition theory and economic theories of fertility decline suggest that the changing relationship between the costs and benefits of having children is the main driving force to fertility change. According to Yavuz (2008), Turkey's modernization, socioeconomic development and accompanying social change came into a new phase with the 1980s. This period was characterized by the development of a free market economy, volatile economic growth during the 1990s, globalization with its social and cultural dimensions, urbanization and massive migration from East to West Turkey where better job opportunities have favoured women labour force participation. These various societal changes have exerted an impact on fertility behaviour, amplified by the poor quality of public primary and secondary education which has led families to opt for costly private education and to choose "quality" over "quantity".

Against this backdrop, the current pro-natalist rhetoric in Turkey originated in a speech given by then Prime Minister Recep Tayyip Erdoğan in 2008, on Woman's Day, advising women to give birth to at least three children. The latest offering in this vein of glorified motherhood was given by Health Minister Mehmet Müezzinoğlu during a visit to the first baby born on January 1, 2015, in Istanbul, and giving advice to women:

> "Mothers have the career of motherhood, which cannot be possessed by anyone else in the world. Mothers should not put careers other than motherhood at the center of their lives. They should make raising good generations the center of their attention."[1]

Since 2008, the Turkish government has been studying a number of policies to increase population growth rates. The Minister for Family and Social Policies announced a pilot project in early 2013 to provide fertilization treatment to 2500 low-income families having no children. About 2.5 million families are also in the process of being evaluated to join the project at a later stage. Other policies that are currently explored is to raise maternity leave from 16 to 24 weeks, and to offer incentives to encourage families to have more children, giving a monthly baby bonus of 300 Turkish Lira (TL).[2]

Although some of the aspects of the pro-natalist rhetoric have recently been discussed in the general press as opinion pieces, little

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[1] Hürriyet Daily News, January 02, 2015.
[2] About US$ 100 in average in 2015.

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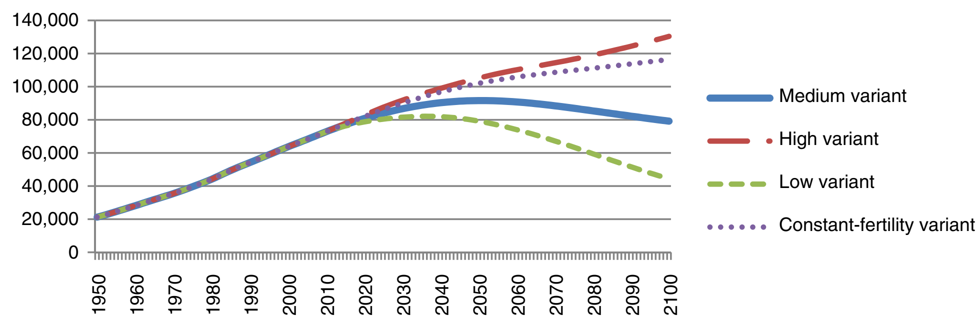


Source: Compiled by the authors using UN Population Division data – World Population Prospects, the 2010 Revision (esa.un.org/unpd/wpp/unpp/panel_indicators.htm)

Fig. 1. UN population projections for Turkey (in thousand) — medium vs. other variants.

academic research has attempted to gauge their possible impacts, and none in a general equilibrium context. Several reasons can explain the muted reaction of academics. First, demographers believe that a target of at least 3 children per family is unrealistic given the current fertility rate in Turkey (Türkyılmaz et al., 2013). Second, economists believe that agents act on incentives not on rhetoric, but the announced policies appear timid and exploratory. Third, for most economists, pro-natalist policies are seen as an attempt to change the relative sizes of various cohorts as current low fertility rates threaten the long run financial viability of pension schemes and health care systems. But, it is argued, these are not the best available policies to deal with the demographic transition. As a matter of fact, if the Turkish government was serious about the eventual ageing problem and the sustainability of pension plans, then reforms of the social security, not fertility policies, should be undertaken (Sayan, 2013; Şirin and Janssen, 2013). If the government was serious about family policies, it should try to favour a concomitant increase in women's fertility and their participation in the labour market through child care facilities. More generally, a pro-natalist policy does not make economic sense in the face of low labour participation rates, a high pool of unskilled labour, and high unemployment. And if sustained growth instead of ageing per se was the preoccupation of policy makers, then the priority should be technological progress as a major source of economic growth in the upcoming decades (Attar, 2013).

Yet, the muted reaction referred above is also a missed opportunity. Instead of an outright dismissal of natalist policies, we could benefit from a better understanding of their economic, fiscal, and social security impacts relative to the currently expected demographic changes in Turkey.[3] The objective of this paper is therefore to study the impacts of a realistic policy-supported change in fertility by comparing two "likely" projections, the medium and high variants of the United Nations Population Division (UN Population Revision, 2010) over the demographic transition. We gauge the economic, fiscal, social-security, and welfare impacts of both scenarios and highlight the magnitude of the economic cost, in terms of living standards, of a pro-natalist policy. To do this we have built an overlapping-generation applied general equilibrium model of the Turkish economy (TOLGAGEM). The model is in the Auerbach and Kotlikoff (1987) tradition and introduces age-specific mortality following Börsch-Supan et al. (2006) with perfect annuity markets, that is, with accidental bequests distributed implicitly, as in the life insurance framework by Yaari (1965). The remainder of this paper is organized as follows. Section 2 illustrates in more details the UN demographic projections for Turkey and the assumptions underlying the medium and high variants. Section 3 outlines the structure of TOLGAGEM which models key features of the Turkish economy and discusses how the model is calibrated. A series of simulations using TOLGAGEM are carried out in Section 4 and results are discussed. We will see that a higher fertility rate is unlikely to solve, by itself, the social security pressures of ageing. Section 5 concludes.

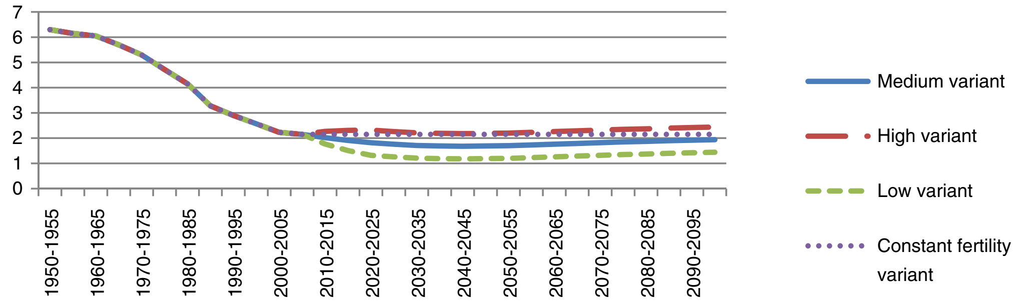
2. UN demographic projections: medium and high fertility variants

Fig. 1 compares four population scenarios projected by the United Nations for Turkey — the medium, high, constant and low fertility variants. In the following we will concentrate on the medium versus high variants. From about 77 million now, the population could reach 130 million by the end of the century in the high fertility variant compared to 80 million in the medium variant scenario. This section provides underlying assumptions made by the UN Population Division so as to project population estimates (Fig. 1), in particular, assumptions regarding future trends in fertility, mortality and international migration. Because future trends in fertility cannot be known with certainty, a number of projection variants are produced. Fig. 2 shows historical figures and projections on the fertility rates in Turkey for the four variants. The constant fertility variant assumes that the number of children per women remains constant from 2010 to 2100 at its level of 2.15 children per woman for the period 2005–2010. The medium fertility variant is the median of 100,000 projected trajectories for the fertility rate (until 2100).[4] Under the high variant, fertility is projected to remain 0.5 children above the fertility in the medium variant over most of the projection period. That is, as Turkey reaches a total fertility of 1.82 children per woman in the medium variant in 2020–2025, it has a total fertility of 2.32 children per woman in the high variant during that period. Under the low variant, fertility is projected to remain 0.5 children below the fertility in the medium variant over most of the projection period (i.e., a total fertility of 1.32 children per woman in the 2020–2025 horizon).

UN assumptions for life expectancy, under-five mortality and migration are the same across all variants and Fig. 3 gives the historical data and projections. Life expectancy at birth was 73 years (both sexes combined) in 2005–2010 and is projected to reach 84.5 at the end of the century. Under-five mortality was 34 per 1000 in 2005–2010 down from 293 in 1950 and is projected to reach 2 deaths per 1000 in 2100. The net migration rate fell from −2.1 per 1000 in 1960–1965 (about

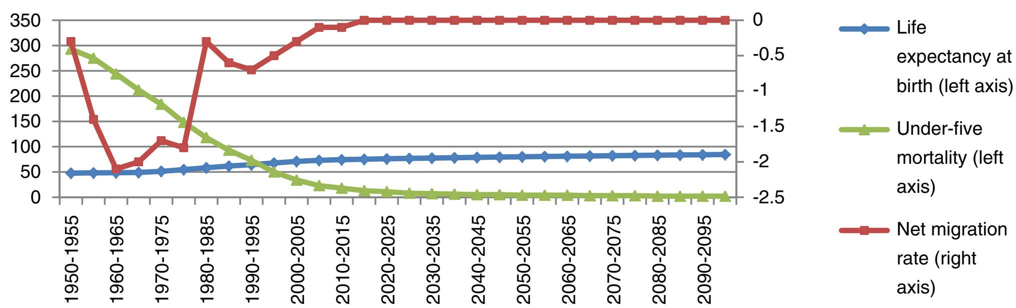
[3] See Hoşgör and Tansel (2010) for a study of the effects of demographic changes in Turkey on several sectors of the economy. Alper et al. (2012) provide historical background, demographic projections, and fiscal and social security implications of ageing in Turkey. Kenc and Sayan (2001) show within an OLG-CGE model that the spillovers of the demographic shock in Europe would intensify the changes that Turkey would experience from its own demographic transition. Attar (2013) stresses that priority should be given to technological progress instead of pro-natalist policies. He uses a reduced form model with no prices and, essentially, no market for goods, labour and capital. Thus the model ignores the general equilibrium interactions between factor prices and capital accumulation. Furthermore, without pension system and with no government and no age sensitive public spending (health and education spending), the model does not offer a framework that permits the analysis of the challenges associated with demographic changes per se.

[4] See the UN 2010 Population Division web-site for further details on the stochastic simulation model that generates the 100,000 projections underlying the medium variant.



Source: Compiled by the authors using UN Population Division data – World Population Prospects, the 2010 Revision (esa.un.org/unpd/wpp/unpp/panel_indicators.htm)

Fig. 2. Total fertility rate: historical data and UN projections for Turkey.

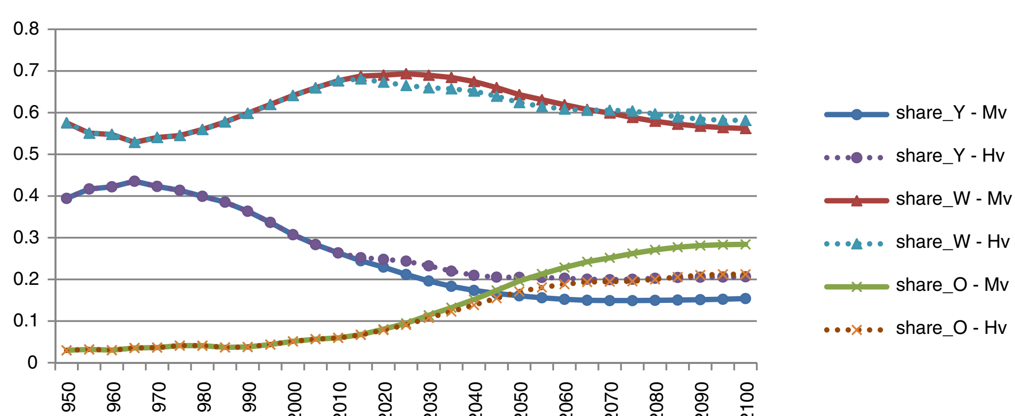


[a]Both sexes combined. Under-five mortality gives the number of deaths under age five per 1000 live births; Net migration is a rate per 1000 population.
Source: Compiled by the authors using UN Population Division data – World Population Prospects, the 2010 Revision (esa.un.org/unpd/wpp/unpp/panel_indicators.htm)

Fig. 3. Life expectancy at birth, under-five mortality, and net migration rate[a].

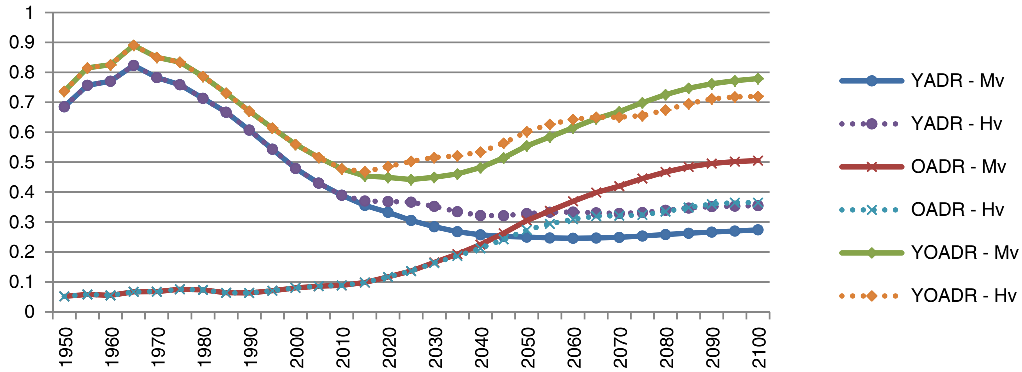
63,000 individuals migrating out of Turkey annually in the early 1960s) to −0.1 in 2005–2010 (about 7500 net departures yearly), and is expected to quickly converge to zero.

The evolution of the population structure and composition by age groups must also be considered. Fig. 4 shows the implications for the share of young (here typically, 0–14 years), the 15–64 age group, and the elderly (65 year of age and above) in total population. As in subsequent graphs (unless mentioned otherwise), solid and dashed lines are used to represent the projections for the medium and high fertility variants, respectively. The share of young (share_Y) in total population is assumed to fall from 26% in 2010 to 15.5% in 2100 in the medium variant scenario and to 20% in the high variant. The share of elderly in total population (share_O) is assumed to increase from 6% to 28% in the medium variant and 21% in the high variant. Fig. 5 shows the corresponding impacts in terms of old age dependency ratio (OADR), which is the ratio of the elderly (65 and +) on population of age 15 to 64, young age dependency ratio (YADR), which is the ratio of those less than 15 year old on population of age 15–64, and total dependency



Source: Compiled by the authors using UN Population Division data – World Population Prospects, the 2010 Revision (esa.un.org/unpd/wpp/unpp/panel_indicators.htm)

Fig. 4. Shares of young (Y), old (O), and 15–64 years (W) in total population.



Source: Compiled by the authors using UN Population Division data – World Population Prospects, the 2010 Revision (esa.un.org/unpd/wpp/unpp/panel_indicators.htm)

Fig. 5. Dependency ratios: young age (YADR), old age (OADR), and total (YOADR).

ratio (YOADR, which is the summation of YADR and OADR). The old age dependency ratio is expected to increase from less than 10% in 2010 to 50% in 2100 in the medium variant or 30% in the high variant. On the other hand, the decline in the young age dependency ratio is somewhat muted in the high fertility case and more pronounced in the medium variant (a decline from 39% in 2010 to 36% and 27%, respectively in 2100). As for the total dependency ratio (YOADR), the high fertility scenario tends to prop up its value until 2065 (higher YADR), but it will eventually be lower than the medium variant scenario hence after (lower OADR).

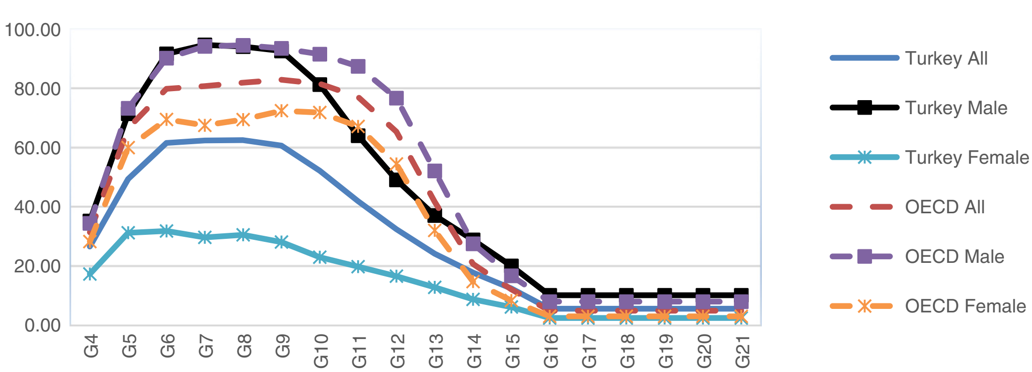
From these projections, it is clear that the high fertility variant does not eliminate the eventual prospect of an ageing society for Turkey, but its process is somewhat smoother and less dramatic. A key limitation of these demographic projections is that they do not take into account the economic behaviour of agents and the fiscal and social security impacts of ageing. For this, we need to build an economic model with behavioural assumptions. Section 3 briefly describes the OLG general equilibrium model that we have used for this analysis while Section 4 presents simulation results by comparing the impacts of the medium and high fertility scenarios.

3. TOLGAGEM: an OLG applied general equilibrium model for Turkey

TOLGAGEM is an OLG applied general equilibrium model built specifically to analyse the long-term economic and fiscal impacts of demographic projections in Turkey. The model, itself is in the Auerbach and Kotlikoff (1987) tradition with endogenous labour supply and introduces age-specific mortality, following Börsch-Supan et al. (2006), with a perfect annuity market, through which unintentional bequests are implicitly distributed. The theoretical description of this approach was first presented in Yaari (1965). Several OLG models have been developed and extended in many directions over the last 20 years. For a survey of these advances, see Fehr et al. (2013) and references therein. Since then, the applied OLG-CGE literature analysing the implications of population has continued to expand (e.g., Nishiyama, 2013; Georges et al., 2013; Braun and Joines, 2014; Kitao, 2015; Kudrna et al., 2015; Kolasa and Rubaszek, 2016). Although some OLG-CGE models have been built for Turkey (e.g., Kenc and Sayan, 2001, Voyvoda and Yeldan, 2005), none of them include age-specific mortality.

For transparency reasons, the version of TOLGAGEM used here has been kept as simple as possible and proposes a closed economy model of Turkey, but there exist multi-country, multi-skill, and multi-sector extensions of TOLGAGEM. The model allows precise replication of the population structure from the UN population projections given in Section 2. Furthermore, the model is particularly well suited to a comparison of fertility scenarios since its OLG structure and calibration explicitly allows for the incorporation of ageing effects related to age-specific productivity differences and age-specific government expenditures.

The equations of the model and the definition of variables and parameters are given in Appendix A and Table 2. Here, we only highlight a few points. The model assumes that all markets (goods, labour, and capital) are perfectly competitive (Eqs. (22)–(24)). A representative firm produces each period a single good using a Cobb–Douglas technology (Eq. (1)). The firm hires Turkey-specific labour and capital (Eqs. (2)–(3)). For the consumption side, Turkey is represented by



Source: OECD (2015) Labor force participation stats. for year 2010

Fig. 6. Labour force participation rates. Males and females, Turkey versus OECD averages.

Table 1
Computing "birth" and "survival" rates from UN projections for Turkey.[a]
Source: Compiled by the authors using UN Population Division data — World Population Prospects, the 2010 Revision (esa.un.org/unpd/wpp/unpp/panel_indicators.htm).

a) Population structure per age group in 2010 and stationary population assumption from 2010 onwards

Years/generations	G1 (0–4)	G2 (5–9)	…	G21 (100+)	Total pop
2010	6413	6242		0.	72752
2015	6413	6242		0.	72752
…					
2100	6413	6242		0.	72752

b) Constructing implied birth rates and survival rates from UN population data from 2010 onwards

Years/generations	G1 (0–4)	G2 (5–9)	…	G21 (100+)	Total pop
2010	6413	6242		0.	72752
2015	6211	6399		0.	77002
…					
2100	4042	4062		121	

[a] Numbers in cells correspond to historical (2010) and projected (UN medium variant) population sizes (in thousands) by years and generations (relabeled here G1 to G21). The "birth rates" are computed "vertically" for consecutive time periods on the basis of G1 population sizes (e.g., $BR = 6211/6413 = 0.9685$). "Survival rates" are computed "diagonally" across consecutive age groups and time periods (e.g., $SR = 6399/6413 = 0.9978$).

21 representative individuals in an Allais-Samuelson overlapping generations structure. We classify adult generations into seventeen age groups (i.e., age groups G5 = 20–24 years old, …, G21 = 100–104). Younger generations (age groups G1 = 0–4, …, G4 = 15–19) are fully dependent on their parents and play no active role in the model, but they influence the age dependent components of public expenditure (health and education) and the population structure. The model introduces age-specific mortality with a perfect annuity market, through which unintentional bequests are implicitly distributed. An individual optimization problem consists of choosing a profile of consumption (*Con*) and leisure (*TLeis*) over the expected adult life cycle, taking into account the exogenous probability of survival, *SR*, in order to maximize a CES type inter-temporal utility function of consumption and leisure (Eq. (4)), subject to a lifetime budget constraint (Eq. (6)) itself based on the inter-temporal budget constraint given in Eq. (5).[5] In Eq. (5), $Y^L_{j,\gamma}$ is gross labour income, $HA_{j,\tau,\gamma}$ represents the individual assets at the start of period τ, $Pens_{j,\tau,\gamma}$ is pension benefits accruing to retired individuals, τx^L is the effective tax rate on labour income, *Ctr* is the worker contribution to the PAYG pension system, τx^K is the effective tax rate on asset income where *ri* is the rate of return on assets (defined later on in Eq. (21) with respect to the rental price of capital *re* and the depreciation rate of capital) and τx^C is the effective tax rate on consumption spending.[6] Gross labour income per capita, (i.e., per individual of generation γ) is defined in Eq. (7) as the standardized wage rate $w_{j,\gamma}$, (the wage rate of a new adult) multiplied by $EP_{j,\gamma}$, an age-dependent productivity (earnings) profile reflecting the individual's change in earning capacity over time, and defined as a quadratic function of age (Eq. (8)).

LS is the individual exogenous supply of potential non-effective units of labour. *PART* is an age-dependent, time-invariant labour participation rate. Finally, the term (1-*Leis*) permits to endogenize labour supply. It represents the units of leisure foregone or the fraction of exogenous labour supply time that is optimally chosen as work instead of leisure.[7]

The intratemporal condition for optimal choice of consumption and leisure and the intertemporal first-order condition for life-time consumption are given in Eqs. (9) and (10). For a given preference parameter (γa), Eq. (9) indicates that leisure increases with respect to consumption if the tax rate on consumption increases and the reservation wage (*ResWage*) decreases. As shown in Eq. (12), the reservation wage equals the net effective wage rate plus a Lagrange multiplier (*mu*) or "shadow" wage that represents the excess return over the net effective wage per unit of leisure foregone $(1-\tau x^L_{j,\tau}-Ctr_{j,\tau})w_{j,\tau}EP_{j,\gamma}$, that the individual would require to leave retirement and supply a positive amount of labour.[8] In the intertemporal condition (Eq. (10)), when the intertemporal and the intratemporal elasticity of substitution are equal ($1/\theta = Sigi$), the term *V* in Eq. (11) equals 1, and the intertemporal first-order condition would be reduced to the simpler formula, in which the growth rate of household consumption depends positively on the net rate of interest and negatively on the pure rate of time preference. The extent to which the growth rate of consumption is sensitive to these terms is determined by the value of the intertemporal elasticity of substitution. If $Sigi > 1/\theta$, consumption will increase further if the wage profile is increasing. In other words, a rising wage rate will have a positive effect on the intertemporal consumption profile as the household will be willing to substitute consumption for leisure when the wage rate is relatively high.

Public expenditure on health and education (Eqs. (15)–(16)) are age-dependent (i.e., fixed per person of a specific age). Other types of public expenditures (Eq. (17)) are assumed to be age invariant, that is, they are fixed per capita, so that other total expenditure depends only on the size of the total population, not on its age structure. In this version of the model, public debt is assumed to remain constant per capita while the government must respect its budget constraint (Eq. (14)). Total government spending, including interest on the public

[5] The life-time budget constraint of the individual is obtained by using the inter-temporal budget constraint (Eq. (5)) and writing out 17 equations for the household assets, *HA*, solving recursively for *HA* and taking into account the probability of survival until age $g + k$.

[6] We assume the implicit existence of an actuarially fair insurance company. The term $1/SR$ reflects how accidental bequests are dissipated through the annuity market.

[7] In this formulation, total leisure time at time τ is $LS_{j,\gamma}PART_{j,\gamma}(Leis_{j,\tau,\gamma}) = TLeis_{j,\tau,\gamma}$.

[8] The multiplier *mu* is the Lagrangian associated to the constraint that leisure cannot be larger than the total time endowment. It is different from zero only when no labour is supplied (see Eq. 13), that is, if the individual choose to retire.

Table 2
Model variables and parameters.

Indices	Description
j	Region j (Turkey)
τ	Period τ (five-year).
	Time t is the first period at which an individual reaches adult life (20–24 years)
γ	Age groups (by five-year periods) or generations of an individual.
$\gamma = g + k$	k is increment in age (and time) over adult life: $\gamma = g + k$; $k = 0, \ldots 16$
$\tau = t + k$	g is first period of adult life (20–24 years of age)
	$g + k$ represents age groups from 20 to 24 years of age to 100–104 years of age.
kr	kr is increment in age over retired life: $\gamma = g + kr$; $kr = 9, \ldots 16$
kw	kw is increment in age over working life: $\gamma = g + kw$; $kw = 0, \ldots 8$
ka	ka is increment in age over entire lifetime, including childhood: $ka = -4, \ldots 16$ where $k = -4$ to -1 correspond to age groups (0–4) to (15–19)

Variables	Description
$Y_{j,\tau}$	Turkey (region-j) output (GDP)
$P_{j,\tau}$	Turkey's output price (Numéraire)
$K_{j,\tau}$	Demand of physical capital by representative firm
$L_{j,\tau}$	Demand of effective units of labour by representative firm
$re_{j,\tau}$	Rental price of capital
$w_{j,\tau}$	Wage rate
$Con_{j,\tau,\gamma}$	Consumption demand of household of generation γ at time τ
$Inv_{j,\tau}$	Investment demand in region-j at time τ
$Gov_{j,\tau}$	Age-independent public expenditures
$GovH_{j,\tau}$	Age-dependent government spending on Health
$GovE_{j,\tau}$	Age-dependent government spending on Education
$HA_{j,\tau,\gamma}$	Stock of wealth of household of generation γ at the start of period τ
$Kstock_{j,\tau}$	Capital stock accumulated at the start of period τ
$Bond_{j,\tau}$	Public debt accumulated at the start of period τ
$ri_{j,\tau}$	Rate of return on assets (public debt and physical capital)
$Pens_{j,\tau,\gamma}$	Pension benefits to retired generations γ
$Y^{L}_{j,\tau,\gamma}$	Labour income of household of generation γ at time τ
$LS_{j,\gamma}$	Supply of skill-unadjusted units of labour of household of generation γ
$Leis_{j,\tau,\gamma}$	Time and age dependent fraction of the effective time endowment allocated to leisure
$Pop_{j,\tau,\gamma}$	Population size of cohorts of age/generation γ

Parameters	Description
$A_{j,\tau}$	Scaling factor of Cobb–Douglas production function (TFP)
α_j	Share of physical capital in Cobb–Douglas production function
ρ_j	Constant rate of time preference
$\theta_j = 1/sig_j$	Inverse of the constant inter-temporal elasticity of substitution
$sigi_j$	Intratemporal elasticity of substitution
$\gamma a_{j,\gamma}$	Utility weight on leisure (vs. consumption/work)
$EP_{j,\gamma}$	Household age-dependent productivity (earnings) profile
$PART_{j,\gamma}$	Age-dependent labour participation rate
$\tau x^{L}_{j,\tau}$ (=$WTxR$)	Effective tax rate on labour income (endogenous)
$\tau x^{K}_{j,\tau}$	Effective tax rate on capital income
$\tau x^{C}_{j,\tau}$	Effective consumption tax rate
$Ctr_{j,\tau}$	Contribution to the public pension system (endogenous)
$PensR_j$	Pension replacement rate (exogenous)
δ_j	Depreciation rate of capital
$BR_{j,\tau}$	Time dependent birth rate
$SR_{j,\tau,\gamma}$	Age and time dependent survival rate
$HEAC_{j,\gamma}$	Age-specific health expenditure per capita
$EDUC_{j,\gamma}$	Age-specific education expenditure per capita
$GEPC_j$	Age-invariant "other government expenditure" per capita

debt, must be financed each period by tax revenues from labour, capital and consumption taxes. Here, the tax rate on labour income $\tau x^{L}_{j,\tau}$, is the endogenous variable that fulfils the government budget constraint. In simulation results the path for this tax rate will therefore be indicative of the fiscal pressure of ageing in Turkey. We assume a PAYG pension plan separated from the government budget constraint so as to gauge the impact of the pension pressure due to ageing independently from the rest of the budget. Retirement age is at 65 years of age, at the latest, but participation rates fall dramatically as soon as 50 and 55 years of age (see Fig. 6) reflecting early retirement in Turkey. Retirees' pension benefits represent a fixed percentage of an individual's lifetime labour

Table 3
Some parameter values.

Parameters	Values
α_j	35%
ρ_j	1.6%
$\theta_j = 1/sig_j$	1/0.25 (inverse of intertemporal elasticity of subst.)
$sigi_j$	0.8
$\gamma a_{j,\gamma}$	1.5
$EP_{j,\gamma}$	$.857 + .242\gamma - .018\gamma^2$
$PART_{j,\gamma}$	See Fig. 6
$\tau x^{L}_{j,\tau}$ (=$WTxR$)	12.88% (benchmark) (endogenous)
$\tau x^{K}_{j,\tau}$	10%
$\tau x^{C}_{j,\tau}$	12%
$Ctr_{j,\tau}$	6.2% (benchmark) (endogenous)
$PensR_j$	66.7%
δ_j	12%
$BR_{j,\tau}$	Based on UN demographic projections: see Table 1
$SR_{j,\tau,\gamma}$	Based on UN demographic projections: see Table 1
$HEAC_{j,\gamma}$	Age-dependent: See Fig. 7
$EDUC_{j,\gamma}$	Age-dependent: See Fig. 7

income (Eq. (18)). The contribution rate, Ctr, applied on gross labour income, is determined endogenously so as to permit the financing of total pension benefits (Eq. (19)). Hence, endogenous increases in the contribution rate will be indicative of future pension plan tensions due to population ageing (separately from other fiscal pressures).

The accumulation of Turkey's capital stock ($Kstock$) is subject to depreciation (Eq. (20)), where Inv represents investment and δ the depreciation rate of capital. Physical capital ($Kstock$) and government bonds ($Bond$) are assumed to be perfectly substitutable. Hence the expected rate of return on bonds ri is equal to the rate of return on physical assets defined as the rental price of capital minus the depreciation rate (Eq. (21)).

A demographic process (Eq. (27)) superimposed on the OLG model provides the exogenous shock or driving force behind the simulations results. The first law of motion simply implies that the number of children (age group $g + ka$ for $ka = -4$, i.e. age group 0–4) born at time τ is equal to the size of the preceding generation multiplied by the "birth rate", BR, in period $\tau - 1$. The second law of motion gives the size of any age group $g + ka$ beyond the first generation, as the size of this age group a period ago, multiplied by the age specific conditional "survival" rate, SR. In this model survival rates vary across time and age. For the final generation ($ka = 16$), the age group 100–104, the conditional survival rate is zero. This means that for the oldest age group, everyone dies with certainty at the end of the period. For model calibration purposes (as discussed in further details shortly), we initially assume a stationary population at the start of 2010 and total population is normalized at 1. Based on the UN population data per age group for year 2010, we compute birth rates and age variable fertility rates so that the population structure per age group would replicate itself periods after periods as shown in Table 1a. This is the population structure that is assumed in the calibration part of the model and which is used together with the model to replicate the Social Accounting Matrix of Tables 4a/4b. Then, from 2010 onwards, we apply birth rates and variable fertility rates that are consistent with the UN population data projections, as shown in Table 1b. Hence, from 2010 onwards, the population structure and population size vary.[9] This procedure allows precise modelling of the population size and structure within the model and replicates the UN demographic projections given in Section 2 from 2010 onwards.

As just mentioned, the model is calibrated so as to replicate in the benchmark the Social Accounting Matrix (SAM) given in Tables 4a/4b in part based on National Accounts for Turkey (based on NA data obtained directly from TUIK, the Turkish Statistical Institute). The SAM,

[9] Technically, the model is simulated from 1925 to 2260. It starts in 1925 for welfare analysis purposes and ends in 2200 to also ensure a stationary sate.

Table 4a
Social accounting matrix (2010) in billions (Turkish lira).[a]

	FIRM	CAPITAL	LABOUR	CON	GOV	GOVH	GOVE	INV	PENSION	*TOTAL*
FIRM				534.85	96.32	2.12	5.09	120.02		758.39
CAPITAL	265.44									265.44
LABOUR	492.95									492.95
HOUSEHOLD		130.88	403.02		34.79				30.34	599.03
TAX		14.54	59.59	64.18	3.87					142.18
SAVING		120.02								120.02
CONTRIBUTION			30.34							30.34
TOTAL	758.39	265.44	492.95	599.03	134.98	2.12	5.09	120.02	30.34	
TAX Rates (%)		10.00	12.88	12.00	10.00					
CTR Rate (%)			6.15							
TAX REVENUE/GDP (%)		1.92	7.86	8.46	0.51					

[a] The SAM assumes a stationary state, and is replicated by the OLG model of Section 2 in the baseline.

Table 4b
Social accounting matrix (2010) in proportion of 2010 GDP.[a]

	FIRM	CAP	LAB	CON	GOV	GOVH	GOVE	INV	PENS	*TOTAL*
FIRM				0.705	0.127	0.0028	0.0067	0.158		1.000
CAPITAL	0.350									0.350
LABOUR	0.650									0.650
HOUSEHOLD		0.172	0.532		0.046				0.040	0.789
TAX		0.020	0.078	0.084	0.005					0.187
SAVING		0.158								0.158
CONTRIBUTION			0.040							0.040
TOTAL	1.000	0.350	0.650	0.789	0.178	0.0028	0.0067	0.158	0.040	

[a] The SAM assumes a stationary state, and is replicated by the OLG model of Section 2 in the baseline.

and therefore the calibration of the model, assumes a stationary state in 2010. In fact, GDP (and total population) is normalized to 1 in 2010 and Table 4b shows all values with respect to a GDP of 1 (or, equivalently, in terms of GDP). Labour share of the output, $1-\alpha$ in Eqs. (1) to (3), is set to 0.65.[10] Age-earning profile (*EP*) is estimated with Mincer age-earnings regressions (Mincer, 1958). The resulting wage profile peaks at 50 years of age, and wages at that age are 45% higher than at 20 year old (see Table 3). Turkish age-specific labour force participation rates (PART) are obtained from OECD statistics data reproduced in Fig. 6 (with a comparison between male, female, and total rates and with respect to the OECD-countries average). Therefore, given Eq. (7), multiplying $Y^L_{j,\tau,\gamma}$ by the population size of generation γ and summing over generations, we get that: $\sum_\gamma Pop_{j,\tau,\gamma} Y^L_{j,\tau,\gamma} = (1-\alpha) Y_{j,t} =$ TL 492.95 billion as given in the SAM in Table 3.

Other parameters of the model, including effective tax rates on consumption, labour, asset incomes, and pension contribution rates are reported in Tables 3 and 4a. Consumption taxes are the most important source of revenues used to finance public spending in Turkey, where the share of taxes on consumption (general consumption taxes plus specific consumption taxes) is more than 40%.[11] Pension benefit rates and contribution rates were calculated in the benchmark, according to Eqs. (14) and (15), so as to generate total pension benefits of 4% of GDP. This generates an equilibrium contribution rate of $Ctr = 6.2\%$ and a pension benefit rate of 66.7%. The pension benefit rate is in line with other OECD countries, while the contribution rate is much lower in the base year, which reflects a very low current old age dependency ratio in Turkey. An objective of the paper is, of course, to show by how much the equilibrium contribution rates will have to increase under the medium and high fertility scenarios. The pure rate of time preference is set at 1.6%. The intratemporal elasticity of substitution is set at $sigi = 0.8$ while the intertemporal elasticity of substitution is set at $sig = 1/\theta = 0.25$. These values are similar in magnitudes to the ones reported in Auerbach and Kotlikoff (1987).

Also used in the calibration are the age profiles for per capita government spending on health (*HEAC*) and education (*EDUC*) (Eqs. (15)–(16)) as estimated for Turkey by Seçkin et al. (2014) using the National Transfer Accounts methodology (Lee and Mason, 2011), and reproduced in Fig. 7. Observe that the majority of education spending per capita occurs between ages 5 to 29 (G2 to G6 in Fig. 7). Health spending per capita grows slowly until the age of 55–59 when it starts increasing much faster and accelerates until ages 80–90 (G17 and G18) and then starts decreasing slowly. The calibration procedure ensures that aggregate health and education spending by the government in the benchmark are just equal to the data obtained from the Ministry of Finance.[12] Total private assets must also be consistent with total stock of government bonds (*Bond*) and physical capital (*Kstock*) in the economy (Eq. (25)), while the household and government budget constraints (Eqs. (6) and (14)) and the Euler Eq. (10) are used to distribute initial private assets ownership across all generations (i.e., to generate the asset structure $HA_{j,\tau,\gamma}$ for each adult age group γ).

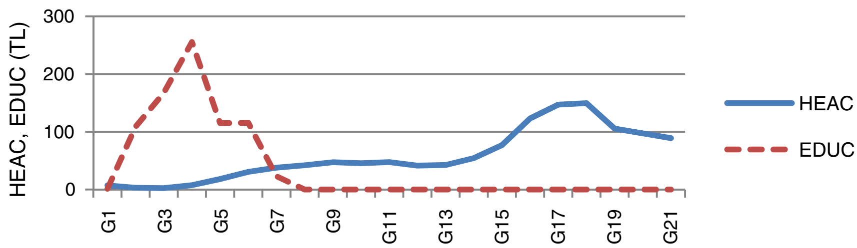
4. Simulation results from TOLGAGEM

We assume that the demographic transition in Turkey is inevitable. Hence, the issue is not to compare steady states with different demographic growth rates. Instead, we assume that total fertility inevitably tends towards a replacement level of 2 in the long term. Also, as

[10] In general, in developing countries such as Turkey the labour share is around 0.5–0.65 and the capital share, α, is thus around 0.35–0.5. See Altuğ et al. (2008); Ismihan and Metin-Ozcan (2009), and Tiryaki (2011) for discussions on the values of factor income shares in Turkey.

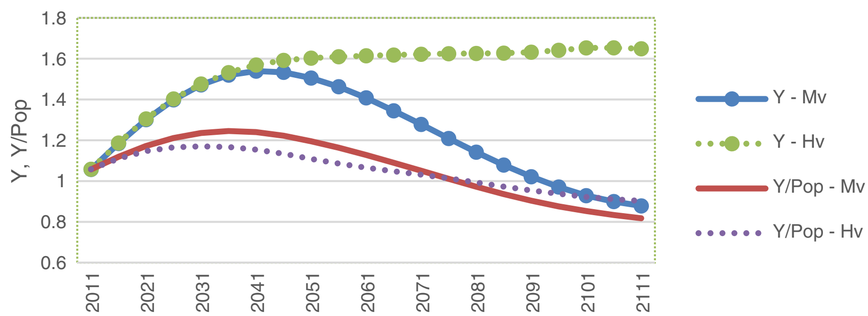
[11] Üngör (2014) finds that the average effective tax rate on consumption in Turkey increased from around 10.5% in 1998 to around 15.5–16.5% in 2012.

[12] Note for example that total government spending on education is roughly TL 5 billion of which roughly TL 1 billion is allocated to generation G3 (10–14 years old). Given that there are about 6.5 million individuals in that age group, yearly per capita government education spending for this age group is TL 167.



Source: Compiled by the authors on the basis of Turkey's National Transfer Accounts project (Seçkin et al., 2014)

Fig. 7. Age profile of per capita government spending on health (*HEAC*) and education (*EDUC*) (in TL).



Source: simulation results using TOLGAGEM

Fig. 8. Output (GDP) and output per capita (normalized to 1 in 2010).

mentioned in the Introduction, demographers believe that 3 babies or more per women is not a credible target for present-day Turkey. More realistically, a successful pro-natalist policy could be one that achieves the UN high fertility variant (i.e., 2.32 children per woman instead of 1.82 in the 2020–2025 horizon). In Section 4.1, we therefore compare the economic and fiscal consequences of the high and medium variants of the UN Population Division.[13] Note that the model replicates exactly all demographic projections given in Section 2. Section 4.2 briefly introduces other scenarios.

4.1. High versus medium fertility scenarios

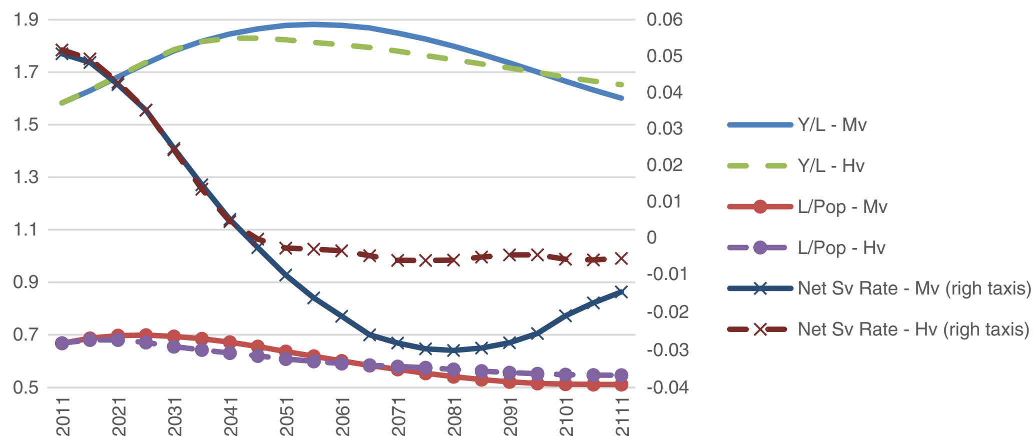
Fig. 8 illustrates the simulation results over the demographic transition for GDP or output (Y) and GDP per capita (Y/Pop). Total factor productivity growth is not included in these paths in order to focus exclusively on demographic factors. Therefore these paths should not be viewed, say, as a forecast of GDP but as the pure effect of demographic factors on GDP. Recall that the benchmark model is calibrated on year 2010 with a GDP normalized at 1 and a total population of size 1. The demographic shock (with respect to an assumed stationary population in 2010) is then introduced and the following graphs capture the impacts of the medium and high fertility scenarios from 2011 onwards.[14] By 2031 the GDP projections of both variants start diverging when the baby-boom cohort of the high fertility scenario enters the labour market.[15] By 2111, a century later, GDP in the high variant is 62% above its 2011 level. GDP in the medium variant is lower by 10% in 2111 relative to 2011, even if total population is slightly larger. This difference reflects the change in the population age structure, in particular a lower support ratio (L/Pop) by 2111 due to population ageing (Fig. 9).

To explain GDP per capita, recall that $Y/Pop = (Y/L) \times (L/Pop)$, that is, GDP per capita is equal to output per worker times the support ratio. A higher fertility scenario increases the number of consumers (the additional babies) for a given number of workers. Therefore the support ratio falls progressively with respect to the medium variant scenario as shown in Fig. 9, putting pressure down on Y/Pop. Starting 2031, additional adults (in the higher fertility scenario) join the labour force, which tends to lower the capital labour ratio (with respect to the medium variant scenario) so that output per worker (Y/L) also starts to fall (Fig. 9). Therefore, both lower capital–labour and support ratios explain the fall in Y/Pop (Fig. 8) relative to the medium fertility variant. The capital–labour ratio which determines the output per labour (Y/L) ratio is not only affected by labour, but is also driven by net saving rates. For the households the demographic change per se is also perceived as an increase in their survival rates, so that they re-evaluate upward their demand for wealth and increase their saving rates in order to generate additional capital income revenues during their retirement. Hence, from a zero (stationary state) aggregate net saving rate, saving rates jump upward (to about 5% of GDP as shown in Fig. 9) to generate the additional wealth needed, but thereafter they progressively decrease and eventually turn negative as a large share of the population retires and starts dissaving. Of course, this must also eventually affect negatively the capital–labour ratio, the output per worker, and GDP per capita. Relative to the medium variant, the high fertility scenario generates a higher support ratio towards 2070. This tends to support Y/Pop both directly and indirectly, as it also moderates the eventual decrease in aggregate saving rates (a larger working age population leads to additional saving) which also mitigates the initial downward pressure on the capital–labour ratio and on Y/L. The loss in living standard due to the higher fertility (with respect to the medium

[13] Note that the UN does not project population beyond 2100. For the purpose of our own projections we have used a longer time horizon. For demographic projections after 2100, we simply assume that the population quickly stabilizes and reaches a stable value by 2150.

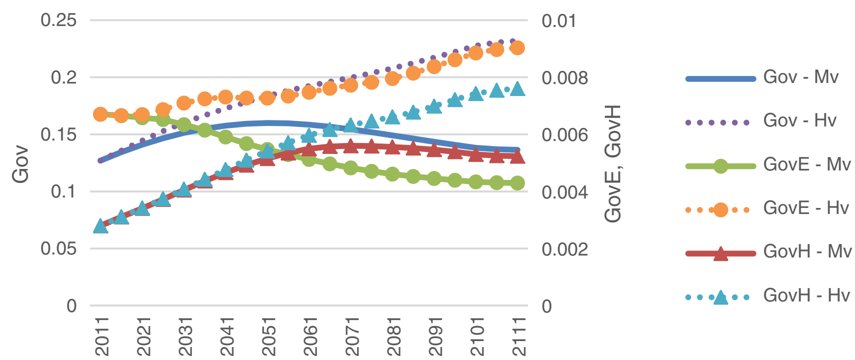
[14] As mentioned before, periods represent five years. 2011 is a short-cut for conveying the idea of an actual 5 year period 2010–2015.

[15] The age-dependent participation rates are assumed constant across both variants.



Source: simulation results using TOLGAGEM

Fig. 9. Output per efficient worker (*Y/L*), support ratio (*L/Pop*) and net saving rates.



Source: simulation results using TOLGAGEM

Fig. 10. Government spending — general purpose (*Gov*), education (*GovE*), and health (*GovH*).

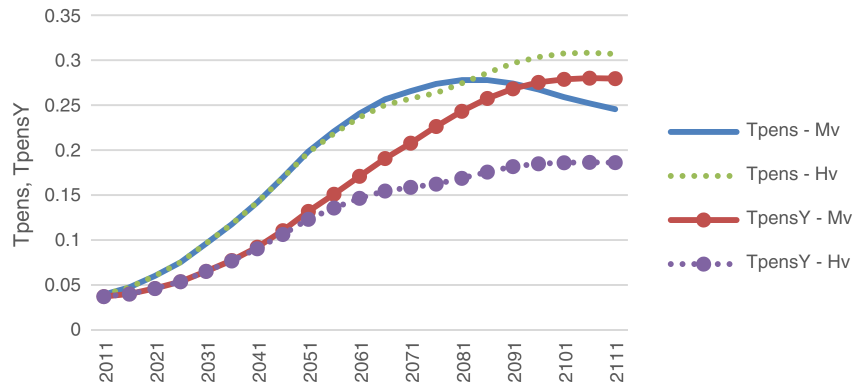
variant) amounts to 7.3% of GDP per capita at the 2046 horizon, at a time when the population size and GDP does not yet differ widely across variants.[16]

In terms of government spending, the first component is general purpose spending, which in this model is kept fixed per capita at a prespecified amount. Thus, aggregate general purpose spending (*Gov*) depends on the size of the population but not on its age structure. Hence, as shown in Fig. 10, the profiles for aggregate general purpose spending (in terms of 2010 GDP) should match the respective projected profiles for population size under both fertility variants (Fig. 1). Aggregate education and health spending, on the other hand, depend on the size of the population and its age structure (i.e., education (health) spending per capita is generally higher for the young (elderly) generations as shown in Fig. 7). The high fertility scenario leads to increased education spending *GovE* (as measured as a percentage of 2010 GDP), by 34% over the projected horizon while the medium variant leads to a 35% decrease. Government health spending (*GovH*) is expected to increase by 87% and 171% over the horizon for the medium and high variants. That the profiles for age sensitive spending *GovE* and *GovH* do not follow the projected profiles for population size (given in Fig. 1) is a consequence of the changes in the population age structure (i.e., a decrease in the share of the younger population and an increase in the share of the elderly, under both variants).

In terms of social security measures, we assume here that the pension benefit rate remains constant in the model at its level given in the calibration (66.7%). (Section 4.2 will relax this assumption.) Given the increase in the old age dependency ratio, total pension benefits are expected to increase, generating a social security deficit if no action is taken. Fig. 11 illustrates that pension benefits (*TPens*) will increase from about 4% of (2010) GDP in 2011 to 25% and 31% of (2010) GDP in 2111 in the medium and high fertility scenarios. The larger cohorts of the high fertility scenario eventually age, adding to the elderly population of the medium variant and generating the path divergence across variants in the second part of the century. Note that the slightly lower value for the high versus medium fertility path between 2056 and 2081 reflects that pension benefits are computed on the basis of the average wage income over lifetime, which tends to fall under the high fertility scenario as the larger cohorts of workers under this scenario have a depressing effect on the wage rate once they will join the labour force. For example, Fig. 12 illustrates the rental factor price difference between both scenarios. In the high fertility scenario the capital–labour ratio tends to be lower (from 2036 onwards), which puts upward pressure on the rental price of capital while lowering wage rates (according to Eqs. (2) and (3)).[17] When measured in terms of "current" GDP instead of base-year (2010) GDP, we also observe a dramatic increase in the ratio of pension benefits to current GDP

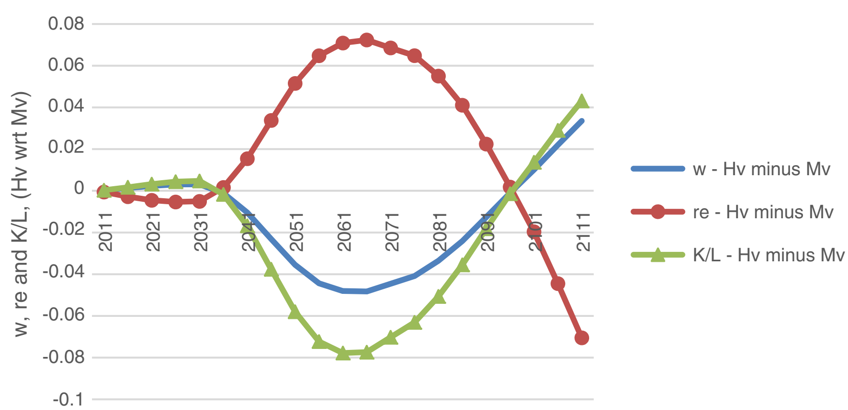
[16] Later on in the century GDP per capita in the higher fertility scenario recovers essentially because the support ratio starts to be higher in the high fertility scenario, at that horizon. Of course, this is a transitory phenomenon as long as the high fertility scenario is itself a transitory phenomenon.

[17] As discussed above, later on in the century the high fertility scenario leads to a larger support ratio (Fig. 9) which tends to sustain saving rates and the capital-labour ratio with respect to the medium variant scenario associated with a sharp increase in the old age dependency rate and large dissaving.



Source: simulation results using TOLGAGEM

Fig. 11. Pensions benefits.

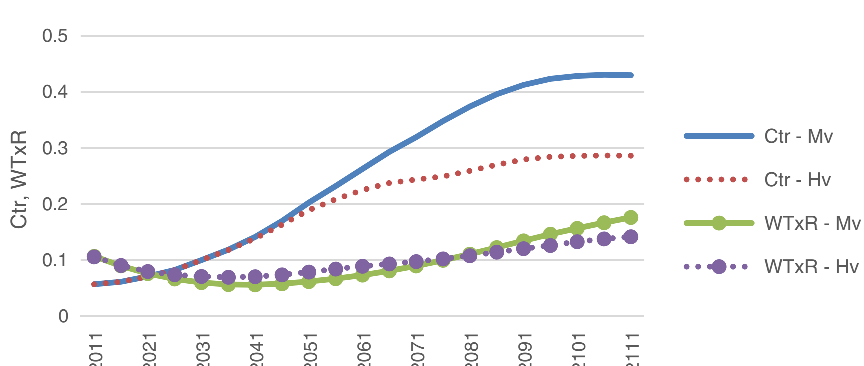


Source: simulation results using TOLGAGEM

Fig. 12. Factor prices (wage and interest rates) and capital–labour ratio.

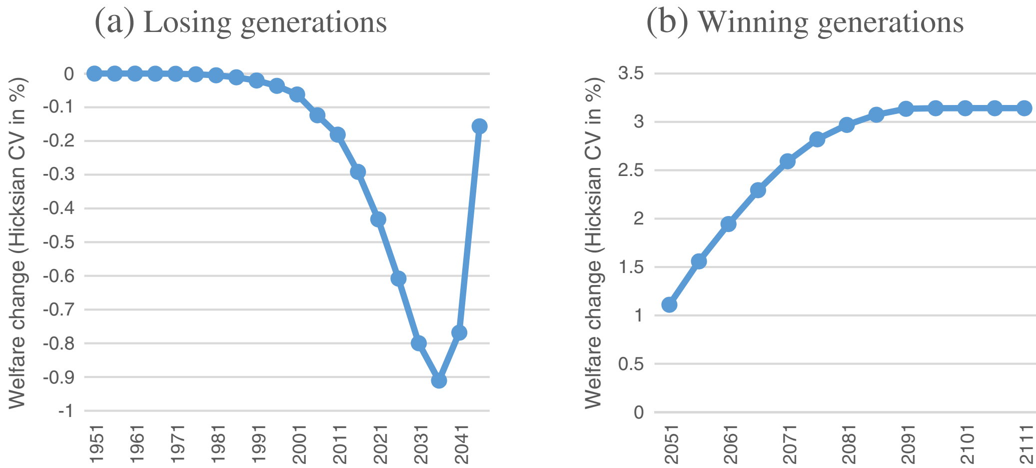
($TpensY$) from 4% to 28% and 19% in the medium and high fertility scenarios. Of course, the large increase in GDP over the projected horizon in the high fertility scenario permits to mitigate the increase in pension benefits when measured in terms of current GDP. To better evaluate the consequences of the increase in pension benefits we need to gauge the impact on the contribution rates.

Larger government and social security spending due to ageing imply an additional fiscal pressure for the government and, down the line, for the working age population. Fig. 13 shows the impact on the wage tax rate needed to finance the fiscal pressures (across both variants) and the impact on the contribution rates. The pressure on the wage tax rate ($WTxR = \tau x^L$) will be relatively small, even decreasing in the first few decades of the century, as the raise in the share of active over total population increases the tax base. This, of course, is an indication of the current demographic dividends in Turkey. The high variant scenario with its larger size of young cohorts to educate will, on this regard, be less favourable. In both scenarios, however, the fiscal pressure will become more intense in the second part of the century. The wage tax rate would increase at the end of the projected horizon to 15% and 18% under the high and medium fertility scenarios respectively.



Source: simulation results using TOLGAGEM

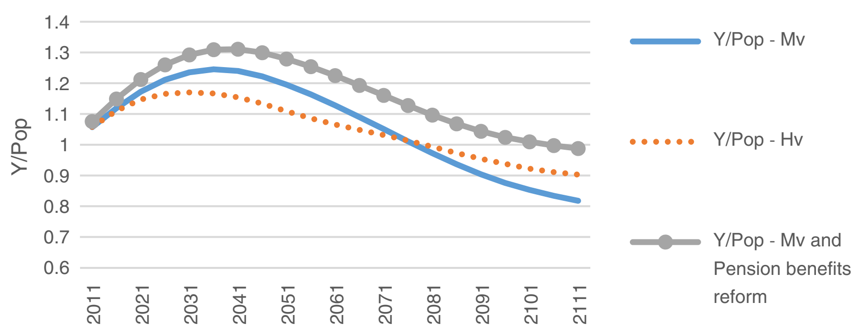
Fig. 13. Wage tax rate ($\tau x^L_{j,\tau} = WTxR$) and contribution rate (Ctr).



Note: *Age groups are identified on the horizontal axis by the period at which they become economically active (i.e. they start to work).

Source: simulation results using TOLGAGEM

Fig. 14. Welfare effects for each age group*.



Source: simulation results using TOLGAGEM

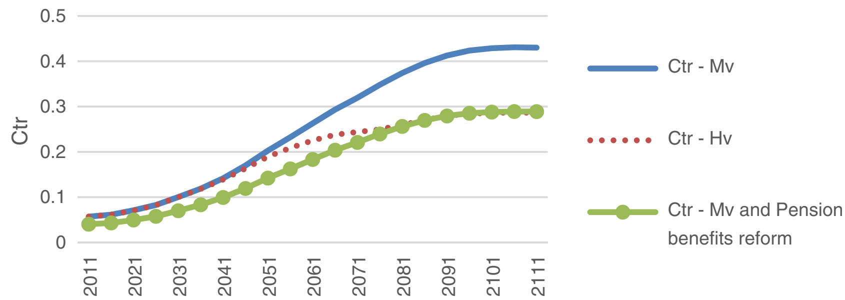
Fig. 15. GDP per capita: several scenarios.

This reflects larger health spending to be financed as population is ageing and, in the medium fertility scenario, a stronger reduction in the support ratio (tax base). Still, the overall fiscal burden of ageing does appear 'moderate', in both scenarios, because government health spending per capita (Fig. 7) remains small in Turkey relative to the OECD average.[18]

As shown in Fig. 13, the pressure on the contribution rate will be more dramatic, rising from an effective rate of 6% to about 42% and 29% a century later, under medium and high fertility variants. This is a very significant rise in the social security burden of workers under both scenarios. These results do not appear out of line with those reported in Börsch-Supan et al. (2006) for Germany, with equilibrium contribution rates that could increase to 42% in 2050, although from a much higher initial equilibrium level of 27% in 2000 (as Germany is more advanced than Turkey in the ageing process). In fact our simulation results show that from 2056 to 2110, the contribution rates in Turkey would follow the same evolution as the one simulated for Germany from 2000 to 2050. Furthermore, France according to Börsch-Supan et al. (2006), with higher fertility rates than Germany and more favourable dependency ratios, would see an increase in the equilibrium contribution rates from 27.5 in 2000 to 37.5% in 2050. In comparison, observe in our results that the pressure on the contribution rate (Ctr) at the end of the century is smaller in Turkey under the high (relative to the medium) fertility variant (29% instead of 42%) because the support ratio eventually becomes larger, and the old age dependency ratio, lower. Of course, this is one of the arguments in favour of pro-natalist policies cited in the Introduction — a change in the relative sizes of various cohorts coexisting in a country may improve the financial sustainability of pension schemes. However, even under the high fertility scenario, the contribution rate at the end of the century is such that workers would need to work 1.5 days per week just to contribute to the pension benefits of the elderly, a significant difference from today's 1/3 of a day. Hence, simulation results show that even if pro-natalist policies were successfully implemented, there would still be a need for other reforms.

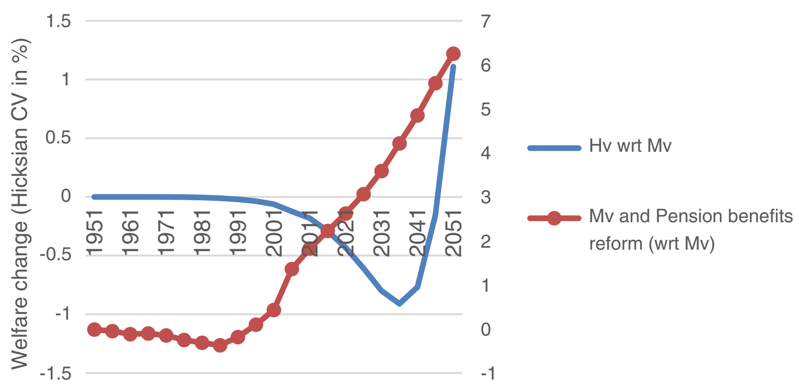
An analysis based on the national transfer accounts data for 40 countries in Lee et al. (2014) shows that while low fertility will challenge government programmes and very low fertility undermines living standard, moderately low fertility and population decline favour the broader material standard of living. Fig. 8 illustrates this point with GDP per capita projections. Yet, although GDP per capita is typically viewed as a measure of standard of living, it may be useful to build a welfare index by cohort or age group. The essential idea is to take, for each cohort, the present value of the flow of current, and future remaining utility derived from consumption and leisure time over the expected lifetime. This gives an index of welfare for each cohort in the model. To quantify the welfare effects, we use the concept of compensating variation à la

[18] However, as a large share of the population reaches older ages, political pressures to increase health spending per-capita for the elderly could intensify, increasing the budget deficit and requiring larger tax rate increases.



Source: simulation results using TOLGAGEM

Fig. 16. Contribution rates: several scenarios.



Note: *The HCV of the high variant scenario with respect to the medium variant scenario is measured on the left vertical axis. The pension reform is measured on the right axis.
Source: simulation results using TOLGAGEM

Fig. 17. Welfare effects for each age group*.

Hicks (see Fehr et al., 2015) and compute the percentage change in both consumption and leisure the individual would require in the initial scenario (the medium variant scenario) in order to be as well off as in the high fertility scenario. Fig. 14 provides, for each age group, this percent change. If it is positive, then the high fertility scenario is welfare improving for this age group and vice versa. Age groups are identified on the horizontal axis by the period at which they start to be economically active (i.e., they start working). An important conclusion is that all cohorts that are or will enter the labour market before mid-century will lose due to the higher fertility scenario. Indeed, in the first part of the century, households would quickly face higher labour income tax rates to finance education spending (Fig. 13) and then lower gross wage rate (Fig. 12) when the larger cohort enters the labour market. It is only towards mid-century that contribution rates would start declining and even later on that labour income tax rate would be reduced while gross wage rate itself recovers with respect to the medium variant scenario. This timing creates winners and losers and intergenerational redistribution as observed in Fig. 14. It is clear that cohorts that start working in the second part of the century would benefit from the pro-natalist policy. Of course, these cohorts are not born yet, which illustrates the problem for the Turkish government in translating natalist rhetoric into policies that would be endorsed by current generations.[19]

4.2. Other scenarios

The main objective of this paper is to understand the impacts of a higher fertility scenario, not to study alternative policies that could be introduced to face the eventual challenge of ageing in Turkey. We believe, however, that this will soon become an active field of research in Turkey. Here, for pure comparison purpose, we simply illustrate the impact of a pension reform that would lower the benefit rate from 67% to about 50% (relative to the pre-reform medium fertility scenario).[20] As shown in Fig. 15, such a reform would sustain GDP per capita at higher levels (relative to both the pre-reform medium fertility scenario and the high fertility scenario). The equilibrium contribution rate (Fig. 16) would eventually increase to 29% just as in the high fertility scenario, instead of 42% in the medium fertility scenario. Note again the similarity with results given in Börsch-Supan et al. (2006) where a reform for Germany that lowers pension benefit rates from 70% to 50% is consistent in their model with an equilibrium contribution rate of 29%. Smaller increase in contribution rates and lower benefit rates under this reform imply that households will increase their own saving rates, which stimulates further national saving and investment, leading to beneficial impacts on GDP per capita with respect to the pre-reform medium fertility variant.[21] This reflects the discussions held in most OECD countries related to moving out of PAYG systems towards mix or fully funded pensions plans where households

[19] In order to address efficiency issues, we could assume that the government pays lump-sum transfers to current and future losing age groups so as to make them as well off in the pro-natalist scenario (as in the medium variant scenario). The deficit generated could then be redistributed across all future winning age groups in a way so that they all face the same compensating variation. This unique compensating variation could thus be interpreted as a measure of efficiency, where a positive variation would indicate a Pareto improving high-fertility scenario after compensation.

[20] Objectively, this policy should not be applied immediately because this will directly affect the seniors who are now retired and are expecting a specific (defined) benefit rate.

[21] Furthermore, in an endogenous labour supply model we also capture the household's decision to supply more work and reduce leisure, as lower contribution rates under the pension reform implies an increase in net wage rate.

must save to finance their own pensions instead of relying only on intergenerational transfers. Besides efficiency issues, the merits of such reforms would need to be evaluated with respect to the intergenerational redistribution and inequities that they generate. For example, the welfare of the elderly is reduced due to lower benefit rates, while younger and future generations could derived substantial benefits as shown in Fig. 17.[22]

Up to now we assumed that the higher fertility rates and the ensuing baby boom had no impact on female labour market participation rates, no impact on the quality of education, and no impact on the unemployment rate. If those channels were introduced, it could be argued that the high fertility variant would have a larger negative impact on living standards than those observed in Fig. 8.[23] On the other hand, Da Rocha and Fuster (2006) and Martinez and Iza (2004) show that it is possible to increase both birth rates and female employment if the government invests in child care facilities. Yet, given the very traditional role played by women in Turkey and the conservative views and policies of the AK Party (as illustrated for example by the Health Minister quote given in the Introduction), it is doubtful that these policies, even if desirable, can be developed even in the medium term horizon, to target higher female participation rates.

Finally, note that the Turkish government has never considered immigration as a policy option to increase its working age population. Besides traditional objections based on the European experience (e.g., low-skill immigration, poverty, and social exclusions), Turkey is viewed as a platform of transitional immigration whose ultimate destination is Europe (Yüksel, 2013). Even the Syrian war and its flow of refugees into Turkey might probably not change this policy in any fundamental way.[24] Indeed, Turkey has resisted granting Syrians official refugee status, labelling them as 'guests' who enjoy temporary protection status. By doing this, the Turkish government believed that it would not be obligated to extend the international standards of protection to refugees as defined by the UNHCR, which provides a legal basis for refugees to stay in the country and ensure that they won't be forced to return to their home country. Furthermore, under current Turkish laws, temporary protection status and new legal reforms do not allow Syrians the right to work, which makes them vulnerable to exploitation and abuse.[25] In conclusion, even if immigration policies are sometimes proposed as a way to address the eventual demographic challenge, it is at this stage too early to assume that Turkey's authorities will go beyond hospitality and eventually grant legal immigrant status to the refugees. In fact, we argue that the Syrian crisis could influence a majority of Turks to favour more restrictive immigration policies in the future and that many Syrians will continue to consider Turkey as just a transit stage to Europe because their lives and material conditions in Turkey is hard, even if Europe and Turkey reached an agreement to prevent or reduce the flow of Syrians to Europe.

5. Conclusion

A higher fertility rate is unlikely to solve, by itself, the fiscal and social security pressures of ageing and will likely not receive the support of the current population of Turkey on the basis of a purely economic welfare analysis (unless a redistribution scheme from future 'winning' to current 'losing' generations was considered). So how could we further rationalize the pro-natalist rhetoric of the Turkish government? Let us just mention here that economists have perhaps failed to notice that natalist rhetoric and incentives, regardless of their real motive and efficiency, fall in the category of public choice and that government decisions are themselves affected by the self-interests of politicians. Instead of targeting directly the long-run financial viability of pension schemes and health care systems, the natalist rhetoric and policies may perhaps be interpreted as conservative and political demography arguments made by the current Turkish government and the AK (Justice and Development) Party. Georges and Seçkin (2016b) discuss this in details, but briefly, here, let us mention three arguments. First, the AK Party has very traditional and conservative views on the proper role of women in a society, as evidenced through recurrent public interventions of AK members (e.g., the Health Minister quotation in the Introduction on the role of women as mothers and their "career of motherhood"). Second, the fertility gap between Turkish and Kurdish populations within Turkey seems to be of concern to some politicians and to Erdoğan who, in 2010, argued (rather questionably) that Kurds could become a majority in Turkey by 2038. Third, a higher population growth and an increase in the overall population and relative economic size of Turkey is seen by some politicians to have political consequences for the future destiny of the Turkish nation and the role of Turkey as a regional hegemon in the Middle East. By continually referring to demographic grandeur and by evoking, for today's Turks, the glories of their ancestors through famous historical dates (such as the Manzikert battle of 1071 when the Seljuk Turks decisively defeated the Byzantine Empire), newly-elected President Erdoğan instils in the population a sense of pride, even a regional hegemony ambition, while hoping to capitalize on this during key elections.[26]

Recent pro-natalist rhetoric and policies in Turkey seem to reflect the government's bias for conservative policies and political demography at, potentially, the expense of the economic well-being of its current population. However, the time it takes for a country to move from the minor to the major demographic leagues is measured in generations. As noted by McNicoll (1984), "while vague ambitions of demographic grandeur may play a certain part in governing the direction of a nation's population policy, the larger roles are likely to be played by considerations of shorter-run population effects on relative power. These latter effects are overwhelmingly mediated through the economy." Given the economic cost for current cohorts, direct and indirect appeals to arguments in favour of an enhanced influence of Turkey in its geopolitical region (however well received among some segments of the Turkish

[22] If the pension reform is implemented so as to ensure that the current retired generations continue receiving the pre-reform benefit rates, then the negative welfare impact will fall more heavily on the current generations of workers as they continue paying high contributions for the elderly and, at the same time, contribute more to their own pension funds.

[23] The labour force participation of women is likely to fall immediately when some of them decide to take care of their larger family instead of working, reinforcing the effect described in the text. Furthermore, as underlined by de la Croix (2013), pro-natalist policies may well have the opposite impacts of Malthusian population control policies, that is, they may expand the fertility of the poor and thus increase the number of children from poor parents. Through the quantity-quality trade-off (Becker and Lewis, 1973) poor parents with more children will have little choice but reduce the quality of the education of their children and therefore their chance to become skilled. Thus, subsidizing birth has the same effect as taxing education and eventually tends to increase poverty and inequality. This makes the rich richer and with fewer highly educated children, while the poor are poorer and with many uneducated children. Also, once these children have grown up, there is yet another negative impact on the labour market participation. Lesser skilled people (due to the channel above) have lower participation rates. In fact, when unemployment is already high, the participation of the baby boomers in the labour force may just be an increase in the unemployment level of the less educated segment of the society. Finally, average human capital is kept low by the mass of young poorly educated adults from poor family, with damageable impact for average growth of the economy.

[24] Since the Syrian war began in March 2011, Turkey hosts around 1.5 million Syrian refugees (January 2015) and, according to the UNHCR, the number of refugees and asylum-seekers in Turkey is expected to rise to nearly 1.9 million, including 1.7 million Syrians by the end of 2015. See the 2015 UNHCR country operations profile for Turkey at: www.unhcr.org.

[25] Syrians have already become an exploited underground labour force, as evidenced with falling wages for workers in industries such as construction, textile manufacturing, heavy industry, and agriculture (Kirişci, 2014). Also, according to a recent report (Amnesty International, 2014), job competition and emergence of violence and higher crime rates in cities with high concentrations of Syrians are such that local people increasingly feel that refugees have outstayed their welcome.

[26] Since 2002, Erdoğan has won three consecutive elections and served as Prime Minister for three mandates. In 2014, Erdoğan won the presidential election at universal suffrage. This was the first presidential election in Turkey to be held nationally rather than by decision of members of parliament. The ultimate aim of Erdoğan is to transform the Parliamentary regime into a Presidential regime with a much more influential role for the President.

population) seem unlikely to affect significantly the fertility choices of families.

The benchmark model presented here is a closed economy model.[27] Georges and Seçkin (in press) show in a multi-country model that Turkey might benefit from the unsynchronised pattern of ageing across the world by doing some trade diversification away from older ageing countries towards younger ones. Much work remains to be done to ensure a smooth demographic transition in Turkey. First, Turkey is still under a period of demographic dividends thanks to the historical decrease in fertility rate. The total dependency ratio will continue to decrease up to 2025. It is a period when Turkey should be able to make significant investments in education, research, and infrastructure, before the demographic window of opportunity closes. The objective is to be in a better position to deal, later on, with the ageing problem and to avoid the backlash by younger people disillusioned with their economic prospects. By increasing the fertility rate now, Turkey would basically eliminate this short period of remaining demographic dividends.

Second, as shown in this paper, the projected contribution rate required to finance pension benefits, albeit smaller under the high fertility variant, would reached an unsustainable level at the end of the century in both scenarios. Hence, a high fertility scenario is not a solution to the pension problem that Turkey will experiment during the 21st century. In fact, as mentioned in the Introduction, and partly confirmed by the simulation results, if the Turkish government was serious about the ageing problem and the sustainability of pension plans, then social security reforms, not fertility policies, should be re-examined (including reduction in pension benefit rates, postponement of the eligible retirement age, shifting from defined benefit to defined contribution rates, and shifting to partially- or fully-funded pension schemes). More research should be done to analyse the efficiency and intergenerational redistribution of these reforms, including the Turkish pension reform of 1999 and Law 5510 that have been introduced to postpone the eligible retirement age (see Şirin and Janssen, 2013, for a critical assessment). In this perspective, we emphasize that the current analysis in this paper abstracted from productivity growth in part because technical progress projections are typically much less reliable than demographic projections. However, productivity growth might be more important than demographics when forecasting the economic paths of economies. Furthermore, when analysing pension reforms, Song et al. (2015) remind us that mechanically transposing policy advices from mature to developing economies or emerging economies might be misleading. Although a fully-funded system may be preferred to a pay-as-you-go system, in fast-growing societies with high wage growth, however, a draconian shift would imply dispensing with a powerful institution that redistributes resources from richer future generations to poorer current generations.

In a future research, we also plan to analyse the trade-off between higher fertility rates and the quality of education, and its consequence on quality-adjusted aggregate labour supply and output per capita. For this, we will use a recently developed version of the model that, beyond the current assumption of skill-level by ages, explicitly introduces skill-level by type of workers.

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[27] As long as the focus of the analysis is mainly on the difference between paths for endogenous variables across scenarios, then the hypothesis of a closed economy will have little impact on the results. For example, it is reasonable to expect that GDP per capita paths would be slightly above what they are currently in the paper as a result of the opening of the economy [Charts 15 to 20 in Fougère and Mérette (1998) suggest that this difference might be small]. But the difference between the medium and high fertility paths would remain approximately the same under closed or open economy frameworks and the qualitative message of the paper would remain unchanged.

Appendix A. TOLGAGEM: list of equations, variables and parameters

A.1. Production sector

$$Y_{j,\tau} = A_{j,\tau} K_{j,\tau}^{\alpha_j} L_{j,\tau}^{1-\alpha_j}, \quad 0 < \alpha_j < 1, \quad j \in J = \{\text{TURKEY}\} \tag{1}$$

$$re_{j,\tau}/P_{j,\tau} = \alpha_j A_{j,\tau} (K_{j,\tau}/L_{j,\tau})^{\alpha_j - 1}; \quad P_{j,\tau} = 1 \ \text{(Numéraire)} \tag{2}$$

$$w_{j,\tau}/P_{j,\tau} = (1-\alpha_j) A_{j,\tau} (K_{j,\tau}/L_{j,\tau})^{\alpha_j} \tag{3}$$

A.2. Household behaviour

$$U_j = \frac{1}{1-\theta_j} \sum_{k=0}^{16} \left\{ \left(\prod_{k=0}^{k} \frac{SR_{j,t+k,g+k}}{\left(1+\rho_j\right)} \right) \left((Con_{j,t+k,g+k})^{1-\frac{1}{\sigma i_j}} + \gamma a_{j,g+k} (TLeis_{j,t+k,g+k})^{1-\frac{1}{\sigma i_j}} \right)^{\frac{1-\theta_j}{1-\frac{1}{\sigma i_j}}} \right\} \tag{4}$$

$$\begin{aligned} HA_{j,\tau+1,\gamma+1} = 1/SR_{j,\tau,\gamma} \Big\{ & \left(1-\tau x_{j,\tau}^{L} - Ctr_{j,\tau}\right) Y_{j,\tau,\gamma}^{L} + \left[1 + \left(1-\tau x_{j,\tau}^{K}\right) ri_{j,\tau}\right] HA_{j,\tau,\gamma} \\ & + Pens_{j,\tau,\gamma} - \left(1+\tau x_{j,\tau}^{C}\right) Con_{j,\tau,\gamma} \Big\} \qquad \tau = t+k; \quad \gamma = g+k; \quad k = 0, \ldots 16. \end{aligned} \tag{5}$$

$$\begin{aligned} \sum_{k=0}^{k=16} \Bigg\{ & \frac{\prod_{k=0}^{k} SR_{j,t+k,g+k}}{\prod_{\tau=t}^{t+k} \left[1 + \left(1-\tau x_{j,\tau}^{K}\right) ri_{j,\tau}\right]} \Big[Y_{j,t+k,g+k}^{L} \left(1-\tau x_{j,t+k}^{L} - Ctr_{j,t+k}\right) \\ & + Pens_{j,t+k,g+k} - \left(1+\tau x_{j,t+k}^{C}\right) Con_{j,t+k,g+k} \Big] \Bigg\} = 0 \end{aligned} \tag{6}$$

$$\begin{aligned} Y_{j,\tau,\gamma}^{L} &= w_{j,\tau} EP_{j,\gamma} LS_{j,\gamma} PART_{j,\gamma} (1-Leis_{j,\tau,\gamma}), 0 \le Leis_{j,\tau,\gamma} \le 1; \tau \\ &= t+k; \quad \gamma = g+k; \quad k = 0 \ldots 16. \end{aligned} \tag{7}$$

$$EP_{j,kw+1} = c + (\lambda)(kw+1) - (\psi)(kw+1)^2, \quad c, \lambda, \psi \ge 0 \quad kw = 0, \ldots 8 \tag{8}$$

$$\frac{Leis_{j,\tau,\gamma}}{Con_{j,\tau,\gamma}} = \left(\frac{\gamma a_{j,\gamma} \left(1+\tau x_{j,t,\tau}^{C}\right)}{\text{ResWage}_{j,\tau,\gamma}} \right)^{Sigi_j} \tag{9}$$

$$\frac{Con_{j,t+k+1,g+k+1}}{Con_{j,t+k,g+k}} = \left[\frac{1 + \left(1-\tau x_{j,t+k+1}^{K}\right) ri_{j,t+k+1}}{1+\rho_j} \frac{1+\tau x_{j,t+k}^{C}}{1+\tau x_{j,t+k+1}^{C}} \right]^{\frac{1}{\theta_j}} \left(\frac{V_{t+k+1,g+k+1}}{V_{t+k,g+k}} \right) \tag{10}$$

$$V_{j,\tau,\gamma} = \left[1 + \gamma a_{j,\gamma}{}^{Sigi_j} \text{ResWage}_{j,\tau,\gamma}{}^{1-Sigi_j}\right]^{\frac{Sigi_j - 1/\theta_j}{1-Sigi_j}} \tag{11}$$

$$\text{ResWage}_{j,\tau,\gamma} = \left(1-\tau x_{j,\tau}^{L} - Ctr_{j,\tau}\right) w_{j,\tau} EP_{j,\gamma} + mu_{j,\tau,\gamma} \tag{12}$$

$$mu_{j,\tau,\gamma}(1-Leis_{j,\tau,\gamma}) = 0 \tag{13}$$

A.3. Government sector and pension plans

$$\begin{aligned} Bond_{j,\tau+1} - Bond_{j,\tau} = {} & Gov_{j,\tau} + GovE_{j,\tau} + GovH_{j,\tau} + ri_{j,\tau} Bond_{j,\tau} - \sum_{\gamma=g}^{g+k} Pop_{j,\tau,\gamma} \\ & \left\{ \tau x_{j,\tau}^{C} (Con_{j,\tau,\gamma}) + \tau x_{j,\tau}^{L} (w_{j,\tau} EP_{j,\gamma} LS_{j,\gamma}) + \tau x_{j,\tau}^{K} (ri_{j,\tau} HA_{j,\tau,\gamma}) \right\}; \end{aligned} \tag{14}$$

$$GovH_{j,\tau} = \sum\nolimits_{\gamma=g-4}^{g+ka} Pop_{j,\tau,\gamma} HEAC_{j,\gamma} \;\; ; \;\; ka = -4, \ldots 16 \tag{15}$$

$$GovE_{j,\tau} = \sum\nolimits_{\gamma=g-4}^{g+ka} Pop_{j,\tau,\gamma} EDUC_{j,\gamma} \;\; ; \;\; ka = -4, \ldots 16 \tag{16}$$

$$Gov_{j,\tau} = TPop_{j,\tau} GEPC_j \tag{17}$$

$$\begin{aligned} Pens_{j,\tau,g+kr} = {} & PensR_j \times \frac{1}{9} \sum\nolimits_{kw=0}^{8} w_{j,\tau-kr+kw,g+kw} \\ & \times EP_{j,g+kw} LS_{j,g+kw} PART_{j,g+kw} \left(1 - Leis_{j,\tau-kr+kw,\gamma+kw}\right); kr = 9 \ldots 16 \end{aligned} \tag{18}$$

$$\sum\nolimits_{kr=9}^{kr=16} Pop_{j,\tau,g+kr} Pens_{j,\tau,g+kr} = Ctr_{j,\tau} \sum\nolimits_{kw=0}^{8} Pop_{j,\tau,g+kw} Y^{L}_{j,,\tau,g+kw} \tag{19}$$

A.4. Investment and asset returns

$$Kstock_{j,\tau+1} = Inv_{j,\tau} + \left(1 - \delta_j\right) Kstock_{j,\tau} \tag{20}$$

$$ri_{j,\tau} = re_{j,\tau} - \delta_j \tag{21}$$

A.5. Market and aggregation conditions

$$Y_{j,\tau} = \sum\nolimits_{\gamma=g}^{g+k} Pop_{j,\tau,\gamma} Con_{j,\tau,\gamma} + Inv_{j,\tau} + Gov_{j,\tau} + GovH_{j,\tau} + GovE_{j,\tau} \tag{22}$$

$$L_{j,\tau} = \sum\nolimits_{\gamma=g}^{g+k} Pop_{j,\tau,\gamma} LS_{j,\gamma} EP_{j,\gamma} PART_{j,\gamma} \left(1 - Leis_{j,\tau,\gamma}\right) \tag{23}$$

$$K_{j,\tau} = Kstock_{j,\tau} \tag{24}$$

$$\sum\nolimits_{\gamma=g}^{g+k} Pop_{j,\tau,\gamma} HA_{j,\tau,\gamma} = Kstock_{j,\tau} + Bond_{j,\tau} \tag{25}$$

$$\begin{aligned} & \underbrace{\left(\sum\nolimits_{\gamma=g}^{g+k} \mathrm{Pop}_{j,\tau+1,\gamma} HA_{j,\tau+1,\gamma} - \sum\nolimits_{\gamma=g}^{g+k} \mathrm{Pop}_{j,\tau,\gamma} HA_{j,\tau,\gamma}\right)}_{\text{Private Saving}} \\ & \quad - \underbrace{\left(\mathrm{Bond}_{j,\tau+1} - \mathrm{Bond}_{\tau,t}\right)}_{\text{Public Dissaving}} = \underbrace{\left(\mathrm{Kstock}_{j,\tau+1} - \mathrm{Kstock}_{j,\tau}\right)}_{\text{Domestic Investment}} . \end{aligned} \tag{26}$$

A.6. Demographic process

$$Pop_{j,\tau,g+ka} = \begin{cases} Pop_{j,\tau-1,g+ka} BR_{j,\tau-1} & \text{for } ka = -4 \\ Pop_{j,\tau-1,g+ka-1} \left(SR_{j,\tau-1,g+ka-1}\right) & \text{for } ka \in [-3, \ldots, 16]. \end{cases} \tag{27}$$

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