BEYOND CRISIS ADJUSTMENT:

Investigation of Fiscal Policy Alternatives in an OLG Model of Endogenous Growth for Turkey

Ebru Voyvoda
Bilkent University, Ankara
voyvoda@bilkent.edu.tr

Erinc Yeldan
Bilkent University, Ankara
yeldane@bilkent.edu.tr

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ABSTRACT

The purpose of this paper is to investigate the fiscal policy alternatives on domestic debt management and public expenditures on education, cohort welfare, and growth for the Turkish economy. We exclusively focus on the increased burden of debt servicing on public funds for investments in human capital formation and the constraining effects of the mode of debt financing on the economy's capability to generate investments in physical capital. We utilize a model of endogenous growth in the overlapping generations (OLG) tradition with intertemporally optimizing agents and open capital markets, roughly reflecting the Turkish economy in 1990s. We examine the macroeconomic effects of the current IMF-led austerity program driven by the objective of attaining primary fiscal surpluses and illustrate the ruinous effects of constrained human capital investments due to insufficient funds to public education, and constrained real production activities due to the current mode of financing of domestic debt. We then examine various taxation alternatives to mitigate the reductions in the availability of public funds to reproducible factors of production. Our results suggest that the current fiscal program based on the primary surplus objective suffers from serious trade offs on growth and fiscal targets, and that an alternative public expenditure program supported by tax reform over wealth income is likely to produce superior economic performance.

Key words: *Turkey, fiscal policy, IMF austerity, OLG models, endogenous growth*

1. Introduction

Would it be much of an exaggeration to identify the 1990s for Turkish economy as the "lost decade"? The rate of growth fluctuated severely as the economy was trapped with cycles of growth and crisis. The inflation rate floated around the plateau of 65-70% in the first half and 80-90% in the second half. The nominal interest rates stayed above 100% almost throughout the decade. Drastic enough itself, the borrowing requirement (PSBR) as a ratio to GNP, which averaged around 4.5% during 1981-88, rose over 10% in 1991, and stayed around 9.5% during the 90s. The increase in PSBR was caused by the rapid escalation of the domestic debt whose cost expeditiously

reached to unprecedented levels. Interest on domestic debt, which was on the order of 2.4% of GNP in 1990, challenged almost all of the public disposable income by the end of 1990s. The underlying characteristic of the domestic debt management was its extreme short-termism. Net new domestic borrowings, as a ratio of the stock of domestic debt continued at a pace of above 50 per cent for most of the decade. Thus, the public sector was trapped in a short term rolling of debt, a phenomenon characterized as *Ponzi-financing* in the fiscal economics literature.[1,2]

The experience of 1990s in Turkish economic history has pointed its end by the initiation of the extensive dis-inflation program in December 1999. Aided with the supervision and technical support of the IMF, the program relied on *exchange rate based* disinflation and monetary targets. The program further entailed a series of austerity measures on fiscal expenditures and set specific targets for the balance on non-interest, primary budget. Yet, just eleven months after launching the disinflation program Turkey experienced a severe financial crisis in November 2000, and finally declared the surrender of the pegged exchange rate system on February 2001, thereby letting the exchange rates to free float. The stock markets, employment, production, finance, and the Turkish lira went into a downward spiral and the gross domestic product shrunk by 7.4 per cent over 2001, the worst performance since World War II. As the resumption of normalcy seemed distant and almost out of reach, relations between capital, social groups and the state became openly conflictual and the policy making process was paralyzed at a point which fell short of constraints required by the IMF. In response to the crisis, and in order to reinvigorate the now-stalled free market reforms, a new standby agreement was signed with the IMF. [3]

The 2001 program, hailed as the Transition to the Strong Economy Program (TSEP)[4] included the standard IMF austerity measures: drastic cuts in public spending, monetary contraction, flexible exchange rate management, and reductions in wage remunerations and in

[1] See Akyüz and Boratav (2002), Boratav, Yeldan and Köse (2002), Yeldan (2002), Ertuğrul and Selçuk (2001), Metin, Voyvoda and Yeldan (2001), Cizre-Sakallıoğlu and Yeldan (2002 and 2000), Kepenek and Yentürk (2000), Uygur (1996), and Ekinci (1998) for a thorough overview of the post-1990 Turkish macroeconomic history. For the deterioration of fiscal balances see San (2002), Konukman, Aydın and Oyan (2000), Özatay (1999), Türel (1999), Selçuk and Rantanen (1996), Atiyas (1995), and Zaim and Taşkın (1997).

[2] Kletzer and Buiter (1997:2) define *Ponzi-finance* as, "a government engages in Ponzi finance if, after some date it never runs a primary surplus despite having a positive debt stock of debt outstanding. Equivalently, the value of additional debt issued in each period is at least as the interest payments made on the debt outstanding at the beginning of that period, or the growth rate of debt each period is equal to or greater than the one period interest rate on public debt"

[3] The underlying elements of the disinflation program and the succeeding crises are discussed in detail in Akyüz and Boratav, 2002; Alper and Öniş (2002); Ertuğrul and Yeldan (2002); Yeldan (2002); Ertugrul and Selçuk, 2001; Gençay and Selçuk (2001), Yentürk, 2001; Alper, 2001; and Uygur, 2001.

[4] For the official document of the Transition the Strong Economy program, see Undersecretariat of Treasury, *http://www.treasury.gov.tr*

public employment. In particular, the TSEP has targeted a primary fiscal surplus of 6.5% to the GNP every year until 2004, and aimed at reducing the outstanding net stock of domestic debt to 40.9%, and that of foreign debt to 40.3% as a ratio of GNP by the end of that year. It has foreseen a real rate of growth of 3% for 2002, and 5% for 2003 and 2004 and assumed an operative nominal rate of interest of 69.6% for 2002, 46% for 2003 and 32.4% for 2004.[5]

Given the experience of 1990s, and the blurred picture ahead of the Turkish economy, we believe that it is timely to study the welfare and growth implications of Turkey's recent process of transformation of its macro and fiscal structure and investigate the trade offs over inter and intra-generational distribution of wealth, accumulation, and growth. Thus, the primary purpose of this study is to investigate the effects of fiscal policies of debt management and financing of productive government spending on welfare and growth in a debt constrained economy, Turkey.

We attempt to address these issues in the framework of overlapping generations, small open economy model of endogenous growth, to study the effects of fiscal and social policies of the government under the constraints of debt servicing and a binding fiscal gap. The model developed has an OLG structure with 15 generations (12 of which are in the work force, while the rest are retired) at any moment, optimally choosing lifetime consumption and saving paths. The growth process is characterized by the accumulation of both physical and human capital. Public spending on accumulative factors of production as well as the society's endowment of social capital contribute to the formation of productive factors.

We focus on three sets of issues: *First*, the model is calibrated to generate the approximate macro-economic panorama of 1990s for the Turkish economy. We then analyze the increased burden of debt servicing on public funds for investments in productive factors and the resulting effects on aggregate output, consumer welfare and growth, and the constraining effects of the mode of debt financing on the economy's capability to generate investment in physical capital. *Next*, we try to view the path of the model economy under two distinct fiscal programs, focusing on macro variables such as production, investment and growth as well as the welfare across generations.

[5] The targeted end-of-year inflation of the wholesale prices was set at 31%, 16.2%, and 12% for the same years, respectively. Thus, the Program implicitly assumed a significant real rate of interest through the time horizon of its implementation. See also the web site (*www.bagimsizsosyalbilimciler.org/iktisat.htm*) of the Association of the Independent Social Scientists –Economists' Group (Bagimsiz Sosyal Bilimciler-Iktisat Grubu) for a set of critical assessments on the 2000-2001 economic policies. In particular, a detailed evaluation of the so-called *Transition to the Strong Economy Program* (announced in 15 May, 2001) is provided by the *Association* in July, 2001.

In the first policy simulation exercise, we study the specifics and the expected macro economic consequences of the current austerity program, TSEP, as implemented under close IMF supervision. The distinguishing characteristic of the simulation is the attainment of primary surplus targets as set out in the official TSEP and the consecutive Letter of Intend documents that followed. As an alternative policy environment, we next simulate a fiscal expenditure-*cum*-tax reform strategy. Here, rather than focusing on primary fiscal surpluses, the objective is to implement a selective tax reform on wealth incomes and to support an increased public expenditure program addressed to finance public investments on education. Our results suggest that the current fiscal program based on the primary surplus objective suffers from serious trade offs on growth and fiscal targets, and that an alternative public expenditure program supported by tax reform over wealth income is likely to produce superior economic performance.

The paper is organized as follows: in the next section we provide an overview of the endogenous growth literature destined over human capital (education)-driven specifics, and highlight the recent advances in the OLG modelling literature as pertain to our analysis. The algebraic set up of the model is introduced in section 3. In section 4, we first provide a broad overview of the Turkish economy over the 1990s. Then we highlight the details of our calibration strategy to track the macro economic performance of the Turkish economy in that period. We carry out our policy simulation exercises in section 5. Section 6 summarizes and concludes.

2. Antecedents of the Human Capital-Driven OLG Framework

Recent advances in the "new growth theory" identify and emphasize the role of human capital and its rate of accumulation as the key determinants in explaining disparity across countries in macro-variables such as productivity, income per capita and the rate of growth.[6]

As recent models provide evidence regarding human capital as one of the key determinants of economic growth, following the theoretical contributions of Uzawa (1965) and Lucas (1988), the process of accumulation of human capital through the

[6] Barro and Sala-i Martin (1995) point to the significance of both the stock of human capital (part of which is the school enrolment rates and the government expenditures on education (as a ratio to GNP) as important determinants of economic growth. Among the studies that document the importance of human capital in the context of conditional convergence and persistent economic growth are Romer (1989), and Barro(1991). More recent surveys include Temple (1999) and Ahn and Hemmings (2000).

education system, both the private and public funds to education and the role of government policy have served as interesting topics for many researchers of theory and empirics of growth.[7]

In the Lucas (1988) model, the level of output is a function of the stock of human capital, which is generated as a result of a recursive production function on itself. The embedded externality emanating from accumulation of educated labor force (human capital) serves as the engine of growth. The significance of the educational funds to generate human capital and the provision of such funds to education investments within a large portion of countries, have increased the awareness of education as the ultimate engine of growth, inviting many researchers to analyze the associated welfare effects.[8]

From such a perspective, educational attainment is also regarded as one of the key factors influencing the distribution of income both across households and labor categories. On the one hand, educational attainment and individual's stock of human capital formation enable its owner to obtain better-paying jobs, more bargaining power and flexibility in the job market. On the other hand, initial distribution of wealth and household income have a direct impact on the family's capacity to invest in its offspring's human capital formation, as most of the investments in education are made when agents are young. This two-way causality between income distribution and investment in human capital signifies that families who are on the bottom of the strata of income ladder and are dependent on subsistence earnings, would likely to be caught in a low-education, low-income trap. Hence, the manner in which the society stratifies will automatically determine who has access to education, what skill levels are to be accumulating, and, therefore, the patterns of income distribution.

Under these conditions, provision of public funds to education and the government's ability to invest in education and human capital formation play a crucial role in both attaining greater equality and in promoting growth.[9] Such observations

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[7] A rigorous survey can be found in Aghion and Howitt (1998, Ch.10). See also Bils and Klenow (2000), Romer (2000) and Temple (2001a, 2001b).

[8] Educational spending is one of the largest expenditure categories in the developed economies. In US, the average education expenditures is just under 7% of GDP, 55% of which is provided by government enrolling 89% of the school children. (Bowles, 1999) Public and private expenditures on educational institutions accounts for over 6% of the collective GDP of the OECD member countries. (Temple 2001a)

[9] Perhaps the best known paper on the subject of public education is Stglitz (1974). Among other seminal references are Glomm and Ravikumar (1992), St. Paul and Verder (1993), Fernandez and Rogerson (1995).

bring issues of human capital formation and optimal design of public policies in terms of investments in education, fiscal debt management, and the inter-household and inter-generational burden of taxation into forefront of analysis.

The framework used in this study focuses on the impact of government policies on capital formation, welfare, and growth into a finite-horizon framework as emphasized by Jones and Manuelli (1992). In their study, they examine the conditions under which endogenous growth becomes possible within finite-lifetimes, and highlight the importance of redistributive policies that affect the rate of economic growth.

Because we aim at developing a model in which main features of the Turkish economy through 1990s are taken into account, and our interest is mainly on the inter and intra-generational distribution effects of government policies, we find it appropriate to work on a framework of finite-lifetimes. The OLG model is a dynamic structure within a general equilibrium framework in which agents' demand functions are based on micro-foundations. The OLG framework has traditionally based the process of accumulation of wealth on Modigliani's "life cycle theory". Agents save and dis-save at different stages of their lives to smooth consumption. The characteristics of the OLG model makes it possible to study a large set of economic issues including aggregate implications of life-cycle savings by individuals, effects of redistributive government policies on capital formation and economic growth, welfare of different generations, effects of both intentional and unintentional bequest motives, among others. Moreover, the OLG structure characterizes generations not only by their age, but also by their wealth-situation. Each period, agents will be at different stages of their lifetime planning and therefore, will be affected differently by any policy action taken by the government.

Blanchard (1985) carries the argument of debt management into finite horizons. Jones and Manuelli (1992) highlight the role of government as an income re-distributor in an OLG framework which allows for persistent growth. Likewise, Buiter and Kletzer (1991, 1995) use OLG models to present the theoretical analysis of fiscal policies.

Ni and Wang (1994) and Glomm and Ravikumar (1997), both under the assumption of finite lifetimes, let public spending on education directly enter the production function of human capital. Ni and Wang (1994), adopt the theoretical framework of Becker and Barro (1988) and Becker Murphy and Tamura (1990), and

examine the role of public expenditures on human capital formation. In their model, public spending on education is financed by income tax. Glomm and Ravikumar (1997), in turn, focus on the growth effects of productive government spending and growth-maximizing level of taxation in a dynamic general equilibrium model.

The main reference to large-scale OLG models is that of Auerbach and Kotlikoff (1987). In this seminal work, growth is exogenous. Yet, by building up a model with 55 overlapping generations, the authors look at a large set of fiscal issues including deficit finance, changes in the level and timing of government spending, choice of tax base, social security and demographic changes. The last two issues, in particular have been the subject of most quantitative studies in OLG framework including Auerbach et al (1989), Hviding and Mérette (1998), and Fougère and Mérette (1999).

Hviding and Mérette (1998) and Fougère and Mérette (1999) investigate the macroeconomic effects of pension reforms in the context of demographic transitions. Both studies focus on the aging problem in OECD economies and look over for pension funding alternatives. The latter model extends the former by employing endogenous growth features under human capital accumulation. Both models in Lau (1998) and Jensen at al (1998) are built for the Danish economy. Lau (1998) analyzes how capital and labor income taxes may affect human capital accumulation, employment, retirement and welfare. Jensen et al (1998) simulate their model with imperfect competition in the labor market and a public pension system to investigate the macroeconomic and distributional effects of a policy experiment involving cuts in the capital income tax rate.

In an endogenous growth model where savings take place in the form of both physical and human capital, Mérette (1998) investigates the effects of alternative debt-reduction policies. This model represents a small open economy calibrated to match Canadian data. His analysis investigates how transferring the government solvency burden of future generations to current generations affects growth and inter-generational welfare. The simulations show that growth can vary significantly during the transition from a high to a low debt-GDP ratio. GDP rises in the long run and in general, old generations suffer small welfare deteriorations, while welfare of future generations rises significantly.

More recently, Mérette (2000) takes a further step of including a financial sector into a large-scale model of finite horizons, and in an OLG general equilibrium model,

he studies the effects of confiscation of financial assets as occurred in the Collar Plan in 1990 in Brazil. Identifying the underlying mechanisms of the failure of this stabilization plan, Mérette suggests the need for fiscal reform to enlarge Brazil's fiscal base and enhance its tax administration in order to win inflation once and for all.

Thus, a more general aim of this study is to contribute to this literature by investigating the growth and welfare effects of fiscal policies of financing of public spending on education within the context of an OLG model of the Turkish economy. In the next section, we provide a brief overview of the salient features of our model.

3. The Algebraic Structure of the OLG Model

The model to trace the trajectory of the post-1990 Turkish economy is based on the macro-structure set out and discussed in detail in Köse and Yeldan (1994). The construction here can be regarded as a small open economy version of the one in Auerbach and Kotlikoff (1987). Here, labor supply is inelastic on the part of every individual. However, each individual entering the labor force is endowed with a given level of human capital through a human capital accumulation function. There are no intentional bequest motives.[10]

The economy consists of overlapping generations of finitely lived individuals who are assumed to have G periods to live, starting from the time they enter the workforce. During the first GW periods, the individual works, receives wage income and profits, which she divides between consumption, taxes from labor and capital income and savings. In the last $(G\text{-}GW)$ periods, the agent is retired and consumes her accumulation of assets. So, at any point in time, there are G overlapping generations in the economy, GW working, and $(G\text{-}GW)$ retired. Households are assumed rational, having perfect foresight.

The model incorporates features of endogenous growth through a human capital accumulation function where public spending on education enters directly as an argument.

There is a single production sector that behaves competitively. The single commodity is produced under a neo-classical production technology, using capital and

[10] No bequest motive either in the form of physical or human capital (education) is a strong simplification given the effect of intergenerational altruism on capital accumulation of the economy and given the behavior of a typical Turkish household.

effective labor. The commodity produced is consumed either by domestic households, or exported. The government generates revenues through direct taxation of both types of factor income, issues both domestic and foreign debt, and spends its income on purchases of goods, or investing in education.

There is an intermediary of capital accumulation and expenditures, which collects domestic and foreign savings as well as the interest on previously issued government debt, and disposes off its aggregate funds among investment demand of the production sector, interest payments on its domestic and foreign debt, and the public sector borrowing requirement. The intermediary in the current model has no independent objective function nor incentives for positive profits, and simply acts as a means of collecting and re-distributing the loanable funds of the economy.

The algebraic structure of the model is separated into several sets of equations relating to human capital accumulation, household behavior, production sector, government, capital intermediary, the foreign sector and the aggregation and equilibrium conditions. We discuss each of these sets in detail below.

3.1. Human Capital Accumulation

In what follows, subscript *t* stands for the time period and subscript *g* stands for the age group. The aggregate variables appear in capital letters while the variables at individual level come in small letters.

At any date *t*, $n_{1,t}$ individuals enter the workforce and the basic educational system endows each of these entrants with a human capital stock $h_{1,t}$ that is generated according to an accumulation function of the form:

$$(1) \qquad h_{1,t} = H(h_{1,t-1}, GE_{t-1})$$

where GE_{t-1} is public expenditures on education in period *t-1*.[11]

One way to interpret the sequence of human capital endowments is as follows: The time until an agent enters the workforce is the education period of learning and acquiring skills. During this education period, individuals accumulate human capital

[11] The generic formulation is adopted from Glomm and Ravikumar (1997). The existence of $h_{1,t-1}$ in the accumulation function embodies externality as pointed by Lucas (1988). Empirically, Borjas (1992) presents evidence for human capital externalities by showing that the average level of human capital of the previous generations positively affect the current generation's productivity level.

according to the learning technology given in Equation 1, by inelastically allocating their time to learning. The effect of GE_{t-1} here can be interpreted as an indicator of quality of the public schools.

Under the current setup, G is set to 15 and GW to 12; thus, there are 15 overlapping generations, 12 working and 3 retired at each point in time of the economy. Assuming that every agent enters the workforce at the age of 16, retires at the age of 63 and lives until 75, each period in the model can be regarded as 4 years. So, $g=1$ indicates the age group 16 to 19 years and $g=15$ indicates the age group 72 to 75 years.

Throughout the simulations, population growth rate is assumed zero, keeping the population of each generation constant at some $n_{g,t} = n$ for all (g,t). Each of the n agents entering the workforce at time t accumulates its human capital through the specification:

$$h_{1,t} = \delta h_{1,t-1} + \lambda GE_{t-1} \qquad (2)$$

where $(1-\delta)$ is the exogenous depreciation rate of human capital (skills) and λ measures the rate at which government spending on education enhances the human capital of an agent born at time t.[12] We shall call λ effective rate of human capital investment. λ is one of the calibrated parameters in the model. An agent, once endowed with her human capital entering the workforce, maintains that level throughout her lifespan.

3.2. Households

We work with a representative agent for each generation in the economy. Each individual, once born into working life, derives utility from consuming $cc_{g,t}$ units of consumption good when she lives her g^{th} period at time t. Domestic good and imports form the *consumption composite* along a convex isoquant yielding the consumer maximum level of satisfaction.

[12] This *Romeresque* specification of human capital accumulation constitutes the ultimate driving force of growth in the model. See Romer (1990 and 1992) for more exposition, and see Jones (1997) for a critical assessment of the human capital-led (R&D-driven) specifications of endogeneous growth.

Formally, an agent entering the workforce at time t is assumed to have preferences of the generic form:[13]

$$(3) \qquad U_t(cc_{1,t}, cc_{2,t+1}, ..., cc_{G,t+G-1}) = \sum_{g=1}^{G} \beta^{g-1} u(cc_{g,t+g-1})$$

Here, β is the discount factor, $0<\beta<1$, u is the current period utility function.[14]

Specifically, we use the following constant intertemporal elasticity of substitution (*CES*) type utility function:

$$(4) \qquad U = \frac{1}{1-1/\gamma} \sum_{g=1}^{15} \left(\frac{1}{1+\rho} \right)^{g-1} cc_{g,t+g-1}^{1-1/\gamma}$$

where ρ stands as the pure rate of time preference and γ is the intertemporal elasticity of substitution.

The optimization problem of the representative agent is subject to the physical wealth accumulation conditions. Each agent, following the education period enters the workforce in time t with zero level of initial physical assets and $h_{1,t}$ level of human capital. The current period budget constraint of a member of the workforce is given by:

$$(5) \qquad a_{g+1,t+g} - a_{g,t+g-1} = (1-\tau_i)[(1-\tau_w) w_{t+j-1} h_{g,t+g-1} + (1-\tau_r) r_{t+j-1} a_{g,t+g-1}] - c_{g,t+g-1}$$

where $a_{g,t}$ is the physical wealth asset of an individual of age g at time t, w_t is the effective wage and r_t is the interest rate. τ_i, τ_w, τ_r, and are tax rates on aggregate gross income, wages and profits, respectively. When an individual is a member of the active population, she inelastically supplies her labor endowment to production and allocates disposable income in consumption and saving. During the periods of retirement, she consumes her accumulation of assets.

Differentiating the household utility function with respect to $cc_{g,t}$ and subject to individual's lifetime budget constraint, yields the following first order (Euler) condition for consumption:

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[13] The period of education is assumed to bring no utility to the agent.

[14] Here, the utility function *U(c)* is continuously differentiable, strictly increasing, strictly concave and homothetic. It turns out that the homotheticity of U allows a balanced growth path under labor-augmenting technology. See Caballé (1998)

$$(6) \quad cc_{g+1,t+1} = \left(\frac{1 + r_{t+g}(1 - \tau r_{t+g})}{1 + \rho} \right)^{\gamma} cc_{g,t+g-1} \qquad g = 1,...,14$$

3.3. The Production Sector

Firms face competitive output and input markets to maximize profits. Non-negative quantities of the two factors of production, human capital (or efficiency units of labor) and physical capital can be varied costlessly. All firms are identical. The representative firm's production function exhibits non-increasing returns to scale in its two factors of production, increasing in its both arguments, strictly concave, twice continuously differentiable and satisfies Inada conditions. No depreciation is assumed on the part of physical capital. The good produced is either consumed in the domestic market or exported.

Specifically, the production technology is represented by a simple Cobb-Douglas form depending on physical capital and effective labor force.[15]

$$(7) \qquad X_t = AXK_t^{\alpha} L_t^{1-\alpha}$$

where X is the real output, AX is the technology-scale parameter, α is the capital income share, K is the stock of physical capital and L is the stock of effective labor. In equilibrium, L is given by the summation of human capital factor of each cohort, multiplied by the population over the working generations.

$$(8) \qquad L_t = \sum_{g=1}^{12} h_{g,t} n_{g,t}$$

Factor demands are obtained from profit maximization decision of the firms with:

$$(9) \qquad r_t = \alpha \, AXK_t^{\alpha - 1} L_t^{1-\alpha} \, PX_t$$

$$(10) \qquad w_t = (1-\alpha) AXK_t^{\alpha} L_t^{-\alpha} PX_t$$

[15] Cobb-Douglas function in a numerical model is regarded as a plausible specification. Stokey and Rebelo (1995), for instance, report that the elasticities of substitution in production are rather insignificant for the quantitative impact of fiscal experiments.

3.4. Government

Government may enter the economy in several ways including lump-sum transfers, public good expenditures, management of the pension system, and debt accumulation. Yet, in the current model the analysis is focused on productive vs. non-productive government spending. We hypothesize that the government spends on education of the young, levies taxes on wage and capital incomes, pays interest on its debt, and borrows to finance any excess of current spending over current revenue. The government's single period budget identity is given by:

$$(11) \quad BG_{t+1} - BG_t = r_t BG_t + GC_t + GE_t - T_t$$

where BG_t is the outstanding government debt and T_t is the total tax revenues of the government at time *t*. GC_t represents government non-education expenditures. Here GC_t and GE_t add up to total government expenditures, G_t.

It is assumed that the government has no other income than what it collects through general taxes and does not invest in physical capital.[16] The tax income of the government is determined as a function of proportional taxes on disposable income τ_i, labor income τ_w, capital income τ_r:

$$(12) \quad T_t = \tau_i \left[\sum_{g=1}^{12} (1-\tau_w) w_t h_{g,t} n_{g,t} + \sum_{g=1}^{15} (1-\tau_r) r_t a_{g,t} n_{g,t} \right] + \tau_w \sum_{g=1}^{12} w_t h_{g,t} n_{g,t} + \tau_r \sum_{g=1}^{15} r_t a_{g,t} n_{g,t}$$

3.5. The Intermediary

All the capital accumulation and expenditures in the economy are mediated through an artificial borrowing-lending structure called the intermediary. Here, the intermediary acts as an accounting identity which accumulates the loanable funds:

$$(13) \quad RI_t = SP_t + r_t BG_t + r_t K_t + SF_t$$

[16] We resort to this specification to avoid making ad hoc assumptions regarding public sector's saving and investment decisions.

where SP_t and SF_t represent the aggregate savings by domestic residents and foreigners, respectively. Simply $SP_t = \Sigma s_{g,t}$. The amount of $r_t BG_t$ gives the interest earnings of the intermediary on current debt of the government, and $r_t K_t$ gives the rent on capital stock used in production.

The intermediary disposes its funds on the interest payments for servicing its foreign and domestic lenders, to meet the investment demand for physical capital, and to purchase newly issued government debt:

$$EI_t = I_t + r_t A_t + r_t BI_t^F + D_t \tag{14}$$

Here, $A_t = \Sigma a_{g,t}$ represents the aggregate stock of assets in the economy, held by domestic residents.

We assume no speculative arbitrage gains through the operations of the intermediary, since in a deterministic model such a specification would be implausible. Hence, net profits of the intermediary are zero.

Under the current setup, each period the government deficit D_t, is financed by newly issued bonds, whose only buyer is the intermediary. The intermediary itself creates a market for both the domestic and foreign savers. Equation (14) narrates the crowding-out effects of government's debt instruments (GDIs) on the loanable funds market. Assuming that all assets are substitutes, the newly issued debt directly constrains the funds available for new investments in physical capital.

Consequently, if we represent the portion of government debt financed by the accumulations of domestic residents by BI_t^D, the following identity follows:

$$BI_t^D + BI_t^F = BG_t \tag{15}$$

3.6. Foreign Trade

The model, under the assumption of the small open economy, regards world prices of imports (*PWM*) and exports (*PWE*) as exogenously given. Domestic imports and exports functions are derived through the so-called Armingtonian commodity specification of the traditional CGE modeling exercises. Accordingly, within each financial sector, the domestically produced good (*DC*), the imports (*M*) and exports (*E*) are differentiated from each other by way of imperfect substitutability. Product

differentiation in this context, is specified by functions of elasticity of substitution and elasticity of transformation. Then,

$$(16) \qquad CC_t = ac(bcM_t^{-\upsilon} + (1-bc)DC_t^{-\upsilon})^{-(1/\upsilon)}$$

$$(17) \qquad XS_t = at(btE_t^{\mu} + (1-bt)DC_t^{\mu})^{(1/\mu)}$$

Given the import-domestic good relative price ratio, PM_t, cost minimizing amount of imports each period is M_t. Similarly, faced with a relative export-domestic good price ratio, PE_t, producer maximizes its revenues at the export allocation E_t.

The aggregate demand for imports, and export earnings determination leads to the following balance of payments equation in our model economy:

$$(18) \qquad PWM_t M_t + r_t BI_t^F = PWE_t E_t + S_t^F$$

Here, BI_t^F is the debt of the intermediary held by foreigners and S_t^F is their savings. The "rest of the world" earns interest on the debt they hold each period. Since debt is issued only by the government sector in this model, in fact, BI_t^F turns out to be the debt of the government held by foreigners. The process however, is administered through the intermediary.

3.7. Aggregation and Equilibrium Conditions

In order to ensure that the model is logically consistent and the economy is in equilibrium, the following conditions are introduced.

Resource constraint on the physical capital stock of requires that physical capital and government debt held by domestic residents equals total private wealth every period:

$$(19) \qquad K_t + BI_t^D = \sum_g a_{g,t} n_{g,t}$$

Since in each period the sum of physical investments equals to additions to the capital stock, equation (19) shows, how in equilibrium, the domestic debt servicing requirements by the government constrains the economy's capacity to generate investments, therefore capital accumulation, and real growth.

Total receipts by the intermediary has to be equal to its total expenditures, so:

(20) $RI_t = EI_t$

Finally, output has to be equal to the household and government consumption, plus investment, plus the trade balance:

(21) $Y_t = CC_t + G_t + I_t + E_t - M_t$

In this model, the steady state is a perpetual general equilibrium where all real values grow at a constant rate. More formally, we have a steady state in the model economy, when, (i) perfect foresight consumers derive savings supply and demand for consumption good by the intertemporal optimization of their utility functions (Equation 4) subject to their accumulation constraint (Equation 5), (ii) the firm, takes as given the factor prices, derives their demands and supplies output by profit maximization by satisfying Equations 7 – 11, (iii) The government budget constraint is satisfied, (iv) Equilibrium and accounting conditions are satisfied, (v) Effective wage rate w_t and profit rate r_t become stationary, and (vi) Levels of flow and stock variables are growing at the constant steady state growth rate, given the education expenditure profile of the public sector.

4-1. Main Traits of the Turkish Economy in the 1990s

In this section, we briefly explain the calibration of the model to track the Turkish economy of 1990s. First we give a broad overview of the Turkish economy in the 1990s.

Table 1 portrays the evolution of macro-fundamentals of the Turkish economy throughout 1990s. At a first glance, the table reveals that the Turkish growth experience throughout 1990s has been on a fluctuating trend, starting at 9.4% in 1990, decreasing to 0.3% in 1991 and even reaching to –6.1% during the crisis of 1994. Concomitant with this observation is the cyclical behavior of consumption and investment. The 20% decline in the public expenditures in 1988 could not be recovered until 1996-1997. Private investments were also not on a sustained path. The peak of private capital accumulation in 1993 at 38.8% was immediately followed by the contraction of 1994. Thus, the overall expansion of both private and public capital accumulation could not provide a sustained invigoration to the overall economy.

<Table 1 here>

One of the major signs of the vulnerability of the Turkish macroeconomic balances in 1990s has been continued inflation. Price inflation, which rested at the plateau of 60-65% in 1980s has accelerated after 1998 and reached the plateau of 75-80%. One of the main reasons of the continued disequilibrium and persistent inflation rates in the Turkish economy has been identified as the deterioration in the fiscal balances of the public sector and the resulting borrowing requirement. The table reflects that the PSBR ratio stood around 10% on average between 1990-99. Throughout this period, the budget deficit has been the main actor in the accumulation of PSBR. The ratio of public deficit to PSBR, which has been on the order of 40-50% until 1994, increased to 77.6% in 1995 and 92% in 1997.

A significant constraint on the government's capability in financing its gap was its limited options in borrowings from abroad. Given the fragile asset position of the public sector, government net foreign borrowing was minimal, and at most instances was negative. With the advent of full-fledged financial liberalization after 1989, however, the governments had the opportunity of by-passing much of the liquidity constraints on its operations. Consequently, the financing of the PSBR relied exclusively on issues of government debt instruments to the internal market – especially to the banking sector.

The stock of securitized domestic debt grew rapidly over the 1990s. The stock of GDIs, was only 6% of the GNP in 1989, the year when the capital account liberalization was completed. By the end of 2000 this ratio reached to 29%. Interest costs on domestic debt grew to 15% of the GNP in the same year, increasing almost 10-folds in real terms over the decade (Table 1). As a further comparison, interest costs on servicing the debt reached to 1,010% of public investments, and to 481% of the transfers accruing to social security institutions by the end of the decade. In this regard, the central budget in Turkey is observed to lose its instrumental role of social infrastructure development and long term growth, but rather became rapped to the dictates of domestic debt roll-over under a borrowing scheme of very high real rates of interest.

It is certain that the main reason for persistent budget deficits was the rapidly accumulating debt stock and the rising share of interest payments on domestic debt. In this vein, fiscal debt management not only acted as an income transfer mechanism to

the domestic rentiers, but also constrained the state's ability to act as a "productive" agent.

There is no doubt that the outstanding government debt and its composition not only create a financial burden but also have had adverse affects on the growth trajectory of the Turkish economy in the 1990s. The share of public spending on education decreased from 18.8% in 1990 to 11.8% in 1999. Given that post-secondary education is provided mainly through public schools, it becomes more urgent to study the growth effects of government public education funding policies under the constraining effects of the public debt.

4.2 The Calibration Procedure

Because of the complexity that the generational distinction brings to the structure of the model, the number of equations to be solved increases exponentially with the number of living generations per period. Thus, the model is exempt from analytical treatment and, under the assumption of perfect foresight, all equations ought to be solved simultaneously.

After constructing a data set for the model economy, the general methodology to follow in such large scale models is to calibrate it to approximately represent the "real economy" that is studied, the Turkish economy in our case. Calibration here basically enables us to get the values of the parameters of the algebraic equations describing the model by using the produced data set assuming a steady state equilibrium. The equations then, are expected to reproduce the base-year data set as a "solution" to the model. Thus, assuming that the base year data set constructed is a point on the equilibrium trajectory of the economy, the benchmark steady state is generated to provide an environment to analyze the issues under concern. The calibrated model-economy then makes it possible to carry out simulation exercises that allow to ask "what if" questions with respect to the benchmark equilibrium at hand.

In this study, the base-year data set is constructed by using Turkish macro data of 1990. However, as outlined in the previous section, the period is one of "dis-equilibrium". The growth path of 1990s, as well as the pace of debt management, of which one of the underlying characteristics is extreme short-termism, has brought an unsustainable nature to the economy. Throughout the decade, the state had to resort to

new borrowing, causing the accumulated debt to grow much more rapidly then the growth rate of the economy. This phenomenon, called *Ponzi-financing* in the fiscal economics literature, clearly created an *unsustainable*, and *out-of equilibrium* situation for the economy.

So assuming "constancy" of the parameters for the model economy, we have to first generate an equilibrium path that is "to be" keeping the main structure of the economy intact. While generating this equilibrium path, we basically take the "interest payments on domestic debt" and "interest payments on foreign debt" figures from the data and determine the amounts of "government domestic debt" and "government foreign debt" to support these interest payments. The real interest rate is determined endogenously. Then, "government expenditures" and "foreign savings" that underlie the debt profile and "private savings" that support the physical capital accumulation along the long-run equilibrium path are generated. The generational behavior of consumption and savings is also produced using the data of "private consumption" in 1990. From one perspective, we have generated an economy that would be able to support the 1990 values of "interest on domestic debt" and "interest on foreign debt", in a steady state long run equilibrium, under a constant rate of productivity growth.[17]

One of the key points in the calibration strategy is to produce the consumption-savings profile of each generation, given the income figures. First, using the 1990 profit income and labor income data, the capital intensity parameter for the national production (α) is calibrated. The consumption and asset holdings profile of each generation is then created to be consistent with aggregate output, aggregate private consumption and aggregate labor input figures for 1990. The government domestic debt variable, along with the total capital stock has been obtained in consistency with the amount of "interest on domestic debt".

Once the stocks of both factors of production are known, the scale parameter, *AX,* is easily calibrated. Other parameters such as the intertemporal elasticity of substitution (γ) and the human capital depreciation rate (δ) are chosen to be consistent with other empirical studies. The elasticity of substitution is taken from Auerbach and Kotlikoff (1987). Human capital skill loss rate is set to 0.2, which is higher than the empirical findings of the industrialized countries documented to lie between 0.02-0.04. (Mérette, 1998) The rate of time preference parameter (ρ) ensures that the

[17] The productivity growth rate used throughout the analyses is the average productivity growth rate of 1990s, net of population growth, which is about 2% per annum.

aggregate private consumption is distributed across generations, in consistency with the consumption profile that comes out of the utility maximization problem of the household.

In calibrating the variables of foreign trade, our starting point has been the "interest payment on foreign debt" and the "foreign debt stock" figures. The long-run equilibrium assumption on the benchmark economy determines the value of savings that would be able to support the foreign debt figure, and given the export data of 1990, it is easy to generate the import variable. Then it becomes possible to calibrate the shift and share parameters of the elasticity of substitution (ac, bc, v) and elasticity of transformation (at, bt, μ) functions that frame the trade dynamics.

The aggregate government expenditure variable is calibrated from the government budget constraint equation, given both the domestic and foreign debt stocks and given the data on total tax revenues. The share of government education expenditures in total in 1990 is used to generate the government productive and non-productive expenditures in the model. Once the amount of government educational spending is in hand, it easy to come up with a value for the effective rate of public educational investment parameter, λ.

The parameter values created in the first step of the calibration procedure under the OLG setting has been tabulated in Table 2. The second step of the calibration is to create the benchmark model, in which the economy is allowed to run for a certain period of time, under equilibrium conditions and using the parameters generated in the first step. At this stage, the tax rates, national debt to GNP ratio, share of public spending on education to aggregate government expenditures are all constants.

<Table 2 here>

5. Policy Analysis

Here, we first utilize the model to track the historical path of the Turkish economy throughout 1990s. It is important to note at this point that the model outlined in section 3 cannot be expected to generate "real life" on a one-to-one basis. Any modeling exercise is only a gross approximation of the reality, where the variables and economic relations that deem importance for the purpose at hand receive closer focus.

Since our study mainly focuses on investigating fiscal policy alternatives on debt management and government productive spending, the policy on total government expenditures is the controlled variable throughout the whole set of analysis. In the benchmark economy of sustained path, the ratio of productive and unproductive government expenditures (GE_t and GC_t) to total public expenditures, are constants.

In the benchmark setup, the variables grow at the constant growth rate of the economy; it is easy to determine the coefficient which relates government domestic debt accumulation to its aggregate expenditures. From the modeling perspective, such a coefficient would help to control the amount of burden to be attributed to the domestic market; especially in carrying out the exercise to trace the historical path of the Turkish economy throughout 1990s.

5.1. Reproducing the Historical Path of the Turkish Economy throughout 1990s

As summarized in Section 4.1., the main feature of the Turkish economy throughout 1990s is the deteriorating fiscal balances. The share of public disposable income, as well as the rate of "productive" government spending continuously decreases; [18] yet accompanied by a growing level PSBR and a rolling over government domestic debt.

To be able to analyze the effects of the trajectory of 1990s on the macro-vista of the Turkish economy, we shock the model by imposing an exogenous increase in government expenditures throughout the 1990s. In order to emphasize the "historical" shrinkage of the public funds and to capture the deterioration of the "social capital" of the economy, we simultaneously increase the share of government unproductive spending, GC_t in the model. In the subsequent periods, the "government expenditures" variable is allowed to grow at a plausibly accepted rate of 2 percent per annum. The numerical representation of the simulation can be traced from the "Total Expenditures" and "Education Expenditures" rows of the *Fiscal Balances* set in Table 1. Such a numerical utilization of the inner dynamics of the model is still a distance away from creating the "real" elevated amounts of the decade; yet it is nevertheless capable of capturing a clear picture of how such an action deteriorates the macro-balance of the economy by constraining the accumulation of the factors of production,

[18] See the shares of education and health expenditures in total public spending in Table 1.

productivity and growth. As portrayed in Table 1, total debt stock accumulates rapidly, relying on the domestic market during 1990s.

The first scenario of interest is one of business-as-usual environment, that is continuation of the historically realized patterns of unsustainable debt roll-over. What would the macroeconomic trajectory of the Turkish economy look like if no corrective steps were to be taken beyond 2000? Supposing that the *Ponzi*game of the 1990's were to be carried onto the 3rd millennium as far as it would take, what would be the implications for growth, fiscal debt, capital accumulation, and inter-generational welfare?

These are the questions we analyze first using our model. For this purpose, we continue to the historically calibrated path of the 1990's to 2000 and beyond. More formally, we allow the government expenditures to grow at a plausible rate, keeping the ratio of domestic debt and foreign debt stocks to total constant. We also keep the government education expenditures share in total at its original rate.

We study the simulation results under the identifier, "business-as-usual" in Table 3 and Figures 1 and 2. All results are comparable directly to the hypothetical (calibrated) sustained equilibrium path of Section 4.2.

<Table 3 here>
<Figure 1 here>
<Figure 2 here>

The collapse of the macroeconomic equilibrium under the policy of no-action is clearly visible in Table 3. The rate of growth of GNP decelerates rapidly over the sustainable path for 2000 and beyond. The level of the real aggregate national product is 15.3% lower in 2030 in comparison to the calibrated sustainable path. Likewise, private consumption is less by 11.4%, and the accumulated capital stock is lower by 14.4% in 2030 making the same comparison.

Figure 1 displays the per period growth rate deviations of the business-as-usual policy environment from the calibrated sustainable scenario. After the initial expenditure shock in 1990, the growth rate deviations make a hump towards sustainable path by the end of the decade; yet, the accumulated pressures on domestic debt stock start operating shortly after 2002. This process crowds out the private physical investments and productive public expenditures, and leads to a deceleration of growth then after. The cumulative loss of the GNP is depicted in Figure 2. In comparison to the sustainable path, loss of GNP is 4% by the turn of 2000. It

accumulates rapidly to reach 16% by 2030. Such results clearly confirm that the Turkish macro aggregates were to be thrown out of their equilibrium rather rapidly if no action were to implemented over the Ponzi-finance of the unsustainable fiscal adventures of the 1990's.

The continued (and severed) deterioration of the debt profile gives firm evidence of this assessment. As the historical debt accumulation problems of the 1990's are carried over to 2000 and beyond, the stock of total public debt is observed to be increased by 3.9-folds of that of the sustained equilibrium path. Interest payments on debt likewise reach to a multiple of 3.8-folds. The cost of debt servicing leads to an expansion of public expenditures by 25.2%, while expenditures on education (public social capital) fall by 29% by 2030.

The loss in social welfare is stipulated in Figure 3.[19] Figure 3 narrates the net welfare position of each generation by year of entrance to the work force. As to be expected, the constraint on public productive expenditures on education places the burden of adjustment on the young generations, while the retired generations (as of 2000) are not affected from the deceleration of growth to any significant extend. Per contra, the new generation of entrants in 2000 suffers a loss of 20%, while the "youngest" generation that enters the workforce in 2030 is expected to suffer a loss of 40%.

<Figure 3 here>

Each generation now, endowed with comparably lower level of human capital due to "relatively" insufficient funds to education are able to generate lower levels of efficiency labor, therefore lower levels of output. Thus the utility-maximizing levels of consumption reduce.

Here, even though the model results capture the essence of the detrimental consequences of the deceleration in the rate of investments to education, one necessarily has to use caution in interpreting such simulation results in strict quantitative terms. It has to be remembered that the results here heavily depend on

[19] The welfare analysis is based on the one used by King and Rebelo (1990). Denote $U_t\{c_g\}_{g=1}^{15}$ the utility of an agent entering the workforce at time t extracts, by following a consumption path $\{c_g\}_{g=1}^{15}$, under the benchmark economy. The welfare loss (or gain) associated by the policy action is denoted by

the choice of a set of smooth functional forms which admit sizeable externalities, allowing for magnified results. Given this caveat, however, we find the performance of the model's behavioral equations in response to a variety of sets of shocks to be quite robust and stable.

Such an exercise of "creating" a historical path of 1990s beyond 2000, not only enabled us to picturize the unsustainability and fragility of the Turkish economy once more, but we have now generated a "new" benchmark to carry out the alternative policy scenarios in comparison to. Thus, we now turn our attention to the investigation of alternative policy environments. In what follows, we will use the business-as-usual scenario of the post-1990s' historical path as the new benchmark for carrying out the relevant comparisons.

5.2. Primary Surplus Program (PSP)

In constructing the first policy scenario, we study the specifics and the expected macro economic consequences of the current austerity program, TSEP, as implemented under close IMF supervision. The distinguishing characteristic of the simulation is the attainment of primary surplus targets as set out during the official implementation of the program. Given the focus of the current austerity program on attaining significant fiscal surpluses on the non-interest budget, we will distinguish this scenario as the "Primary Surplus Program" (PSP).

In order to keep maximum consistency for our model of gross-approximation with the outlines of the current austerity program, TSEP, the primary surplus is generated through squeezed funds to public sector, reducing both types of its expenditures in the model. The generated fund then, is channelled into reduction of the outstanding debt of the economy.

To meet the edges of such a scenario, we utilize the model to create just enough level of "government total expenditures"(G_t), to create a pre-determined level of primary surplus (amounting to 6.5% of GNP) in the period just following the 1990s, given the tax burden on both types of income. We, then, gradually let the government expenditures to recover by simply requiring an equilibrium in the primary balance of the budget, given the growth rate of the economy.

θ such that $U_t(\{c_g(1-\theta)\}_{g=1}^{15}) = U_t(\{c_g^{'}\}_{g=1}^{15})$. $\{c_g^{'}\}_{g=1}^{15}$ is the path of consumption after implementation of the policy action.

The macro and fiscal results of the scenario are given in Tables 4 and 5, respectively. Figures 4 and 5, on the other hand, portray the growth effects of the alternative policy environments.

<Table 4 here>
<Table 5 here>
<Figure 4 here>
<Figure 5 here>

The fiscal balances, as illustrate in Table 5, reveal a "credible recovery" in fiscal aggregates. As a ratio to the GNP, total debt stock is brought down to 33% in 2040. In comparison, under the business-as-usual environment of the post-1990 path he 2025 ratio of the debt stock to GNP was simulated to reach 165%. The stock of debt is simulated to be 18% less in the PSP in comparison to the post-1990 no policy change environment. The difference reaches to 43% by 2017, and to 83% by 2040. Likewise, interest costs on debt are cut by half (See Table 4 and Figure 6).

<Figure 6 here>

The success story on the fiscal front, however, is not replicated by the aggregate performance of the overall economy. As the public expenditures are reduced forcefully to attain the primary surplus targets, "supply" side of the economy is affected adversely as the reduction in the public funds to produce "efficiency labor" causes reduction in total output. This occurs despite the revival of the funds to investment through reductions in the accumulation of domestic debt. Thus, the tacit dilemma surfaces out: The attainment of fiscal targets to maintain the warranted rates of primary surplus deprives the social/productive spheres of the economy from the most needed public funds to maintain the social capital investments on education.

Figure 4 gives the differences of the paths of the growth rate in comparison to the business-as-usual environment. Figure 5 indicates that such divergence would lead to a further cumulative loss of 15 percentage points over the previous scenario. We do not observe the same immediate effect on Private Consumption. Rather there is a "lag" in the effect of the policy on consumption variables contrasting with the immediate effect on output. The more explaining picture can be found in Figure 7, showing the welfare analysis of "PSP", in comparison to the benchmark economy. Here, the generations that have been participating the workforce both before and at the time of the implementation of the PSP (period representing years 2002-2005), are

the ones that have already passed through the education system, therefore have already accumulated their human capital. By the implementation of PSP, the public funds available to education decreases, reducing the aggregate amount of effective labor factor of production, increasing wage rate, which is the marginal product of labor in the model. So, generations that have already accumulated their skills, have the chance to earn relatively higher wage incomes, therefore are able to allocate more funds to consumption activities, whose behavior is controlled by the first order condition of utility maximization. This behavior of "older" generations causes aggregate consumption to rise, aggregate savings to decrease. On the other hand, the squeezed funds to productive government expenditures are now able to contribute relatively less to the production of human capital for the future generations, causing their relative earnings to decrease drastically.

<Figure 7 here>

Summarizing, the PSP, whose main objective is to generate a certain level of primary surplus through reductions in government total expenditures and to allocate the additional funds to reduce the debt stock of the economy, suffers from a serious trade-off on growth and fiscal targets, as well as a trade-off on the welfare of current and future generations.[20]

5.3. Wage Income Tax Program (WITP)

Given the trade-offs of the PSP, we think that it is an important step to come up with various alternatives to mitigate the reductions in the availability of public funds to reproducible factors of production. In designing such alternatives of taxation, our objective is to automatically destine the additional tax revenue to available education funds, and nowhere else. The first taxation alternative is increasing the wage income tax rate[21] by 10% of the current rate for 5 modelling periods (that would amount to a calendar period of 20 years), starting with the period representing years 2002-2005. Such a policy generates on average, an additional 10% revenue each period during

[20] An additional ambiguity in the TSEP is the current public discussion in Turkey on how the economy would be able to transfer the gains in the fiscal balances into real production activities and growth. See The Independent Social Scientists Network (Footnote 4 above) for a comprehensive summary of this issue.

when it is in action. There are two main hypotheses underlying this experiment: First, the credibility of the government assures channelling that additional revenue into investments in education; yet does not change its behavior on non-productive spending. Then, it becomes possible to evaluate an alternative scenario giving emphasis to the "real" side of the economy, rather than concentrating on fiscal balances. The second assumption is that the policy shocks are unexpected, once put in operation, the agents are informed on the duration and magnitude. Specific to the experiments carried out in this study, every generation of finite lifetimes is assumed to take its life-time decisions on consumption and savings while the policy remains in action. Thus the transitional analysis here does not take into consideration the generations that might enjoy possible tax reductions in the future.

Under WITP, there are gains in the "production" side mainly because of the comparable increase in the effective labor force The growth rate of the GNP accelerates up to 7.3% by 2041. The accumulates stock of fiscal capital reaches 5% above the business as usual environment. (Table 4, see also Figures 4 and 5). Given the acceleration in the rate of growth, the welfare analysis suggests considerable gain in the utility of the future generations, starting with the ones that take advantage of the additional funds to education, and then entering the workforce. Current generations that have acquired their human capital then, also enjoy the gradual increase in the output, factor incomes and consumption. (See Figure 8)

<Figure 8 here>

Looking at fiscal balances on the other hand, we observe reversed results of the PSP. Although there is a gain in the accumulative factors of production, because the policy on government expenditures is unaltered, the rate of growth in the tax revenues, falls short that of government expenditures for a transitional period. This causes the growth rate of the economy to gradually lose its positive advantage over the benchmark economy of "business as usual".

Would there be a critical level of additional tax revenues such that, while keeping the advantageous rate of growth and gains in aggregate output, will not allow the fiscal balances' deterioration to overcome the positive effects in the production

[21] Given the current taxation structure of the Turkish economy, we regard the wage income as the type of income from which the government can be sure to extract any extra revenue, therefore we do not consider any policy action on other type of incomes.

side of the economy? What would be the main principle of a tax/expenditure reform program which would meet the servicing obligations of domestic debt, while not hampering the positive externalities on future production?

5.4. Wealth Tax Program (WTP)

We now turn towards this question and simulate a fiscal expenditure-cum-tax reform strategy. Here, once more we focus on implementing a selective tax reform, this time on the stock of assets (wealth income). The exclusive focus is to support an increased public expenditure program addressed to finance public investments on education.

The numerical set up of the WTP is as follows: The government implements a once-and-for-all wealth tax of 5% in the period following 1990s. (2002-2005 note that its real life projection will cover a period of 4 years). In the model that roughly approximates the Turkish economy, this amounts to an additional tax revenue that is around 90% of the current public revenue out of taxes.

The growth consequences of the policy is very strong. The GNP reaches to a 4.5% higher level in comparison to the historical no-policy change environment by 2010. The gap widens by as much as 50% by 2041. (See Table 4).

Because this is a wealth tax, that is applied on the stock of assets of the economy, the older generations, that have already accumulated some amount of assets, are adversely affected. Yet, the future generations, starting with the one entering the workforce in period 2006-2009, which benefits the increased funds to education most in the current setup of the model we utilize, enjoy comparable gains, stabilizing at some level after the transition. This path is depicted in Figure 9.

<Figure 9 here>

The path of debt accumulation, on the other hand, could have been brought under control more successfully in comparison to the previous tax reform program on wage incomes. Domestic debt stock is brought down to 86% of the simulated stock of debt under the unsustainable business as usual environment. This level is calculated to be 94% of the GNP by 2041 (in comparison to 165% of the business as usual scenario; and the 161% of the wage taxation program above).

5.5. Calibrated Wage Income Tax Program (CWITP)

Finally, we implement a hybrid taxation program to match the growth performance of the last scenario (WTP), via increased wage taxes. Having realized that the 10% rise of wage taxes (scenario WITP above) was not sufficient to cover the debt burden - despite the growth gains- we ask the question of by how much should the tax rate on wage incomes had to be increased to obtain a comparable growth and debt path as in the WTP scenario.

To answer this question, we rely on the laboratory characteristics of the simulation model and solve for the warranted rate of wage income tax that would have generated the same amount of fiscal revenues obtained from the implementation of the wealth tax. Observe that in our previous wage tax scenario, the rate of increase of the tax rate was arbitrarily set at 10%. Now, given the current fiscal target above, the model's simulation run suggests an increase of the wage tax rate by 60% over its current level. Given the nature of the experiment, we identify this new regime as the "calibrated" wage income tax program, and tabulate its macro results again in Tables 4 and 5. Its intergenerational welfare implications are further portrayed in Figure 10.

<Figure 10 here>

It has to be noted that, due to the endogeneity of the growth rate in the model, an exact replication across policy scenarios is not to be expected. Yet, the calibrated tax increase yields very close paths of growth and fiscal revenues in comparison to the WTP. The rate of growth only marginally falls short of the previous scenario, while the fiscal balances are almost at par. The stock of fiscal debt reaches to 120% of the GNP in 2041, whereas under the WTP it reached as 94%. The interest cost on fiscal debt is calculated to be 23.8% in 2041, compared to WTP's figure of 17.9%.

The welfare effects as displayed in Figure 10, however, reveal quite a different picture across the last two experiments. In the WTP environment, the generation of 2006-2009 enjoys the most welfare gains, to be followed by a decelerated welfare gain for the upcoming generations. On the other hand, the welfare gains are spread more uniformly over time across generations under the calibrated wage tax scenario, with the peak being reached at a later period, the generation of 2026.

Given the complexity and variety of the above results, the natural question to ask is: which tax program would be more plausible and socially realistic? The last scenario relies on wage taxation which is the easiest to implement in the Turkish

context. However, a warranted rise of 60% of the tax burden for 20 (calendar) years on wage incomes could neither be politically realistic, nor desirable from an egaliterian point of view. Taxation of wealth incomes, while promises the most desirable outcomes on many fronts, is harder to implement and may require a stronger and better-managed tax administration. The main message from our simulations, however, is clear. Alternatives on fiscal programming do exists and all it requires is an energetic and decisive state apparatus to carefully weigh the merits of each of the alternatives against the dubious prospects of the current austerity program in implementation.

6. Conclusion

In this paper, we studied the welfare and growth implications of various fiscal policy alternatives for the Turkish economy over the 2000s. Turkish economy experienced a severe deterioration of its fiscal balances and suffered from volatile cycles of growth-crisis-adjustment following its capital account liberalization in 1989. Initiation of an exchange rate-based disinflation program under the close supervision of the IMF failed in February 2001, and a structural adjustment program was introduced in May. The program, advanced as the Transition to the Strong Economy Program, included the standard IMF austerity measures: drastic cuts in public spending, monetary contraction, flexible exchange rate management, and reductions in wage remunerations and in public employment. In particular, the TSEP has targeted a primary fiscal surplus of 6.5% to the GNP every year until 2004, and aimed at reducing the outstanding net stock of domestic debt to 40.9%, and that of foreign debt to 40.3% as a ratio of GNP by the end of that year.

The IMF-led austerity program which is planned to be in operation at least until 2004 is criticized heavily in that it gives priority to targets on fiscal debt rather than growth, and implements an implicit preference for finance over industry. Furthermore, the program is accused of lacking credible public support and of general ignorance of its social welfare implications.

Thus, given the dubious macro-policy environment we attempt to investigate the growth and welfare consequences of the current austerity program as well as the various alternatives of taxation and fiscal expenditures. To this end, we made use of an endogenous growth, overlapping generations (OLG) model, calibrated to the

Turkish data over 1990s. The distinguishing characteristics of the model include a human capital-driven endogenous growth structure based on public administered education investments; intertemporally optimizing agents; and an open capital account. The structure of the model embraces 15 generations with 12 generations being in the active labor force at any moment. Private agents optimally chose lifetime consumption and saving paths and provide physical capital investments, while investments to education and social human capital are administered by the public sector. The growth process is characterized by the accumulation of both physical and human capital. Public spending on accumulative factors of production as well as the society's endowment of social capital contribute to the formation of productive factors.

With the aid of our analytical apparatus, our first aim was to calibrate the performance of the Turkish economy during the 1990s and extend this environment under a no-policy-change (business as usual) scenario into the near future. Given this simulation, the model results clearly underscore the fragile nature of the Turkish fiscal balances together with detrimental consequences on growth and welfare. The rate of growth is observed to fall 15% below of what could have been potentially generated under a sustained growth path where fiscal balances attained equilibrium. Likewise, private consumption and the stock of capital all fall below their potential levels by 11% and 14%, respectively. The culminated pressures of the aggregate fiscal debt reached to unprecedented levels, approaching to 380% as a ratio to the GNP by 2030.

Next, we study the implications of the austerity program focusing exclusively on fiscal balances. We maintained the fiscal targets of the TSEP to attain a primary surplus of 6.5% as a ratio to GNP until 2004 to be complemented by equilibrium in the primary balance of the public sector thenafter.

As simulated over the time horizon as above, the model results forcefully disclose the tacit dilemma of the “primary surplus program” The attainment of fiscal targets to maintain the warranted rates of primary surplus deprives the social/productive spheres of the economy from the most needed public funds to maintain the social capital investments on education. The numerical results of the model suggests that with the implementation of such a program, the fiscal debt constraint could be resolved but the productive sphere of the real economy might be severely hampered. The cumulative loss of the GNP is observed to reach to 15% over the no-policy action of the historical 1990s scenario.

To mitigate this dilemma and to pursue viable fiscal alternatives of taxation and expenditure reform, we studied three alternative scenarios: (i) a 10% rise of the tax rate on wage incomes, to be implemented over five generations (20 calender years in the context of our model); (ii) a once-and-for-all wealth tax set at 5%, to be implemented in early 2000; and (iii) a wage taxation program calibrated at the endogenous tax rate that would generate the comparable tax revenues to the state as in the wealth taxation program.

Our results indicated that the wealth taxation program is likely to produce the most superior outcome in terms of both growth performance and fiscal accounts. Wage income taxation is arguably the easiest to implement given the Turkish tax structure, yet would likely suffer from social and political constraints. Admitting that a tax program over wealth incomes would necessitate a strong bureaucracy and a well administered taxation regime, we nevertheless emphasize that alternatives on fiscal programming do exist and it should essentially be priority of an energetic and decisive government to carefully weigh the merits and dilemmas of each alternative.

Clearly a promising avenue of further research within our theoretical framework would be building larger scale general equilibrium models where rational agents with finite lifetimes and a public sector with an infinite time horizon interact within a "more realistic" market setting. In contrast to simple models, large-scale models would enable one to consider simultaneous changes in a variety of fiscal instruments and provide ways to understand short-to-medium run responses by making it possible to observe the transition paths of the modelled economies. The large -scale models, with assumptions of longer time-spans on the part of each individual would provide more realistic setups that will point to the income distribution effects of permanent policy changes. This would be more conducive in addressing the political economy dilemmas likely to be faced in real policy setting. These issues, of course are beyond the scope of the current model, which we merely consider as an initial step to understand how the economies work and move over time.

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Table 1. Main Economic Indicators and Public Accounts, Turkey (1990-2000)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Annual Rate of Growth											
GNP	9.4	0.3	6.4	8.1	-6.1	8.0	7.1	8.3	3.9	-6.1	6.3
Fixed Investment											
Private	20.6	8.1	3.3	38.8	-9.6	9.8	9.2	9.7	-8.2	-17.8	15.9
Public	6.7	12.7	2.2	14.1	-39.5	-7.6	33.0	26.5	13.9	-8.7	19.6
Private Consumption	13.1	1.9	3.3	8.4	-5.3	5.6	8.5	8.4	0.6	-2.6	6.2
As Share of GNP (%)											
Current Account Balance	-1.7	0.2	-0.6	-3.6	2.0	-1.4	-1.3	-1.4	1.0	-0.7	-4.8
Public Disposable Income	13.4	11.9	11.4	9.6	9.6	9.4	7.9	9.5	8.7	7.0	
Public Savings	3.4	0.7	-0.8	-2.7	-1.1	-0.1	-1.9	-1.7	-2.6	-6.8	
Public Investment	8.6	7.6	6.8	7.3	3.6	3.8	5.3	6.0	6.3	6.6	6.9
Public Sector Borrowing Requireme	7.4	10.2	10.6	12.1	7.9	5.2	8.8	7.6	9.2	15.3	12.5
Budget Balance	-3.0	-5.3	-2.4	-6.7	-3.9	-4.0	-8.3	-7.6	-7.3	-11.9	-10.9
Outstanding Domestic Debt	14.4	15.4	17.6	17.9	20.6	17.3	21.0	21.4	21.7	29.3	29
Interest Payment on Domestic Debt	2.5	2.7	3.1	4.2	5.9	6.0	8.9	6.7	10.6	12.7	15
Annual Inflation Rate (CPI)	60.3	66.0	70.1	66.1	106.3	93.6	80.4	85.7	90.7	70.5	39.1
Real Interest Rate on Government Bor	1.1	16.2	15.8	18.4	19.8	19.3	33.7	25.0	29.5	36.8	4.5
Share in Public Expenditures (%)											
Health	4.7	4.6	4.7	3.9	3.5	3.3	3.0	3.2	2.6	4.1	
Education	18.8	19.3	19.7	16.6	13.4	12.2	11.0	11.1	11.1	11.2	
Interest Payment on Debt	20.6	19.2	17.9	23.7	33.1	33.4	37.8	29.8	40.0	38.6	

Sources: SPO Main Economic Indicators; Undersecretariat of Foreign Trade and Treasury Main Economic Indicators

Table 2. Values of Parameters and Initial Quantities

Parameters					
AX	***α***	***γ***	***1/(1+ρ)***	***δ***	***λ***
0.916	0.495	2.00	0.973	0.20	5.07E-05

Parameters					
ac	***bc***	***v***	***at***	***bt***	***μ***
1.672	0.278	-0.50	2.422	0.714	1.50

Parameters		
Φ	τ_w	τ_i
1.06	0.076	0.127

Initial Values					
r	***w***	***BG/Y(%)***	$BG^D/GE(\%)$	***T/Y(%)***	***S/Y(%)***
0.187	1.014	21.22	99.29	16.404	16.68

Initial values (efficiency labor)		
n	$h_{1,1990}$	***GE/G (%)***
10262	1.898	18.79

Table 3. General Equilbrium Results (Ratio of Deviation from the Sustainable Path)

	Post-1990, "Business As Usual Scenario"					
	1990-1993	1994-1997	1998-2001	2002-2005	2014-2017	2026-2029
GNP	1.000	0.981	0.970	0.963	0.912	0.847
Private Consumption	1.040	0.983	0.942	0.966	0.937	0.886
Private Savings	1.121	0.806	0.639	0.743	0.600	0.440
Capital Stock	1.000	0.970	0.959	0.961	0.920	0.856
Efficiency Labor	1.000	0.993	0.981	0.965	0.904	0.839
Wage Income	1.027	0.956	0.917	0.939	0.888	0.819
Profit Income	1.027	0.991	0.952	0.955	0.903	0.837
Exports	0.947	1.034	1.084	1.013	0.962	0.908
Imports	1.073	0.915	0.834	0.899	0.825	0.745
Fiscal Balances						
Total Taxes	1.027	0.970	0.931	0.945	0.894	0.826
Total Expenditures	1.300	1.300	1.300	1.252	1.252	1.252
Education Expenditures	0.739	0.739	0.739	0.712	0.712	0.712
Debt Stock	1.000	1.168	1.389	1.658	2.582	3.984
Domestic Debt Stock	1.000	1.690	1.690	1.300	1.252	1.252
Foreign Debt Stock	1.000	0.233	0.852	2.299	4.959	8.868
Interest Payments on Debt	1.027	1.151	1.328	1.620	2.492	3.809

Figure 1. Growth rate difference: post-1990 and sustainable path

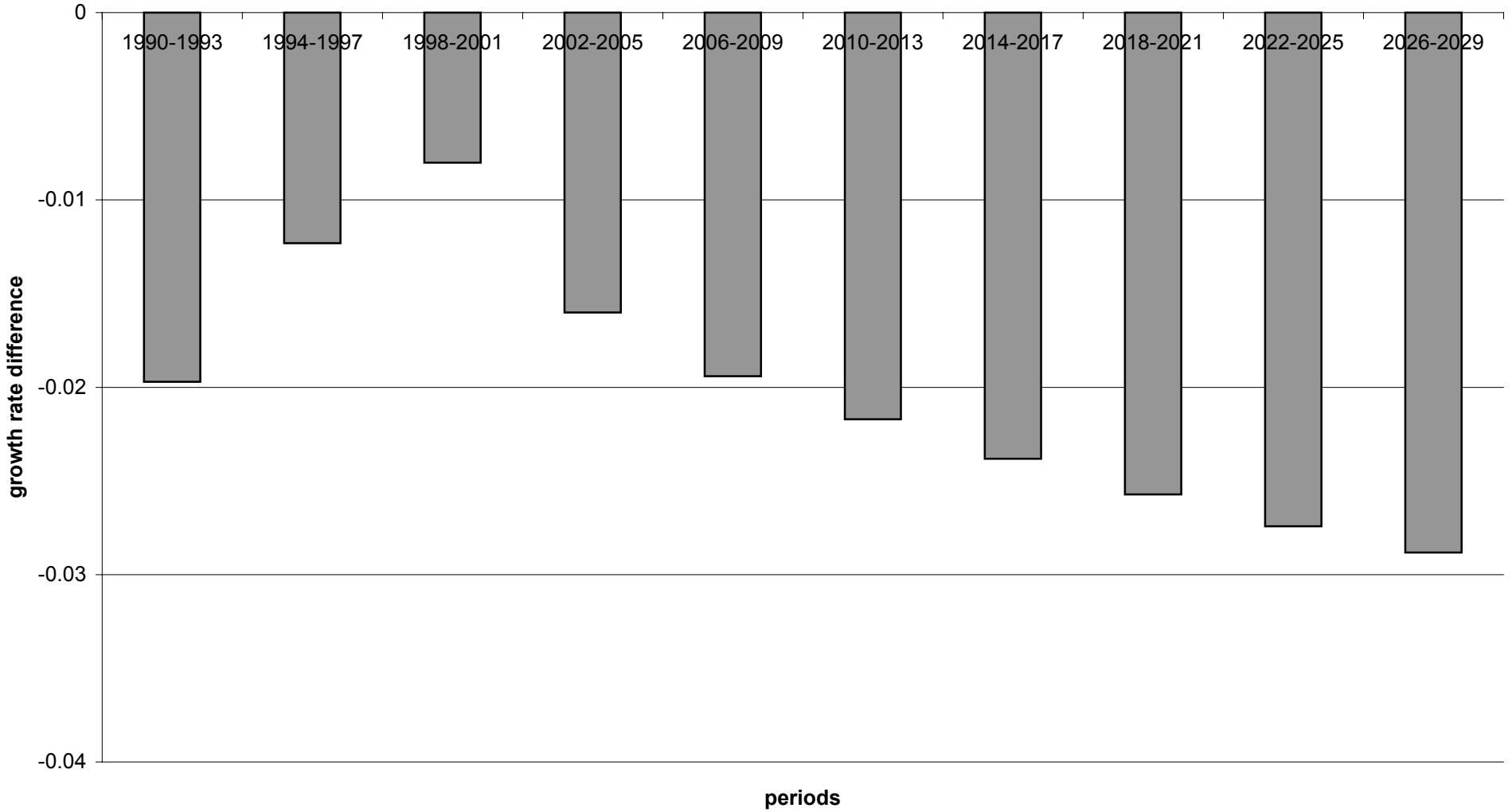

Figure 2. Cumulative loss of post-1990 GNP compared to sustainable path

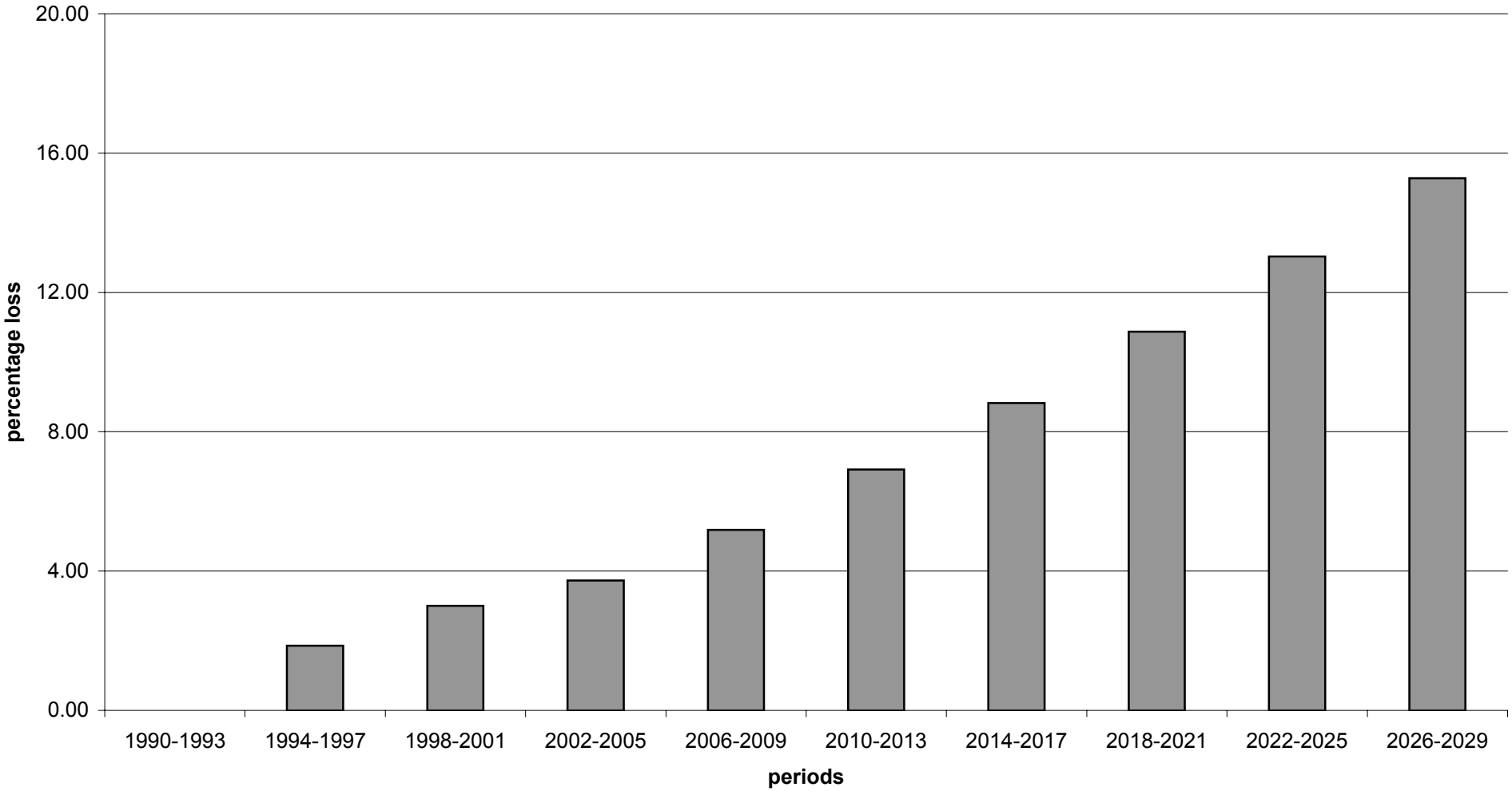

Figure 3. Welfare Analysis of Historical 1990s w.r.t. Sustainable Path

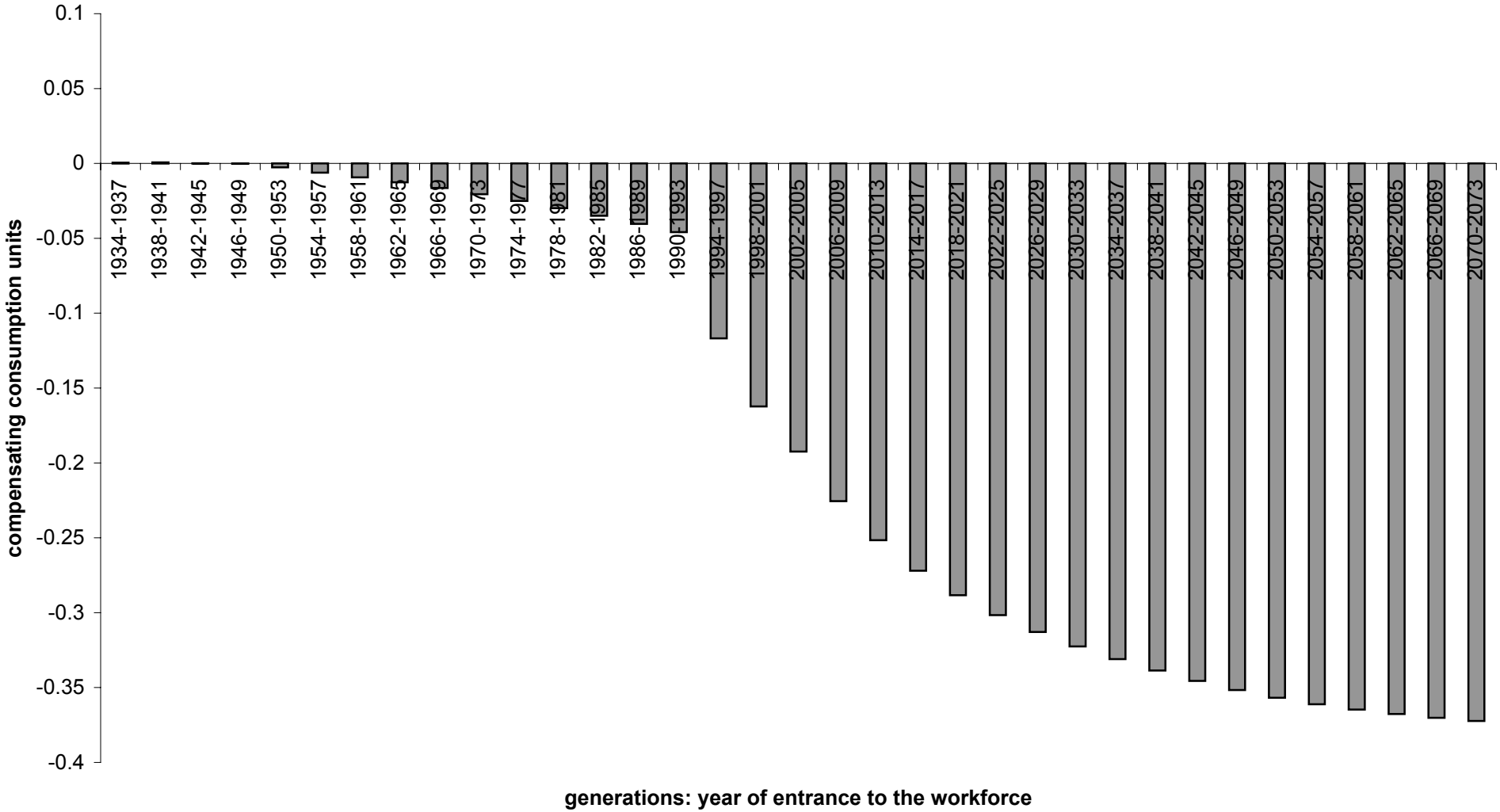

Table 4: General Equilbrium Results (Ratio of Deviation from the Historical 1990s Path)

	EXP1, "PSP "					EXP2, "WITP "				
	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041
GNP	0.999	1.008	0.992	0.936	0.847	1.001	1.003	1.012	1.041	1.073
Private Consumption	1.005	1.065	1.079	1.073	1.029	0.998	0.995	0.992	1.006	1.035
Private Savings	0.934	1.186	0.999	0.467	-0.321	1.018	1.024	1.078	1.304	1.539
Capital Stock	0.997	1.025	1.035	1.017	0.951	1.002	1.001	1.001	1.016	1.051
Efficiency Labor	1.000	0.990	0.951	0.863	0.756	1.000	1.004	1.023	1.066	1.095
Wage Income	0.996	1.053	1.038	0.979	0.884	1.003	1.003	1.009	1.038	1.077
Profit Income	0.996	1.021	1.005	0.947	0.855	1.003	1.004	1.013	1.041	1.076
Exports	1.003	0.923	0.907	0.854	0.776	0.997	1.003	1.019	1.045	1.065
Imports	0.992	1.131	1.118	1.057	0.952	1.006	1.002	1.003	1.035	1.083
Fiscal Balances										
Total Taxes	0.996	1.040	1.025	0.966	0.872	1.026	1.026	1.034	1.040	1.076
Total Expenditures	0.540	0.540	0.540	0.540	0.540	1.022	1.059	1.058	1.038	1.038
Education Expenditures	0.540	0.540	0.540	0.540	0.540	1.198	1.232	1.225	1.038	1.038
Debt Stock	1.001	0.820	0.529	0.278	0.170	1.000	0.999	1.021	1.039	1.046
Domestic Debt Stock	1.000	0.540	0.540	0.540	0.540	1.000	1.022	1.058	1.057	1.038
Foreign Debt Stock	1.001	1.020	0.524	0.211	0.113	0.999	0.983	1.005	1.035	1.047
Interest Payments on Debt	0.999	0.555	0.542	0.521	0.503	1.001	1.013	1.042	1.070	1.069

	EXP3, "WTP "					EXP 4, "CWITP "				
	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041
GNP	1.014	1.045	1.201	1.372	1.509	1.005	1.013	1.063	1.200	1.350
Private Consumption	0.947	0.867	1.030	1.178	1.345	0.990	0.976	0.986	1.055	1.194
Private Savings	1.436	1.188	2.526	3.577	4.251	1.074	1.094	1.433	2.498	3.654
Capital Stock	1.028	0.941	1.057	1.252	1.478	1.010	1.005	1.015	1.088	1.260
Efficiency Labor	1.000	1.158	1.361	1.500	1.540	1.000	1.022	1.112	1.321	1.445
Wage Income	1.019	0.965	1.216	1.406	1.565	1.014	1.012	1.062	1.203	1.386
Profit Income	1.017	1.022	1.214	1.390	1.529	1.014	1.019	1.072	1.208	1.367
Exports	1.003	1.225	1.173	1.305	1.403	0.986	1.016	1.064	1.195	1.281
Imports	1.028	0.836	1.240	1.467	1.665	1.030	1.009	1.061	1.208	1.450
Fiscal Balances										
Total Taxes	1.917	0.989	1.215	1.399	1.550	1.138	1.138	1.196	1.205	1.378
Total Expenditures	1.820	1.038	1.038	1.038	1.038	1.115	1.148	1.149	1.038	1.038
Education Expenditures	8.610	1.038	1.038	1.038	1.038	2.051	2.071	2.077	1.038	1.038
Debt Stock	0.994	0.990	1.004	0.943	0.860	0.994	0.990	1.004	0.943	0.860
Domestic Debt Stock	1.820	1.038	1.038	1.038	1.038	1.000	1.820	1.038	1.038	1.038
Foreign Debt Stock	0.395	0.995	0.971	0.890	0.805	0.988	0.395	0.989	0.919	0.832
Interest Payments on Debt	0.985	1.015	1.154	1.059	0.910	1.002	1.002	1.058	1.113	1.084

Table 5. Fiscal Balances

	Post-1990, "Business As Usual Scenario"					EXP1, "PSP"				
	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041
(As a Ratio to GNP)										
Total Debt Stock	0.366	0.431	0.601	0.998	1.657	0.366	0.350	0.321	0.296	0.332
Domestic Debt Stock	0.184	0.180	0.187	0.201	0.219	0.184	0.096	0.102	0.116	0.140
Foreign Debt Stock	0.182	0.251	0.414	0.797	1.438	0.182	0.254	0.219	0.180	0.192
Interest on Total Debt	0.067	0.079	0.109	0.179	0.297	0.067	0.066	0.058	0.051	0.055
Interest on Domestic Debt	0.034	0.033	0.034	0.036	0.039	0.034	0.018	0.018	0.020	0.023
Primay Balance	-0.017	-0.020	-0.027	-0.043	-0.062	0.064	0.069	0.064	0.048	0.023
Government Expenditures	0.178	0.181	0.188	0.203	0.221	0.097	0.097	0.103	0.117	0.141
Government Education Expenditures	0.019	0.019	0.020	0.022	0.024	0.010	0.010	0.011	0.013	0.015
(As a Ratio to Total Government Revenues)										
Government Education Expenditures	0.118	0.120	0.125	0.135	0.148	0.064	0.062	0.066	0.076	0.092
Government Expenditures	1.107	1.123	1.171	1.267	1.390	0.601	0.583	0.618	0.709	0.861

	EXP2, "WITP "					EXP3, "WTP "					EXP4, "CWITP "				
	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041	2002-2005	2006-2009	2014-2017	2026-2029	2038-2041
(As a Ratio to GNP)															
Total Debt Stock	0.365	0.429	0.607	0.997	1.616	0.358	0.408	0.502	0.686	0.944	0.363	0.423	0.571	0.837	1.209
Domestic Debt Stock	0.184	0.183	0.196	0.204	0.212	0.181	0.313	0.162	0.152	0.151	0.183	0.198	0.202	0.193	0.169
Foreign Debt Stock	0.181	0.246	0.411	0.792	1.404	0.177	0.095	0.341	0.534	0.793	0.180	0.225	0.369	0.644	1.041
Interest on Total Debt	0.067	0.078	0.110	0.182	0.296	0.065	0.076	0.104	0.138	0.179	0.067	0.078	0.108	0.166	0.238
Interest on Domestic Debt	0.034	0.033	0.036	0.037	0.039	0.033	0.059	0.034	0.031	0.029	0.034	0.036	0.038	0.038	0.033
Primay Balance	-0.017	-0.026	-0.033	-0.042	-0.054	-0.016	-0.027	0.000	0.010	0.011	-0.015	-0.024	-0.023	-0.015	-0.008
Government Expenditures	0.182	0.191	0.197	0.202	0.214	0.320	0.180	0.163	0.153	0.152	0.198	0.205	0.203	0.175	0.170
Government Education Expenditures	0.023	0.024	0.024	0.022	0.023	0.162	0.019	0.017	0.016	0.016	0.039	0.040	0.039	0.019	0.018
(As a Ratio to Total Government Revenues)															
Government Education Expenditures	0.138	0.144	0.148	0.135	0.143	0.531	0.126	0.107	0.100	0.099	0.213	0.218	0.217	0.117	0.112
Government Expenditures	1.103	1.158	1.198	1.265	1.341	1.051	1.179	1.000	0.940	0.931	1.085	1.132	1.125	1.091	1.047

Figure 4. Growth Rate Difference w.r.t. "Business As Usual Scenario"

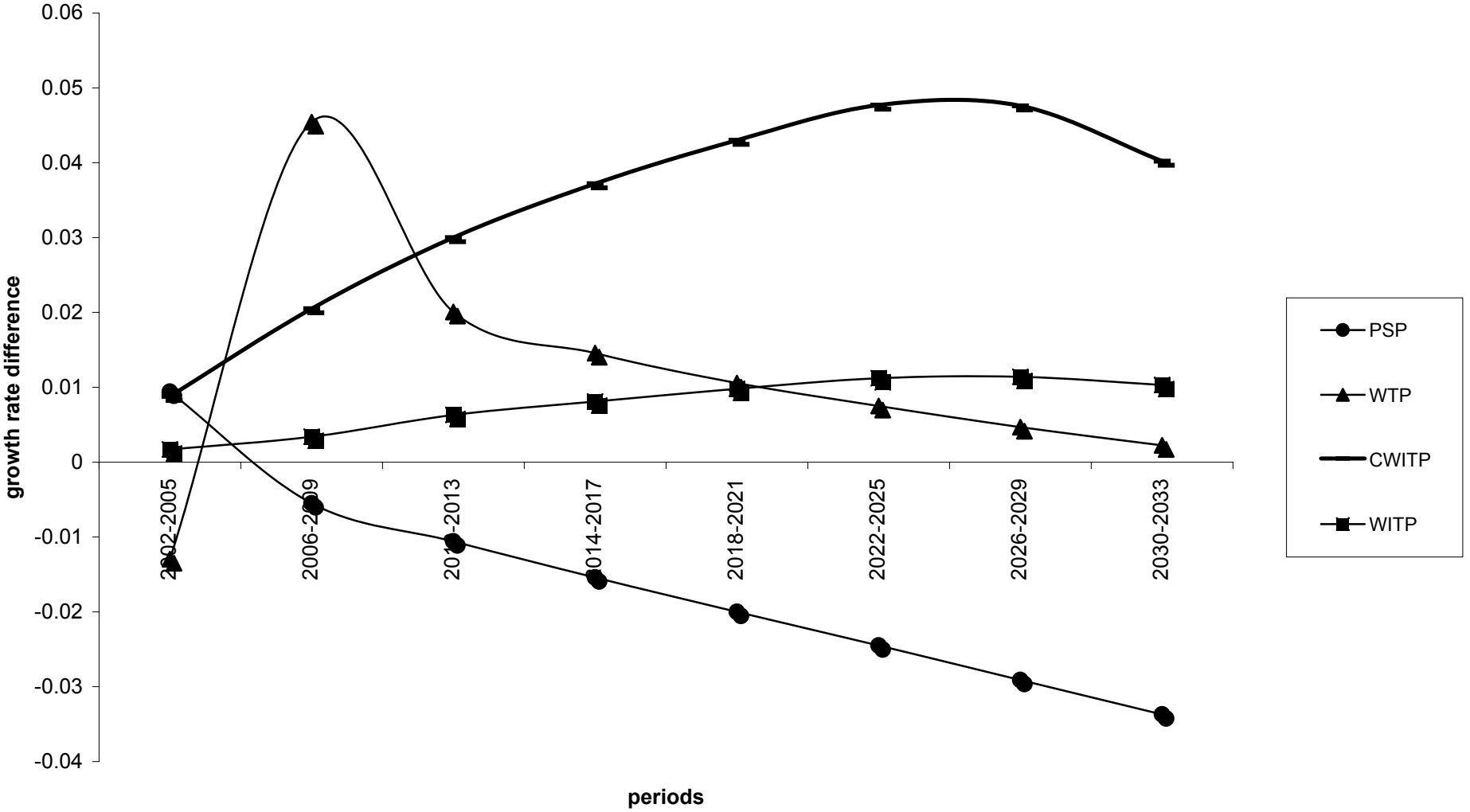

Figure 5. Cumulative Change in GNP w.r.t. Historical 1990s Path

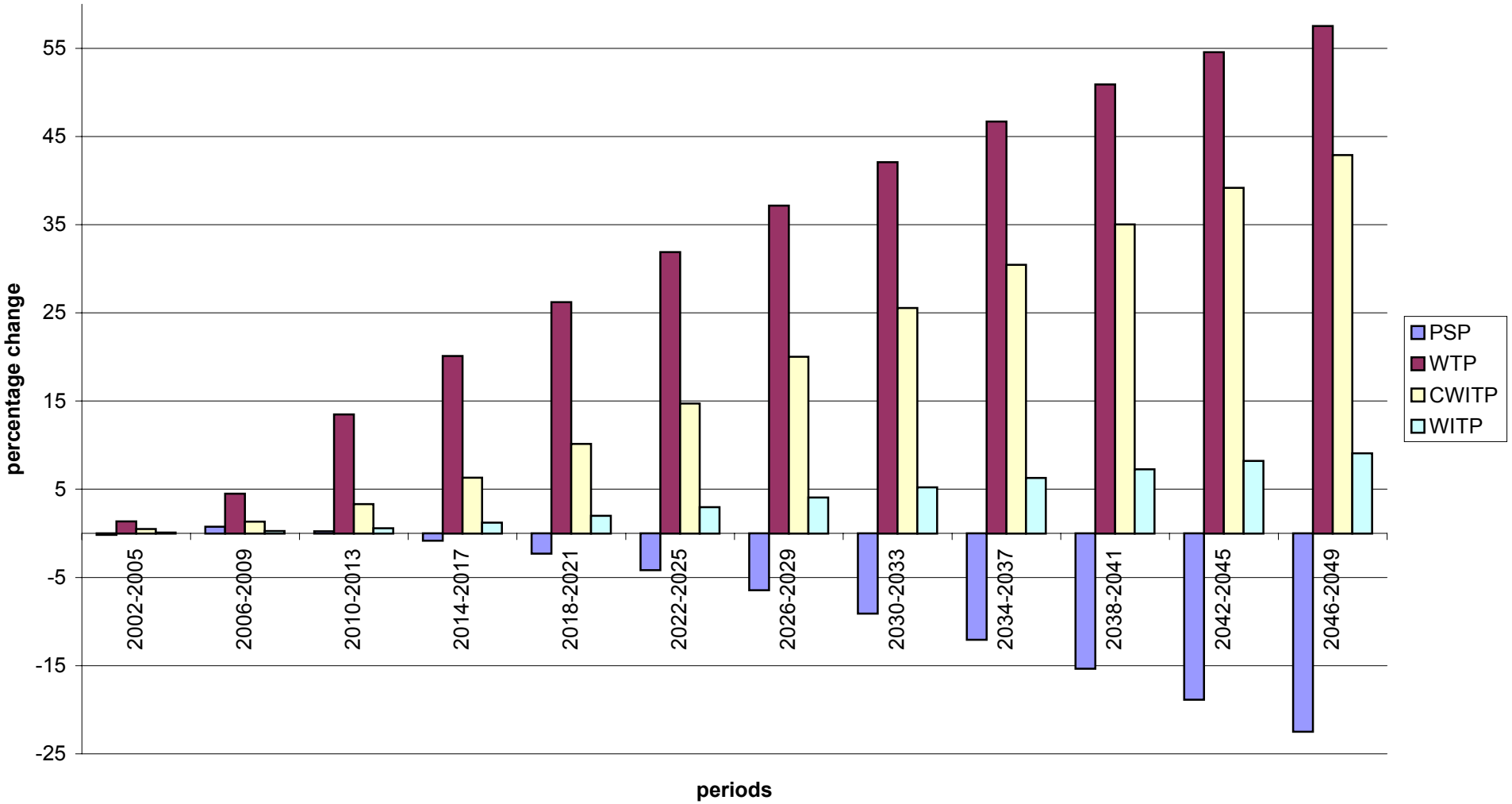

Figure 6. Total Debt as a Ratio to GNP

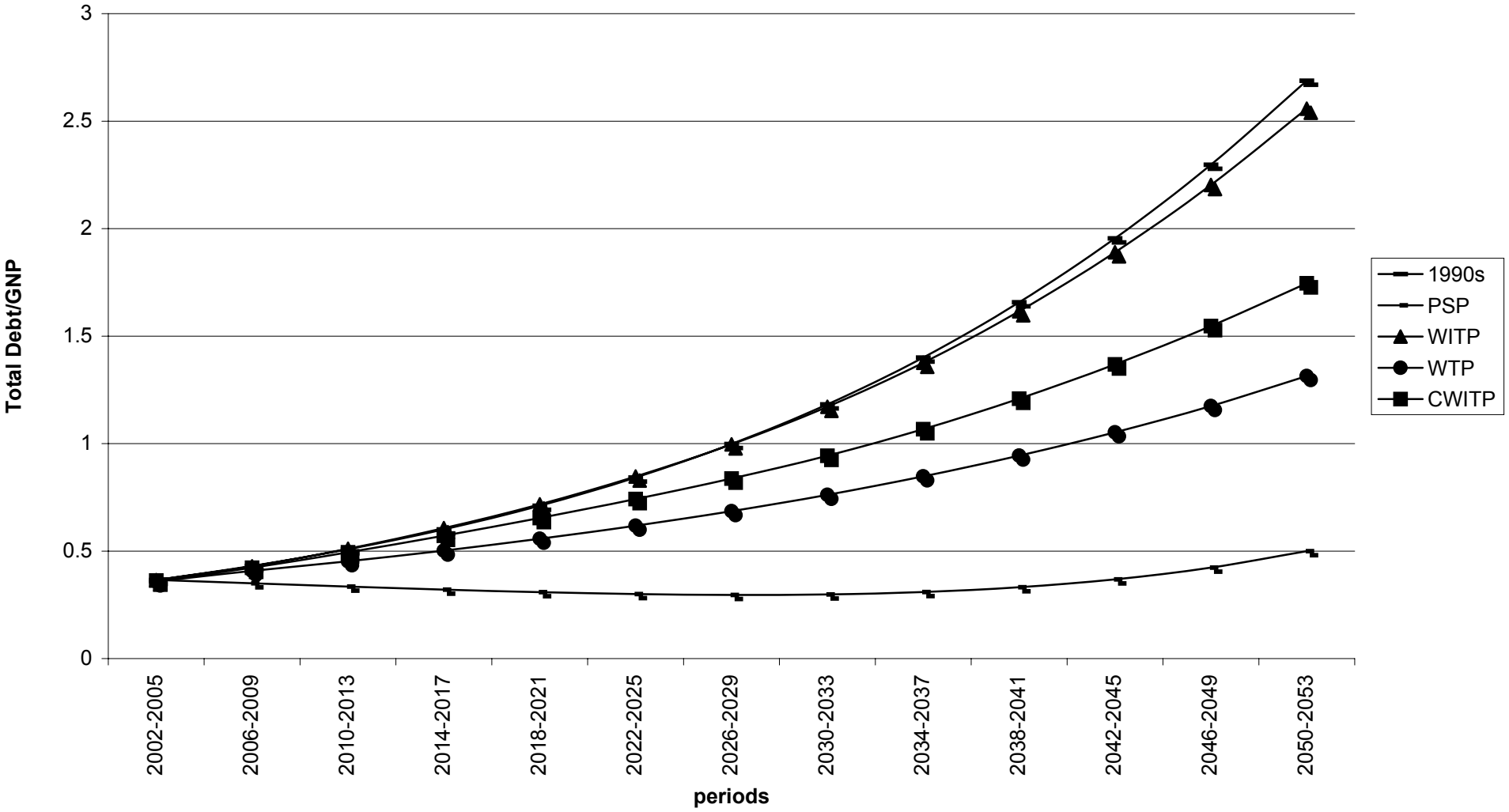

Figure 7. Welfare Analysis of Primary Surplus Policy w.r.t. 1990s Historical Path

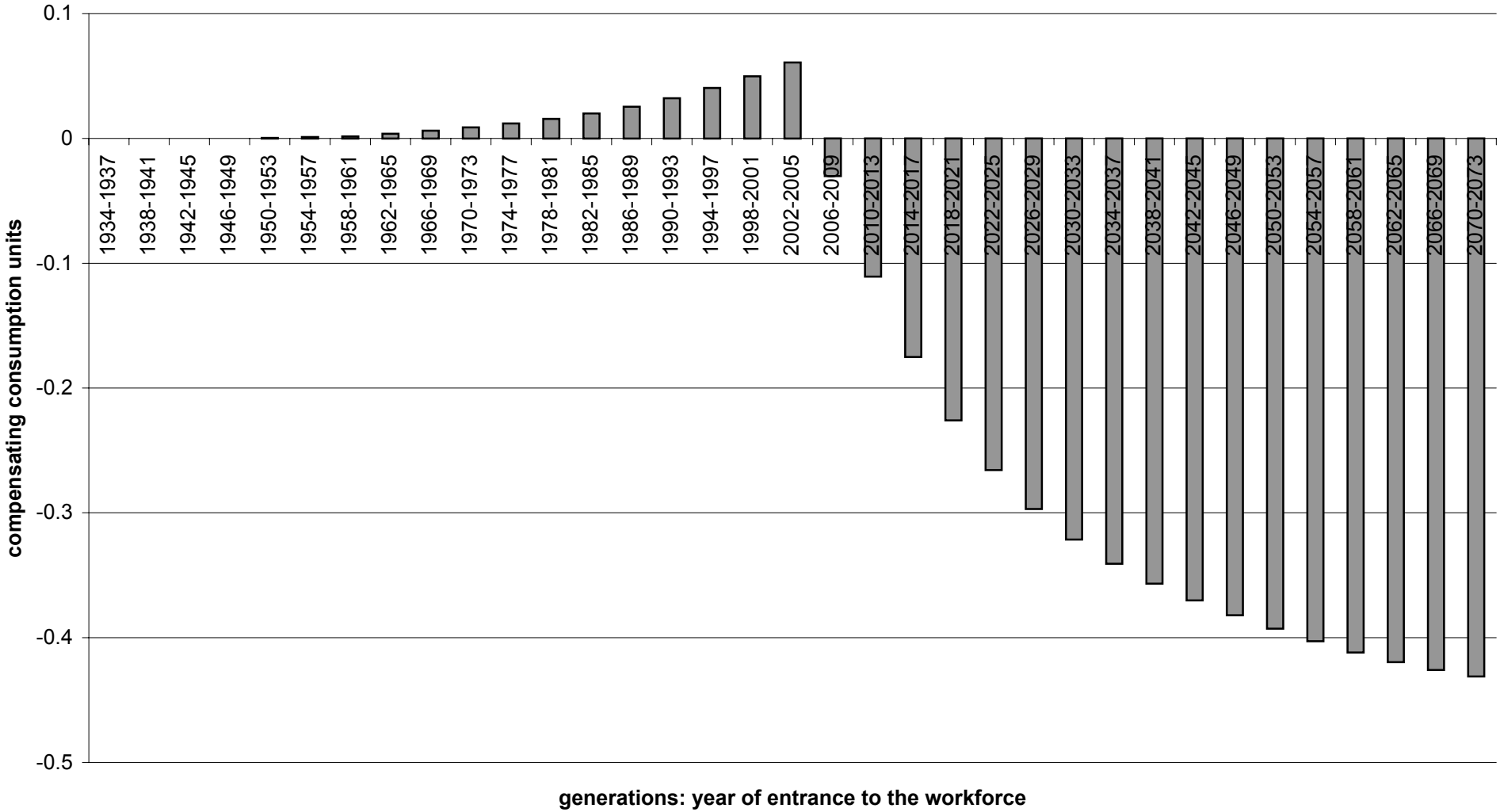

Figure 8. Welfare Analysis of 10% Wage Income Tax Policy w.r.t. 1990s Historical Path

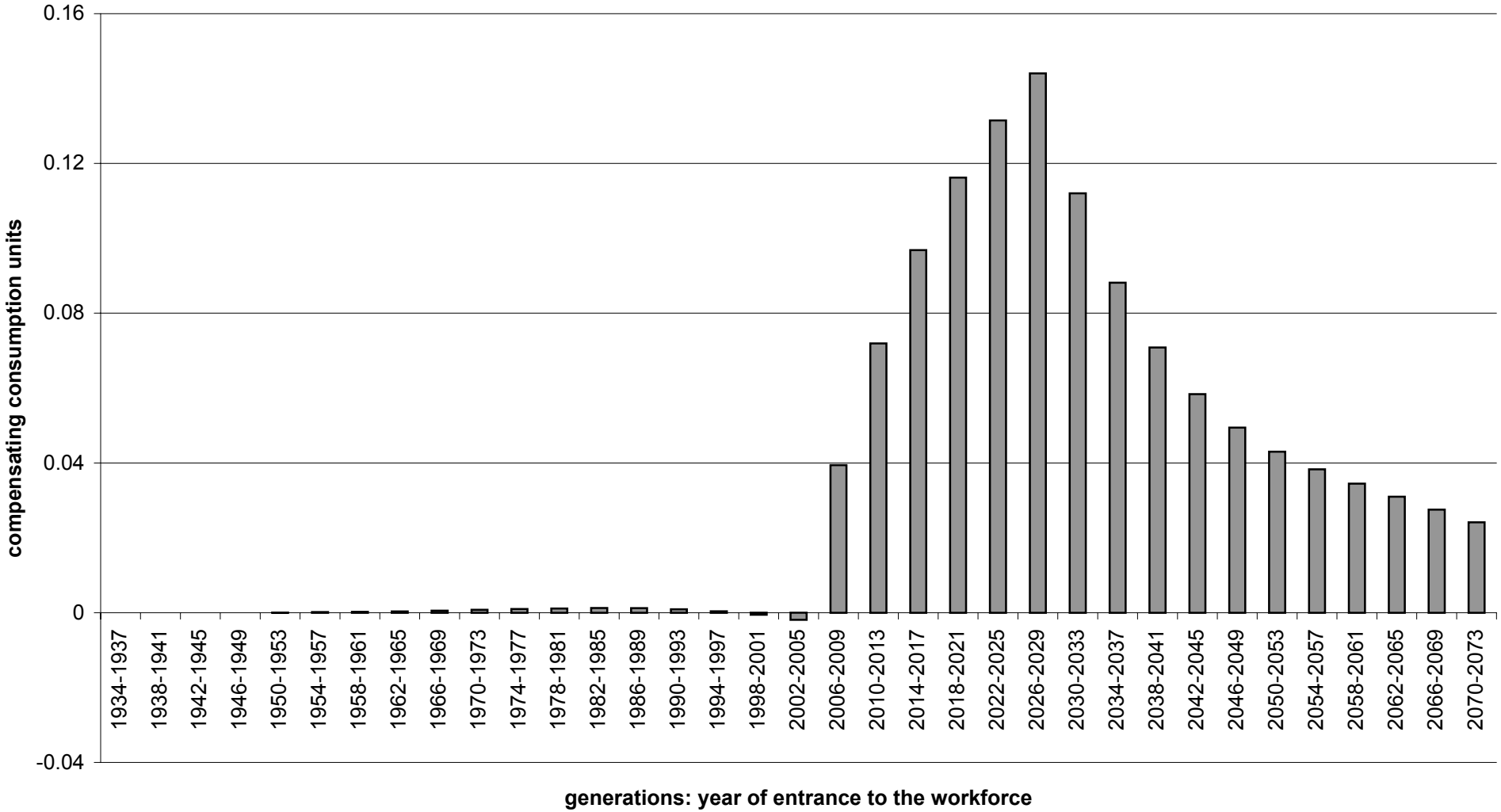

Figure 9. Welfare Analysis of Wealth Tax Policy w.r.t. 1990s Historical Path

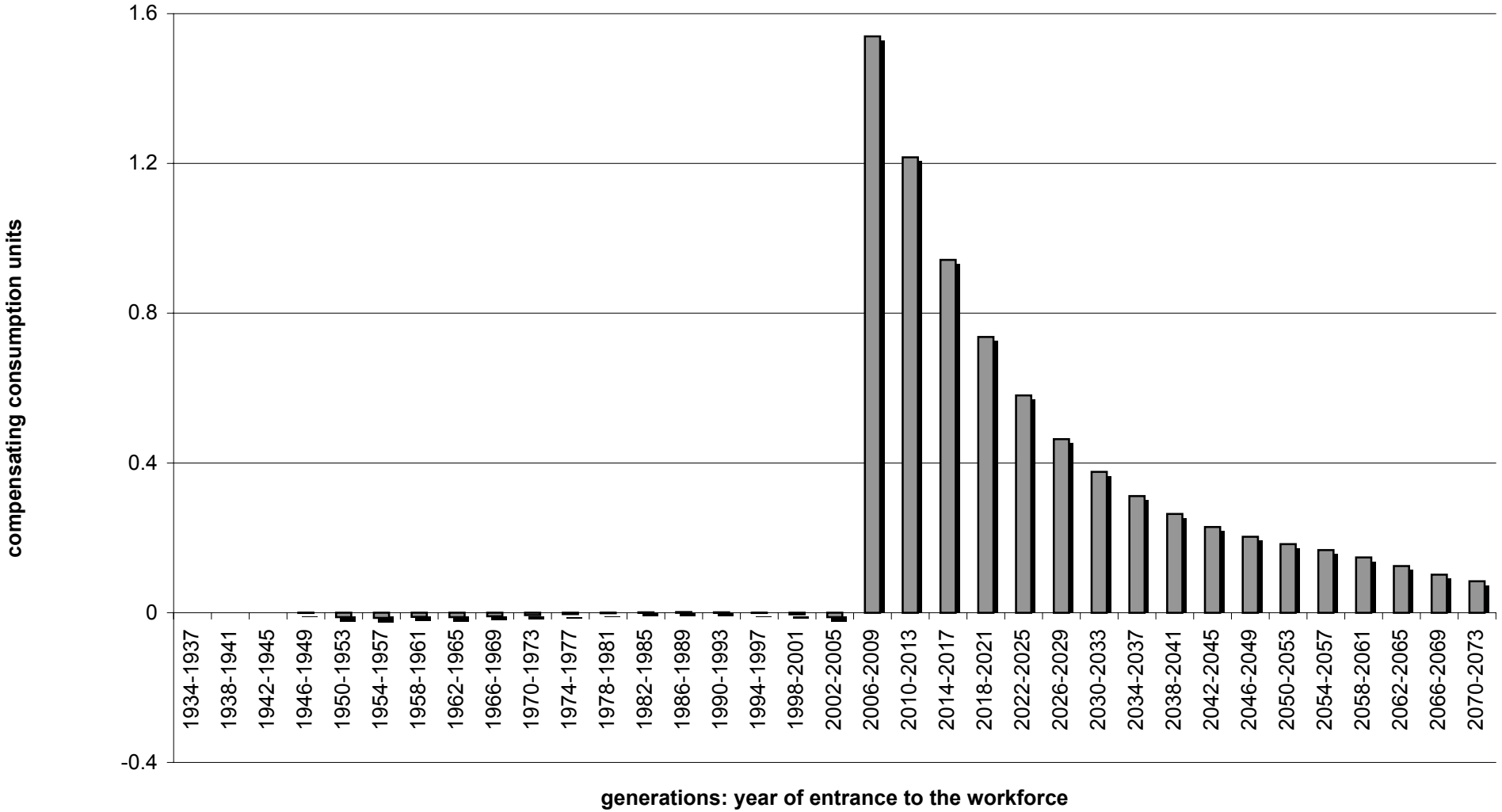

Figure 10. Welfare Analysis of Calibrated Wage Tax Policy w.r.t. 1990s Historical Path