A TAX REFORM PROPOSAL FOR TURKEY: FLAT TAX SYSTEM

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ABSTRACT

A TAX REFORM PROPOSAL FOR TURKEY: FLAT TAX SYSTEM

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This study compares the macroeconomic and welfare effects of of a fundemantal tax reform, that is flat tax system for the Turkish case by using a dynamic life-cycle simulation model. Flat tax system removes all current tax rates and taxes all sources of income at the same rate by expensing the investments at the year they are made. The model projects significant increase in output by shifting from the current graduated tax system to the flat tax; as well as an increase in welfare.

Keywords: Life-cycle Simulation, Overlapping Generations Model, Flat Tax Reform, Turkey

ÖZ

TÜRKİYE İÇİN BİR VERGİ REFORMU ÖNERİSİ: DÜZ VERGİ SİSTEMİ

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Bu çalışma, dinamik yaşam döngüsü simülasyon modeli kullanarak Türkiye için temel bir vergi reformu önerisinde -düz vergi sistemi- bulunarak, iki durum arasındaki makroekonomik değişkenler ve refahın bir karşılaştırmasını sunmaktadır. Düz vergi sistemi durumunda modelde yer alan önceki tüm vergiler kaldırılır ve yerine tüm gelir sabit bir oranla vergilenir ve o yıl yapılan yatırımlar vergi tabanından düşülür. Model, önerilen vergi sisteminin önemli bir üretim ve refah artışı sağlayacağını tahmin etmektedir.

Anahtar Kelimeler: Yaşam Döngüsü Modeli, Ardışık Nesiller Analizi, Düz Vergi Reformu, Türkiye

To my husband

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CHAPTER 1

INTRODUCTION

Although their forms and purposes vary across countries, tax systems are important determinants of the individual decision making process which may indeed constitute the stimulator of an economy. Having such significant impacts on the economy, tax systems should be well-designed. In the pursuit of a sound taxation system which is effective, simple and fair; one fundamental reform proposal belongs by Hall and Rabushka (1995), *The Flat Tax* has come into prominence.

Flat tax means a single-rate tax which is levied on all types of income. According to Hall and Rabushka (1995), flat tax provides more individual freedom relative to the graduated tax systems and by increasing the individual incentives, it encourages work and asset accumulation. Basically, there are a couple of principles of the flat tax system: all income is taxed only once and at the same rate, tax system should be easy to enforce and the poorest households should not be taxed until their income increases to a certain level. These principals make the system efficient, simple and fair.

Need for a reform in Turkish taxation system is a controversial issue and the first steps are taken in 2013. Minister of Finance of Turkey pointed out the need for a change in the tax system by proposing a new *Income Tax Law* which is now on the agenda of the Council of Ministers of the Republic of Turkey. Since there is a need for a fundamental tax reform, promising an increase in the output level, introduction of the flat tax to the Turkish economy might be a policy proposal and may bring welfare gains to the individuals. The aim and the main contribution of this study is to introduce a fundamental tax reform; the flat tax system to the Turkish economy for the first

time and to reveal its impacts on certain macroeconomic variables and welfare by also providing the transition path.

Prevalent approach on the evaluation of the tax systems is conducting a computable general equilibrium framework and project the impacts of the policy change by simulation analysis. Since the problem is dynamic in nature, and both the current and future impacts should be considered, observing the effects of shocks are very intuitive within this framework. Moreover, this structure also provides the necessary tools for the solution of the transition path of the economy. Thus, this study conducts a dynamic life-cycle simulation model with overlapping generations that is constructed by Auerbach and Kotlikoff (1987).

The model in this study contains 55-period living individuals that can be considered as entering the economy at their age of 20 and die at the age of 75. During their lifetime, individuals have perfect foresight of the factor prices and behave accordingly. Individuals have a bequest motive, that is to say, they gain utility as they leave bequests to the upcoming generations. All households are identical and represented by a single household. Firms are also assumed to be identical and operating under a perfectly competitive environment. Government on the other hand, collects the tax revenue and have the right to issue one period debt. Moreover, government expenditures are assumed to be unproductive and do not bear utility to the households. Outlined model is firstly analyzed in its long-run equilibrium and the current structure. Then, the policy change that is the introduction of the flat tax is imposed on the economy. Although there are various ways of including flat tax into the model, this study uses the one of Ventura (1999), since that model provides also the investment expensing feature. Of this policy change, both the long-run consequences and the transition path are examined in detail. It is seen that the proposed tax reform provides welfare gains as well as increase in total output of the economy.

Previous literature regarding the flat tax reform, dynamic life-cycle simulation model and simulation of Turkish tax system are discussed in detail in Chapter 2. Then, Chapter 3 provides a brief summary of the Turkish taxation system and demonstrates how it is modelled in this study. Chapter 4 describes the construction of the 55-period

overlapping generations model for the current structure of the Turkish tax system and for the proposed tax reform. In Chapter 5, following the representation of the solution process of the model and parametrization, simulation results and consequences of the reform is given. Chapter 5 also includes the welfare and sensitivity analysis regarding the model parameters and Chapter 6 concludes.

CHAPTER 2

LITERATURE REVIEW

Of modern macroeconomics, the building blocks contain two main approaches one of which assumes infinitely living agents, while the other attributes finite lives to the agents in the economy according to Delacroix and Michel (2002). The second approach consists the overlapping generations (OLG) model which finds its roots on the life-cycle hypothesis of savings of Modigliani and Brumberg (1954) and Ando and Modigliani (1963) upon which this study is also built.

Although Allais (1947) was the first one who developed the idea behind the OLG Model, the model became famous after the studies of Samuelson and Diamond. While Samuelson's (1958) model does not include production, Diamond (1965) version of the model has a more complex structure since it contains 2-period living agents who accumulate capital and has identical preferences over consumption in each period. From the development of the initial versions, the OLG model has been subject to many extensions as well as modifications. Being one of these extensions, it has been over 30 years that the first version of the Auerbach-Kotlikoff dynamic life-cycle simulation model (A-K Model) was developed. Having introduced a new method of policy implementation, the simulation model, in a broad sense, has greatly contributed to the public economics studies by enabling policy makers to see the impacts of a certain policy on various economic variables such as growth, welfare and distributional issues.

A-K Model considers cohorts which are distinguished by their dates of birth and each cohort lives for 55 years in which they have a perfect foresight of the factor prices. The model not only provides a tool for revealing the steady states of dynamic economies,

but it also allows for studying the exact transition path through a new state, duration of which might carry important information. After the original work was published, many extensions to the model has been made. While the model in Auerbach and Kotlikoff (1983) was including exogenous labour supply while exploring the effect of timing of future taxation, Auerbach et al.(1983) has enriched the model by the addition of endogenous labour supply. With the book "Dynamic Tax Reform by Auerbach and Kotlikoff (1987) which describes the model and the solution process in a detailed manner, the model gained many more extensions such as progressive taxation, social security, demographics and deficit finance. Laitner (1990) proposed a methodology for examining the stability and determinacy for the model. Imrohoglu (1998) developed a 65-period version of the model and introduced life-span uncertainty and idiosyncratic risk to the model. Introduction of the probability of death and life-insurance contracts to tax policy simulations in A-K Model is made by Heidjra and Ligthart (2000). Heidjra and Romp (2008) extends the model by including this mortality process in a small open-economy framework to study the impacts of some typical shocks analytically. The model also has been extended with the idea of successive generations are linked to each other by bequests. Bequest motive can be added by modifying the preferences of the households so as to care about their heirs' utility, as Barro (1974) suggested, or the bequest motive may just rely on the utility gained by the "joy of giving", as Blinder's (1973) study also did.

As the tax reform issue in the U.S. economy become controversial, studies about policy implications of new tax structures have captured attention. Providing a seminal framework for these studies, A-K Model has started to be widely used by the researchers who study on the consequences of the proposed tax structures. For each of the tax reforms proposed, Aaron and Gale eds., (1996) presents the main effects.

Being one of the proposed tax reforms, flat tax has also raised a discussion due to its positive impacts on welfare and simplicity. Flat tax proposed by Rabushka and Hall (1995) refers to "one uniform rate" for the whole income. According to the authors, tax systems that are unfair, complex and inefficient have significant negative impacts on agents' decisions. Unfair tax systems reduce households' incentives both to work and save which are the stimulator of an economy. Graduated tax systems are regarded

as complex, and costly to apply thus they reduce efficiency by distorting prices more. Moreover, if the tax-systems are not well-designed they may create a suitable floor for tax evasion, tax avoidance and underground economy. This need for a sound taxation made the authors come up with the idea of flat taxation in which efficiency, fairness and simplicity are said to be met. This new tax system is expected to reach certain macroeconomic goals within revenue neutrality. Under integrated flat tax, tax rate on all income types are equal and investments are not taxed at the year in which they are made. There are two main benefits of this tax reform proposal. When there are different taxes, income is taxed and then the saving made out of that income and the return on this saving is taxed again. With the investment expensing feature of the flat tax, the double taxation problem is removed which increases capital formation. Furthermore, since all income is taxed equally with a constant rate, individual freedom in decision making increases. Hence, households' incentive to work increases, which improves welfare through an increase in total output.

Exploring the implications of this tax reform for the U.S economy is made under a general equilibrium framework by Ventura(1999). The study revealed that the tax reform brings about sizeable gains on capital accumulation and aggregate labour in efficiency units. Ventura also observes a more concentrated distribution of wealth with the introduction of the flat tax. A more detailed simulation for fundamental tax reform in the U.S was made by Altig et al.(2001) using A-K Model including constant exogenous population growth rate, heterogeneous agents and a bequest motive. The study suggests five fundamental alternatives -proportional income tax, proportional consumption tax, flat tax, flat tax with relief and the x-tax by revealing the welfare comparisons between them. The authors find that the flat tax creates a trade off by producing a positive impact on welfare of low-income households in the long run at a more than the increase in output while leaving the first generations worse off and increases the inequality. However, Gentry and Hubbard (1997) reveals that this tax does not necessarily generate more inequality than other forms of tax. Paulus and Peichl (2009) estimates impact of various flat rates for Western Europe and their simulation projects that a revenue neutral flat tax reform improves work incentives and increases income equality under certain circumstances but creates an equity-efficiency

trade-off in some cases. Caucutt et al. (2003) analyses the growth and welfare effects of shifting from progressive taxation to flat rate taxation in a heterogeneous agent general equilibrium model of endogenous growth and finds out that welfare increases under flat tax system.

Despite many simulation studies on the U.S. fiscal policy, few studies have been conducted for Turkey so far. For the Turkish case, first study using the A-K Model is the one of Sayan and Kenc (1998) which examines the consequences of policies designed to restrain the rapid growth in pension deficits. Voyvoda and Yeldan's (2005) study examines the impacts of IMF-led austerity program in Turkey which was driven with the aim of attaining primary fiscal surpluses in a 30-period OLG environment. Değer (2011) also constructs a 30-period OLG model in which he examines the impacts of the social security reform that has been recently put into practice. More recently, Ileri and Derin-Güre (2014) constructs the A-K model for the Turkish economy in order to propose an alternative tax system. Authors model three heterogeneous agents whose wage earning ability differs -so does their income- and simulates the proposed system to capture the impacts of this policy change on different income groups. The tax proposal in this paper is a decrease in the value added tax rate and an increase in the top labour income tax rate. The study reveals that the proposal does not harm production, increase the welfare and brings about a more even distribution of wealth.

Since there are not many studies conducted about the impacts of a tax reform for the Turkish case, this study aims to fill this gap and introduce a fundamental tax reform under revenue neutrality to the Turkish economy. The study reveals the consequences of the reform and impacts on certain macroeconomic variables by using a dynamic life-cycle simulation model. What the model adds upon the existing simulation study (Ileri & Derin-Güre, 2014) for Turkey is the population growth rate it includes and the bequest motive which carry high importance for the aggregate saving behaviour. Furthermore, the study does not only reveals the final impact of the flat-tax proposal, but it also provides the transition path of the modelled economy through the new long-run equilibrium.

CHAPTER 3

TURKISH TAX SYSTEM

Since this study aims to compare the impacts of transition to a different tax regime for the Turkish case, analysis of the current structure and justification of the modelled economy is important. For this aim, this chapter introduces the main features of the Turkish Tax System and demonstrates how these features are represented in the modelled economy.

3.1 Turkish Tax System: A Summary

Turkish taxation system can be examined under two main systems; direct taxation system and indirect taxation system.

3.1.1 Direct Taxation System

Income tax and corporate tax are the main taxes in the direct taxation of Turkish tas system. Income tax is levied on all kinds of income and earnings, while corporate tax is levied on companies.

3.1.1.1 Income Tax

Income tax is levied on each individual's income separately without considering the source. It might be salaries and wages, business and agricultural profits, rental income, income from capital investment or income from independent personal services.

Tax liability, is generally determined by employing residency criterion. Any individual who lives in Turkey for more than six months in a year, is considered as a resident and has tax liability. Nationality is also another criterion meaning that worldwide income of all Turkish citizens is taxed. Regulations and exemptions regarding income tax are stated in *Income Tax Law*.

There are some elements that an individual's income may consist and determination of net income varies for all types of these elements. Profits made from commercial and industrial activities are named as business profit. Simply, the difference between the net assets at the beginning of the year and at the end of the year constitutes the taxable income of a business enterprise. There are two methods used for determination of business profits: lump-sum basis and actual basis. Computation of the profits by these two methods is a complex issue and includes a long list of deductible and non-deductible expenses. Income derived from agricultural activities, that is, agricultural income is also subject to income tax and requires taxation under two different categories for those who are not exempted. Income of farmers whose annual proceeds does not exceed a certain amount specified by Council of Ministers is determined in lump-sum basis whereas the others are subject to actual basis in which they have to record their revenues and expenses. For agricultural tax, some expenses are deducted from the gross revenue, too. Wages and salaries -income comprising all kinds of employment income and other benefits- are also taxed after legal deductions such as pension payments, insurances and labour union membership payments are made. Income earned by the services performed by independent professionals, are recorded and taxed after all expenses listed by the authority related to the professional service is deducted. Income from immovable property as in forms of interest, dividend, rent and the like are tax after a certain list of earnings are deducted. Lastly, capital gains are taken under *other income and earnings*. Deductions for the taxation to this kind of income has some thresholds under and above which different deductions and calculations are made.

3.1.1.2 Corporate Tax

Earning and income derived by corporations are taxed under corporation tax. Taxpayers specified in the *Corporate Tax Law* are capital companies and similar foreign companies, cooperatives, public enterprises, enterprises owned by foundations, societies, associations and lastly joint ventures.

Legal entities whose head offices are in Turkey or effective management takes place in Turkey are covered by the Law. The Law also assures that the entities whose head office and place of effective management are abroad are taxed over the income derived in Turkey.

Determination of business profit under income tax also applies to the procedure of corporate tax. In addition to the deductions made to the expenses made, another list of expenses are also deducted by determining the net corporate income.

3.1.2 Indirect Taxation System

There are several indirect taxes in Turkey while the most important one is the value added tax (VAT). VAT is not only levied on the supply of goods and services at each stage of production and distribution, but also on import of goods and services. VAT is computed by applying the rate of taxation to the taxable base for the commodities supplied by the tax payer, then this is reduced by a credit for VAT on importation. In both cases, tax is ascribed to the final consumer. There are also some deductions and a list of non-deductable items, and some transactions are exempt from the VAT.

Besides the VAT there are also other forms of indirect taxation such as stamp tax, motor vehicle tax, banking and insurance transactions tax, gambling tax, inheritance and gift tax, property taxes, communication tax, education contribution fee, customs duty, fees and special consumption tax. However, these components constitute a minor part of the indirect taxation.

3.2 Modelling Turkish Tax System

Since Turkish tax system has a graduated structure and has too many components and countless deductions, it exhibits a complex structure for modelling. Thus, in order to provide a simple version that still carries the main characteristics, largest components of the Turkish tax system is chosen for the base case of the model.

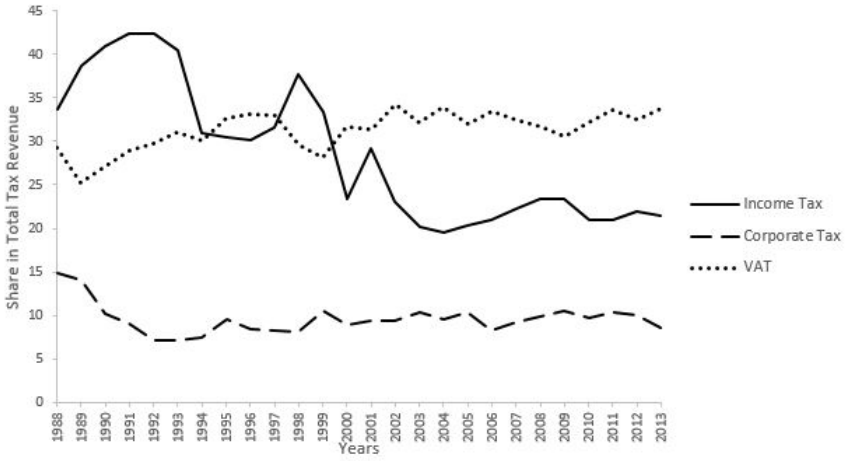

Figure 3.1: Shares of Income Tax, Corporate Tax and VAT Revenues in Total Tax Revenue of Turkey for 1988-2013. Source: Revenue Administration, Tax Statistics

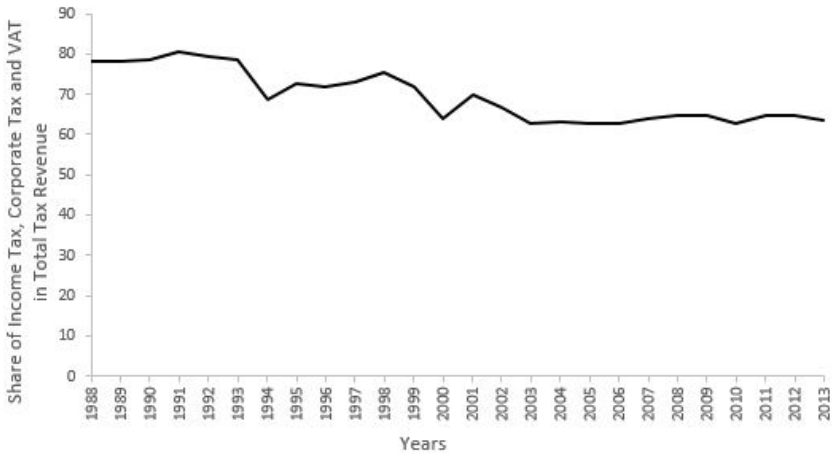

Figure 3.2: Share of Sum of Income Tax, Corporate Tax and VAT Revenues in Total Tax Revenue of Turkey for 1988-2013. Source: Revenue Administration, Tax Statistics

Figure 3.1 demonstrates the shares of income tax, corporate tax and VAT in total tax

revenue of Turkey between the years 1988 and 2013. It is seen that although shares did not stay the same, their dominance in total tax revenue remained. In order to provide a better notion for the dominance of these taxes, figure 3.2 reveals the share of these three taxes in total tax revenues. It is seen that share of income tax, corporate tax and VAT varies between 60 % and 80 %.

In the light of these information about the Turkish Tax System, this study uses income tax and VAT as a proxy for the Turkish tax system in the course of modelling. The reason for excluding the corporate tax is the fact that there are no distinction made on firms that is to say all behave in the same way in the modelled economy and they are assumed to be perfectly competitive and have zero profit in equilibrium. Income tax have two forms since it can be taken from the wages that households earn or the interest income they made out of their savings and lastly, VAT enters the modelled economy as a consumption tax.

CHAPTER 4

THE MODEL

A-K Model framework provides a path for the economy in which all agents rationally take future changes into account while making their decisions. There are three sectors in this model. In the light of the life cycle theory framework, 55-period living households -household sector-, choose the optimal consumption and leisure levels for both current and future periods based on their preferences and given their lifetime budget constraint. The model examined here also contains a bequest motive for the households, thus they also choose the amount of bequests they leave in the last period of their lives which will be transferred to the next generation when they are at the age of one. The second sector, production, on the other hand, is provided by the use of both capital and labour and characterized by a single representative firm. Government, the third sector, levies taxes and make unproductive activities with the revenues collected given the budget constraint where there is only one type of government debt. The base case and the flat tax reform differs only by their tax structures.

This chapter describes the model on which this study is built upon by revealing firstly the base case and secondly the flat tax reform.

4.1 The Base Case

In the base case, there are three types of taxes that are levied on labour and capital income earned, and consumption made.

4.1.1 Households

Household sector consist of 55 overlapping generations of adults, each representing a single member. Agents have identical tastes and economic opportunities. There is a constant population growth rate n meaning that each generation is $(1+n)$ larger than the previous one. Households choose the levels of consumption, leisure and bequest that give them the maximum utility, subject to their budget constraint.

4.1.1.1 Preferences

We assume that a utility function represents each household's preferences for current and future consumption and leisure levels, and for the bequest she leaves. Leisure can take values between zero and one corresponding to the fraction of time that an individual can work. The model constructs a time separable utility function in constant elasticity of substitution (CES) form as in Auerbach and Kotlikoff (1987). The lifetime utility function is given by:

$$U_t = \frac{1}{1-\frac{1}{\gamma}}[\sum_{s=1}^{55}(1+\delta)^{-(t-1)}(c_{s,t+s-1}^{1-\frac{1}{\rho}} + \alpha l_{s,t+s-1}^{1-\frac{1}{\rho}})^{\frac{1-\frac{1}{\gamma}}{1-\frac{1}{\rho}}} + (1+\delta)^{-54}\mu b_{55,t+54}^{1-\frac{1}{\gamma}}] \quad (4.1)$$

In Equation (4.1), indices s and t refer to age and year respectively. Thus, c and l are the consumption and leisure in the corresponding year and age, where b stands for the bequest left. Agents leave the bequest at the age of 55 and this action enters the utility function only in the last period of their lives; meaning that $b_{s,t} = 0$ for $s \neq 55$. Parameter ρ stands for the responsiveness of the labour supply of an individual to the wage rate and reveals the constant elasticity of substitution between c_t and l_t. The parameter α indicates the weight of leisure in households' preferences relative to consumption. High values of α correspond to lower labour supply decision to obtain consumption. δ is the pure rate of time preference which is a discount rate revealing the preference of earlier years of life for both consumption and leisure rather than later years. Higher δ values bring about lower savings since household prefers to spend

sources she has in the early years of her life. γ reveals the inter-temporal elasticity of substitution between consumption in different years and it manages the household's incentive to save. Lastly, parameter μ stands for the weight on bequests revealing the *joy of giving*. All parameters are identical for all agents.

4.1.1.2 Budget Constraint

Since the current decision of the household on the path of consumption, leisure and bequest is made as a part of its life-time plan for each of the upcoming years, it can be said that the entire path is determined from a single optimization problem made at the very beginning of the household's lifespan.

In the base case of the model, households have an earning from the labour and capital income each year, and an inheritance received from the previous generation only in the first year of life. After the labour and capital income are taxed, households can consume these earnings with a consumption tax, save by holding risk-free assets adding this amount to their asset stock, or leave it as bequest to the next generation in the last year of their lifetime. Thus, the household maximizes its utility function presented by equation (4.1) subject to the lifetime budget constraint without leaving debts. There are no liquidity constraints imposed on the households in this model. Under the model economy, budget constraint of each household is represented as

$$a_{s+1,t+1} = (1 + r_t(1 - \tau_{k,t}))a_{s,t} + w_t(n_{s,t})(1 - \tau_{w,t}) - (1 + \tau_{c,t})c_{s,t} + i_{1,t} - b_{55,t} \quad (4.2)$$

where

$$1 - l_{s,t} = n_{s,t} \quad (4.3)$$

In equation (4.2), a is the capital holdings of agents of the corresponding year and age. r_t is the before tax returns to savings and w_t is the wage rate in period t where n given

by equation (4.3) is the labour supply of the household. $i_{1,t}$ is the inheritance that the household receives at the age of one, that is $i_{s,t} = 0$ for $s \neq 1$ and $b_{55,t}$ is the bequest to leave as mentioned earlier. There are three types of taxes that household must pay to the government in the model. First one is the tax on wage income denoted by τ_w, the second is the tax on capital income denoted by τ_k and the third is on consumption denoted by τ_c. Tax system alters the decisions of the individuals since it changes the budget constraint that they face. Moreover, taxation may change the relative prices of consumption, leisure and bequests through the income and substitution effects.

In addition to the budget constraint, another restriction is needed to be imposed on the household to prevent labour supply taking negative values. If the household is to choose more than one unit of leisure, it should be taken as zero labour supply meaning that the household retired.

$$l_t \leq 1 \quad \text{for all } t \tag{4.4}$$

Another restriction on the household is the fact that household enters the economy with zero capital stock and do not leave any assets after death. In other words, all assets should be spent in the form of consumption or bequest before the agent dies. This condition is given as

$$a_{1,t} = a_{56,t} = 0 \quad \text{for all } t \tag{4.5}$$

4.1.1.3 Choice of Consumption, Leisure and Bequest

Given the preferences and constraints, household's problem in this model can be written as

$$\max_{c_{s,t}, l_{s,t}, b_{55,t}} U_t = \frac{1}{1-\frac{1}{\gamma}} [\sum_{s=1}^{55} (1+\delta)^{-(t-1)} (c_{s,t+s-1}^{1-\frac{1}{\rho}} + \alpha l_{s,t+s-1}^{1-\frac{1}{\rho}})^{\frac{1-\frac{1}{\gamma}}{1-\frac{1}{\rho}}} + (1+\delta)^{-54} \mu b_{55,t+54}^{1-\frac{1}{\gamma}}]$$

s. t.

$$a_{s+1,t+1} = (1 + r_t(1-\tau_{k,t}))a_{s,t} + w_t(n_{s,t})(1-\tau_{w,t}) - (1+\tau_{c,t})c_{s,t} + i_{1,t} - b_{55,t}$$

$$l_t \leq 1$$

$$a_{1,t} = a_{56,t} = 0$$

Maximization of the utility function with respect to the constraints described above gives the first order conditions for consumption, leisure and bequest and by using the combination of the first order conditions, one can obtain the following Euler Equations.

$$c_{t+1} = [\frac{1 + r_t(1-\tau_k)}{1+\delta}]^{\gamma}[\frac{1+\alpha\rho(1-\tau_w)w_{t+1}^{1-\rho}}{1+\alpha\rho(1-\tau_w)w_t^{1-\rho}}]^{\frac{\rho-\gamma}{1-\rho}}c_t \tag{4.6}$$

$$l_{t+1} = [\frac{1 + r_t(1-\tau_k)}{1+\delta}]^{\gamma}[\frac{1+\alpha\rho(1-\tau_w)w_{t+1}^{1-\rho}}{1+\alpha\rho(1-\tau_w)w_t^{1-\rho}}]^{\frac{\rho-\gamma}{1-\rho}}[\frac{w_{t+1}(1-\tau_w)}{w_t(1-\tau_w)}]^{-\rho}l_t \tag{4.7}$$

$$l_t = [\frac{w_t(1-\tau_w)}{\alpha(1+\tau_c)}]^{-\rho}c_t \tag{4.8}$$

Equations (4.6) and (4.7) can be interpreted as, leisure and consumption grow at the same rate unless wage varies. If the wage varies, on the other hand, final impact will be determined by the combined effects of intra-temporal and inter-temporal substitution. Equation (4.8) relates contemporaneous leisure and consumption revealing the trade-off.

In order to determine the shape of bequest profile, one should solve the maximization problem with respect to the 55^{th} period's budget constraint. Euler equation regarding bequest is given by the following equation:

$$b_t = [\frac{1}{(1+\tau_c)\mu}]^{-\gamma}c_t^{\gamma/\rho}[(c_t^{1-\frac{1}{\rho}} + \alpha l_t^{1-\frac{1}{\rho}}]^{\frac{\rho-\gamma}{\rho-1}} \tag{4.9}$$

4.1.2 Firms and Technology

Through the decisions of the households, aggregate capital and labour are determined. Assets accumulated by the households less constant debt stock become the capital

stock of that particular year denoted by K_t. Similarly, labour hours supplied by the households constitute the aggregate labour of that period L_t in the economy.

$$K_t = (1+n)^t \sum_{s=1}^{55} (1+n)^{-(s-1)} a_{t+s-1} - D_t \tag{4.10}$$

$$L_t = (1+n)^t \sum_{s=1}^{55} (1+n)^{-(s-1)} (1 - l_{s,t+1-s}) \tag{4.11}$$

Output is produced by a large number identical firms behaving competitively that have a constant-returns-to-scale production function. These firms are represented in the model by a single firm which uses capital and labour. As in the preferences, the model assumes the production function to have the form of CES as in Aurerbach and Kotlikoff (1987).

$$Y_t = A[\epsilon K_t^{1-\frac{1}{\sigma}} + (1-\epsilon) L_t^{1-\frac{1}{\sigma}}]^{\frac{1}{1-\frac{1}{\sigma}}} \tag{4.12}$$

In equation (4.12) Y_t, K_t and L_t stand for output, capital and labour respectively for period t. A is the technology parameter and assumed to be constant over time meaning that there is no technological change in the model. ϵ reveals the intensity of use of capital in the production process whereas the elasticity of substitution is given by σ.

In the model, firms are assumed to adjust the amount of both labour and capital without any cost. Since the firm is competitive, labour will be paid at its marginal product, in equilibrium. Capital will also be paid its marginal product in equilibrium which is equal to the interest rate. Given the production function, one can obtain the wage rate w_t and interest rate r_t from the first order conditions of the representative firm's profit maximization problem. Equations (4.13) and (4.14) represents the factor prices.

$$w_t = (1-\epsilon) A[\epsilon K_t^{1-\frac{1}{\sigma}} + (1-\epsilon) L_t^{1-\frac{1}{\sigma}}]^{\frac{1}{\sigma-1}} L_t^{-\frac{1}{\sigma}} \tag{4.13}$$

$$r_t = \epsilon A[\epsilon K_t^{1-\frac{1}{\sigma}} + (1-\epsilon)L_t^{1-\frac{1}{\sigma}}]^{\frac{1}{\sigma-1}} K_t^{-\frac{1}{\sigma}} \tag{4.14}$$

4.1.3 Government

Government in this model taxes labour income, capital income and consumption and is free to issue a single type of one-period debt to finance its expenses which is a perfect substitute of the capital used in the production. Government uses the tax revenues generated to pay for its own spending and the interest payments on the previous debt. The model assumes that the government spending grows at the same rate with the population, does not provide any direct or indirect utility to households and thus does not have any effect on the decisions of the households. Evolution of the government's debt is given by the following equation:

$$D_{t+1} + \sum_{s=1}^{55} (1+n)^{-(s-1)} TR_t = G_t + (1+r_t)D_t \tag{4.15}$$

D_t is the stock of debt at period t and G_t is the government spending. TR_t is the net tax collections in period t whose formulation is given by equation (4.16) in which C_t stands for the aggregate consumption in time t.

$$TR_t = \tau_{w,t} w_t L_t + \tau_{k,t} r_t K_t + \tau_{c,t} C_t \tag{4.16}$$

4.1.4 Equilibrium

Equilibrium in this model is the one in which the behaviours of households, firms and government is consistent with the current and future prices by virtue of the perfect foresight assumption whose formal definition is given below.

An equilibrium under the base case described above is a sequence of consumption, leisure and bequest choices and demand for factors of production such that:

i) Given the wage w_t, interest rate r_t and tax rates $\tau_{k,t}$, $\tau_{w,t}$, $\tau_{c,t}$, households choose the consumption sequence $\{c_{s,t+s-1}\}_{s=1}^{55}$, labour sequence $\{l_{s,t+s-1}\}_{s=1}^{55}$, asset stock sequence $\{l_{s,t+s-1}\}_{s=1}^{55}$ and bequest levels $\{b_{55,t}\}$ such that the lifetime utility given by equation (4.1) is maximized subject to the contraints given by the equations (4.2), (4.4) and (4.5).

ii) Given the factor prices $\{w_t\}$ and $\{r_t\}$, firms maximize their profits by demanding K_t and L_t.

iii) Government budget constraint that is given by equation (4.15) is balanced for each year t.

iv) Markets for goods, labour and asset clear each year.

4.2 Flat Tax Reform

When the flat tax reform is applied, previous three taxes are removed and one uniform rate instead of those is levied. In this version of the flat tax reform, all labour and capital incomes are regarded as the same and are subject to the same proportional taxation. For simplicity, no threshold level for the labour income is used. The main feature of this reform is its expensing for the investment made. Savings are fully deducted at the year they are made.

4.2.1 Households

Since the tax structure changes, the behavior of the households is also expected to change given the new decision environment.

4.2.1.1 Preferences

Since the taxes and/or government expenditures do not have any weight on the utility functions of the households, tax reform will not make any change on preferences. Thus, equation (4.1) represents the utility function of the households in this case.

4.2.1.2 Budget Constraint

Changing the tax structure changes the budget constraint that households face. Under the tax reform, new budget constraint is given by:

$$a_{s+1,t+1} = (1+r_t)a_{s,t}+w_t(1-l_{s,t})-c_{s,t}-\tau_{f,t}[r_t a_{s,t}+w_t(1-l_{s,t})-(a_{s+1,t+1}-a_{s,t})]+i_{1,t}-b_{55,t} \tag{4.17}$$

In equation (4.17), $\tau_{f,t}$ stands for the flat tax rate at time t. With this tax reform and the new budget constraint, all kinds of income are taxed after the savings of that particular period is deducted. Due to this feature of flat tax, this tax system is regarded as a special type of consumption tax.

Other constraints binding the households do not change and are given by equations (4.4) and (4.5) just as in the base case.

4.2.1.3 Choice of Consumption, Leisure and Bequest

Since the budget constraint is changed, optimal consumption, leisure and bequest profiles will certainly change. In order to find the new path of the behavior, household's problem under flat tax case can be written as

$$\max_{c_{s,t},l_{s,t},b_{55,t}} U_t = \frac{1}{1-\frac{1}{\gamma}}[\sum_{s=1}^{55}(1+\delta)^{-(t-1)}(c_{s,t+s-1}^{1-\frac{1}{\rho}}+\alpha l_{s,t+s-1}^{1-\frac{1}{\rho}})^{\frac{1-\frac{1}{\gamma}}{1-\frac{1}{\rho}}}+(1+\delta)^{-54}\mu b_{55,t+54}^{1-\frac{1}{\gamma}}]$$

s. t.

$$a_{s+1,t+1} = (1+r_t)a_{s,t}+w_t(1-l_{s,t})-c_{s,t}-\tau_{f,t}[r_t a_{s,t}+w_t(1-l_{s,t})-(a_{s+1,t+1}-a_{s,t})]+i_{1,t}-b_{55,t}$$

$$l_t \leq 1$$

$$a_{1,t} = a_{56,t} = 0$$

Deriving and combining the first order conditions from the maximization problem described above, one ends up with the following Euler Equations.

$$c_{t+1} = [\frac{1+r_t}{1+\delta}]^{\gamma}[\frac{1+\alpha\rho w_{t+1}^{1-\rho}}{1+\alpha\rho w_t^{1-\rho}}]^{\frac{\rho-\gamma}{1-\rho}} c_t \tag{4.18}$$

$$l_{t+1} = [\frac{1+r_t}{1+\delta}]^{\gamma}[\frac{1+\alpha\rho w_{t+1}^{1-\rho}}{1+\alpha\rho w_t^{1-\rho}}]^{\frac{\rho-\gamma}{1-\rho}}[\frac{w_{t+1}}{w_t}]^{-\rho} l_t \tag{4.19}$$

$$l_t = [\frac{w_t(1-\tau_f)}{\alpha}]^{-\rho} c_t \tag{4.20}$$

Interpretation of the Euler equations are the same with the base case.

Maximizing the utility function with respect to 55^{th} period's budget constraint in the flat tax case, following bequest profile can be found.

$$b_t = [\frac{1-\tau_f}{\mu}]^{-\gamma} c_t^{\gamma/\rho}[(c_t^{1-\frac{1}{\rho}} + \alpha l_t^{1-\frac{1}{\rho}}]^{\frac{\rho-\gamma}{\rho-1}} \tag{4.21}$$

4.2.2 Firms and Technology

Neither the production function, nor the formulations for the labour and capital formation changes, thus factor demands and prices will remain the same as in the base case given by equations (4.13) and (4.14).

4.2.3 Government

Government also remains the same under flat tax reform whose debt evolution is still given by Equation (4.15). Only change will be the composition of total tax revenue, TR.

$$TR_t^f = \tau_{f,t}[w_t L_t + r_t K_t - (K_{t+1} - K_t)] \tag{4.22}$$

Although the composition of the revenue changes, since the proposed tax reform is a

revenue neutral one, amount of taxes collected will remain the same as in the base case model.

4.2.4 Equilibrium

Formation of the equilibrium in flat tax reform case is the same of the base case's with the changes arising from the new tax system is taken into account.

CHAPTER 5

SIMULATION

In order to examine the consequences of the proposed tax reform, this chapter describes the solution method and simulation process given the relevant parametrization. Simulation results also include the welfare analysis and the sensitivity analysis.

5.1 Solving the Model

Equilibrium path of the modelled economy can be calculated in three steps as suggested by Auerbach and Kotlikoff (1987). First step is to calculate the initial long-run equilibrium of the economy and second step is the calculation of the second long-run equilibrium. Third and the final step is the solution for the transition path of the economy from the initial state to the second. Transition starts with the policy change and agents adjust their behaviour using the perfect foresight feature. In this study, for all three steps of the solution, Gauss-Seidel method which is an iterative technique is used and simulations are done with the help of *MATLAB* software program.

Initial long-run equilibrium in this model is the base case and the second is the flat tax reform. When the economy is operating under the base case and in its long-run equilibrium, the policy change of the study, flat tax reform is introduced. After a certain transition is observed, the economy achieves its new long-run equilibrium with the proposed tax structure.

5.1.1 Base Case Long-run Equilibrium

Solving for the base case and the flat tax reform long-run equilibriums of the economy is not so complex as the transiton path and solution techniques used for the two are identical.

Firstly, initial guesses for aggregate capital stock K and total labour supply L are given. For these guessed values, corresponding interest rate and wage rate are calculated using equations (4.13) and (4.14), since in long-run equilibrium these rates will not change over time.

Given the interest rate and the wage rate, households maximize their lifetime utility subject to the budget constraint. In this stage, there are non-linear equations need to be solved simultaneously for the analytical solution. There are 55 budget constraints, 54 Euler equations connecting consumptions of consecutive periods and 55 Euler equations connecting consumption and leisure for the same period, and lastly 1 Euler equation for the bequest profile. Moreover, initial capital stock is given and equals zero, or a value very close to zero. Although various algorithms might be used, this study uses an algorithm in which four main equations described above are solved in an inner loop for each period's consumption and leisure levels, asset stock amount and bequest level for the 55^{th} period. Solution is obtained with an *fsolve* function that makes the asset holdings zero at the end of the lifetime horizon, that is to say that makes 56^{th} period's asset stock equal to zero.

Obtaining the asset holding and labour supply decision of the households, aggregation is made and the corresponding aggregate capital stock and the total labour supply is compared to the initial guesses for these two values, in an outer loop.

If these two values -guessed and calculated- are identical for both variables, it means that the economy is in long-run equilibrium; if not, the process should be repeated with a new guess until the two are equalized. There are also various algorithms for updating the guesses and this study uses a simple one that depends on the difference between the guessed values and resulting values. Algorithm checks whether the guessed values for each of the two variables are greater or smaller than the calculated ones and applies

the appropriate operations to make these values converge at the specified level.

5.1.2 Flat Tax Reform Long-run Equilibrium

For the flat tax reform long-run equilibrium solution, procedure is exactly the same with the solution of the base case. However, with the proposed reform, since the maximization problem of the households changes, Euler equations and the budget constraint also change. Thus, equations for the second solution are now that of flat tax reform's where the policy change is implemented. For both of the iterations, regardless of the value of initial guesses the algorithm is robust and converges. Roughly $25 - 30$ iteration is adequate for the solution of the both two states which gives the analytical solution in a very short period of time.

5.1.3 The Transition

Solution of the transition path from the base case to the flat tax reform of the modeled economy resembles the method used for the long-run equilibrium solutions, however it requires a more complex structure since conditions change each period throughout the path. Thus individual decisions and aggregate variables must be consistent for the entire path. In other words, problem solved in the steady state solutions should be done simultaneously for every single period of the transition path. Following Auerbach and Kotlikoff (1987), modeled economy is provided with 150 years to achieve the second long-run equilibrium. In this case, initial guesses for each 150 years are given such that the aggregate capital stock and total labour supply in the first and last period of the transition should be equal to the base case long-run equilibrium and the flat tax reform long-run equilibrium, respectively. For economies that are expected to reach the second long-run equilibrium before 150 years, last guesses can be given the same value with the second long-run equilibrium values. Having the algorithm run for the initial guesses, interest rates and wage rates for 150 years are obtained. Given these rates, individuals who live in the transition period make their decisions. The aim is again to make guesses consistent with the aggregation of levels. Updating the guesses is also a more complex task in the transition which requires operations on aggregate capital

stock and total labour supply for each period of the transition path. As in the steady state case, when all guesses are consistent, economy is in equilibrium for each period. However, it should be noted that this algorithm works for the individuals who are born after the policy change. As Altig et al. (2001) also suggested, the ones who were alive when the shock is given does not have 55 years to adjust, so they can be regarded as died with the old policy and born again with the new policy. For these individuals, asset holdings they got until the reform are regarded as their initial capital stock while starting their new lives, and the horizon of their new maximization problem is the number of years left until their age of 55. Analytical solution of the transition path requires roughly 13500 iterations which take approximately 10 minutes, regardless of the initial guesses given.

5.2 Parameterization

In order to solve the model, preference parameters (γ, δ, ρ, α, μ) and production parameters (A, ϵ, σ) should be chosen. Aside from these, population growth rate (n) and tax rates (τ_w, τ_k, τ_c, τ_f) are also needed. The base case long-run equilibrium of the modeled economy should carry characteristics of the calibrated economy -Turkish economy in this case- thus, parameters should be chosen accordingly. In order to calibrate the modeled economy to the Turkish economy, some of these parameters are taken directly from the data for Turkey and some from the empirical studies on Turkey, while the remaining is set so as to achieve certain macroeconomic variables.

Following Sayan and Kenc (2001), the inter-temporal elasticity of substitution and the elasticity of substitution between consumption and leisure is taken as equal to 0.75 and 1.1 for Turkey, respectively. For the production sector, following the estimates of Yeldan (1996), elasticity of substitution between capital and labour is taken as 0.65. Moreover, Rodriguez and Ortega (2006) reveals the capital shares from UNIDO data set and for Turkey, it is equal to 0.78. As for fiscal variables, current tax rates of Turkey are taken. Proportional income tax on wages is taken as 20% which is the rate levied on the wage earnings of middle-income individuals, proportional income tax on capital income is taken as 10% and lastly, VAT is 18%. Population growth rate of Turkey for

the year 2013 is 0.12% according to data provided by the *Turkish Statistical Institute*. Aside from these parameters that are either drawn from data or empirical studies, other parameters are chosen such that certain macroeconomic variables of Turkey are calibrated. Flat tax rate is calculated so as to introduce the reform under revenue neutrality. A summary of parameters used to calibrate the model to Turkish economy is given in table 5.1.

Table5.1: Parameters

Symbol	Definition	Value	
	Preferences		
γ	Intertemporal elasticity of substitution	0.75	
δ	Rate of time preference	0.016	
ρ	Elasticity of substitution (consumption and leisure)	1.1	
α	Intensity of preferences for leisure	1	
μ	Utility weight on bequests	0.3	
	Production		
A	Technology parameter	1	
ϵ	Intensity of use of capital in production	0.78	
σ	Elasticity of substitution in production	0.65	
	Demographics		
n	Population growth rate	0.012	
	Values for Fiscal Variables		
		Base Case	Flat Tax
τ_w	Proportional labour income tax	0.20	-
τ_k	Proportional capital income tax	0.10	-
τ_c	Proportional consumption tax	0.18	-
τ_f	Flat tax rate	-	0.25

5.3 Simulating Flat Tax Reform

5.3.1 Base Case Simulation

Given the parameter choices, the base case model in long-run equilibrium generates similar indicators with the Turkish case. Table 5.2 provides summary statistics for the selected variables for the modelled economy and the Turkish economy. World Bank Indicators for the year 2013 are used for the relevant ratios. For the interest rate, 1 Week Repo interest rate -which is the benchmark- is taken.

Table5.2: Comparison of the Modelled Base Case Long-run Equilibrium with the Turkish Case

Variables (%)	Turkey	Model
Household Consumption to GDP Ratio	71.00	71.17
Government Expenditure to GDP Ratio	15.00	15.72
Tax Revenue to GDP Ratio	21.00	31.41
Interest Rate	5.00	5.00

Household asset holding, labour supply and consumption behaviour in the base case are given in the Figures 5.1, 5.2 and 5.3, respectively. As expected, asset holdings of the individuals increase rapidly in their early ages, since they start with a very low asset stock which is the inheritance. Households also supply high amounts of labour force in their early ages to be able to earn wage income and accumulate asset stock which generates interest income. Since households have a perfect foresight of the lifetime horizon, they tend to work less on their old ages, and decumulate the asset stock they have. Furthermore, households choose not to work at all after their 50^{th} period under the base case, that is to say they retire. Due to the preferences, consumption of the households substantially increase until the end of their lifetime horizon. It should be noted that this behaviour profile is a result of the current tax structure.

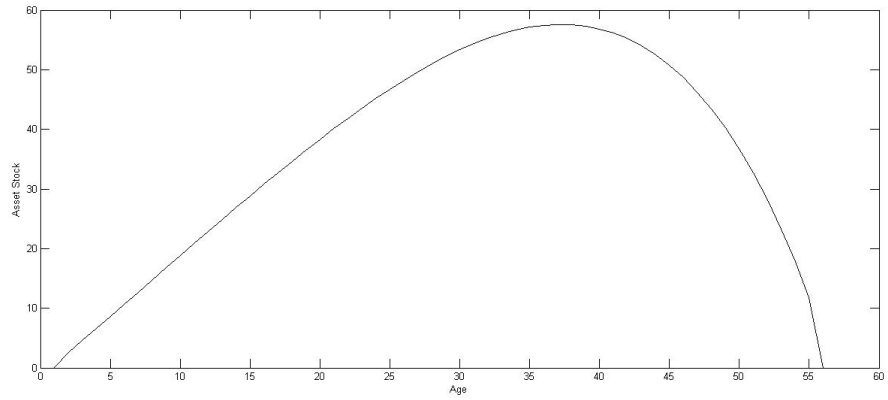

Figure 5.1: Asset Holding Decision in the Base Case Long-run Equilibrium

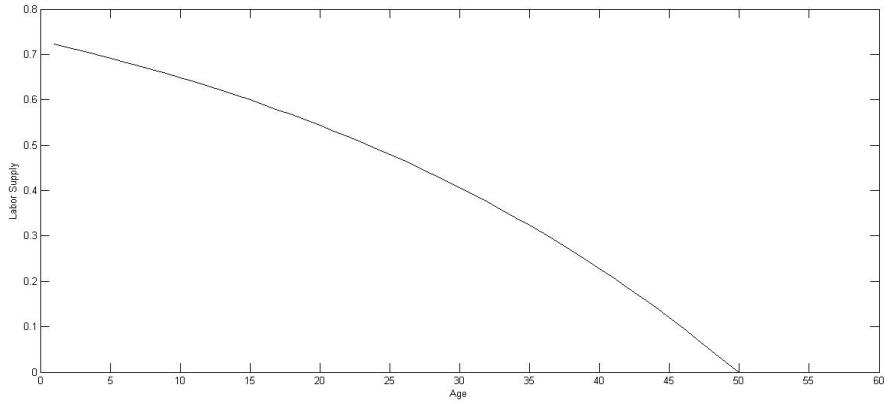

Figure 5.2: Labour Supply Decision in the Base Case Long-run Equilibrium

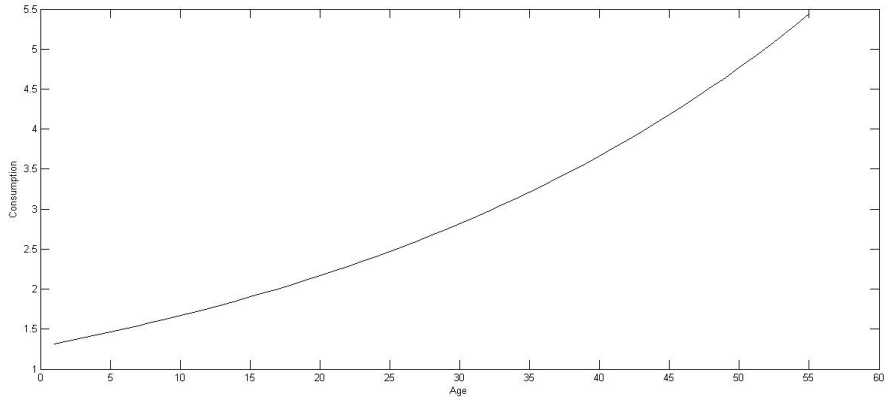

Figure 5.3: Consumption Decision in the Base Case Long-run Equilibrium

5.3.2 Flat Tax Simulation

Flat tax reform is applied to the modelled economy under revenue neutrality. To be more precise, under the flat tax, the amount of tax revenue collected remains the same with the base case. However, as mentioned in the model, the budget constraints of the households change and so do the profiles under maximization behaviour. After the new tax system is introduced and the long-run equilibrium under flat tax reform is achieved, asset holding, labour supply and consumption decisions of the households change.

Figures 5.4, 5.5 and 5.6 reveal the decisions of the households for asset holding, labour supply and consumption by also holding the base case profiles on the same graph in order to see the difference clearly. Asset stock of the households under flat tax increases for each period, by keeping the behaviour profile the same with the base case. Labour supply, given by the Figure 5.5, on the other hand, is less than the base case in the early years of life, and greater in the later years. It is also seen that the households under flat tax reform do not retire, in contrast to the base case. In Figure 5.6, it is seen that the consumption profile shifts upwards and consumption levels of the households ascend for the entire lifetime, meaning that they have more resources to allocate for consumption under the new tax system.

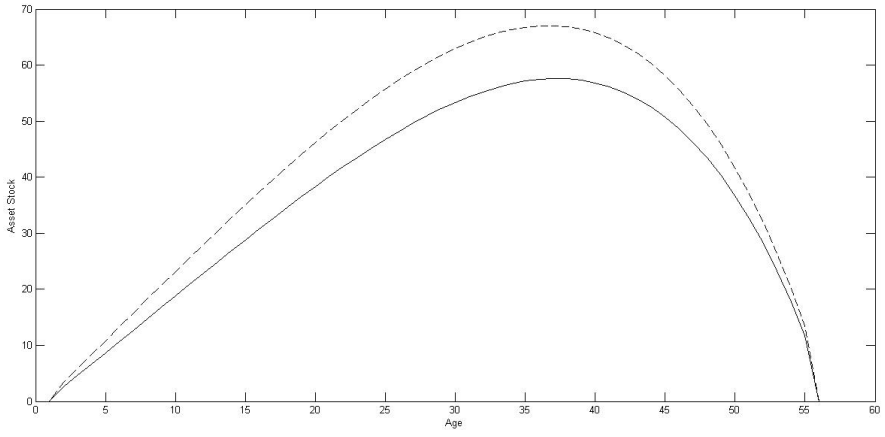

Figure 5.4: Asset Holding Decision in the Base Case and in the Flat Tax Reform

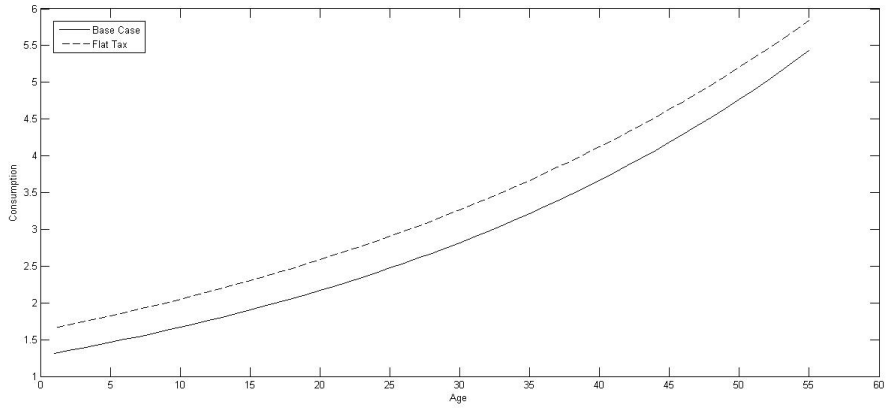

Figure 5.5: Consumption Decision in the Base Case and in the Flat Tax Reform

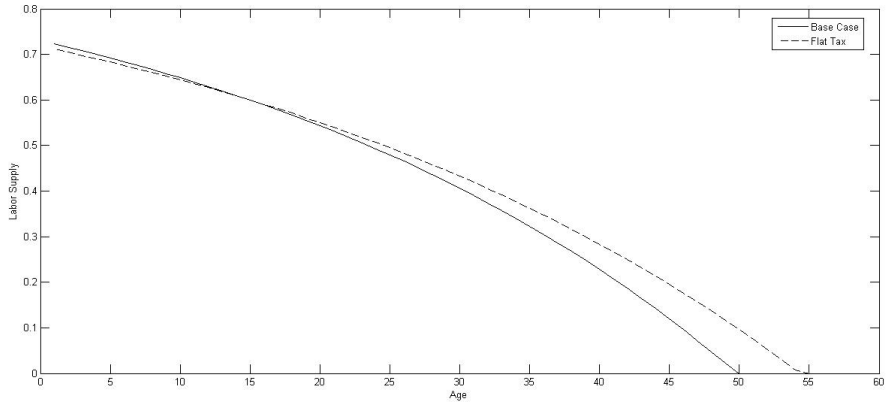

Figure 5.6: Labour Supply Decision in the Base Case and in the Flat Tax Reform

Having changed the decisions regarding asset stock, labour supply and consumption, households' bequest profile also changes. Under the flat tax system, the amount of bequests left increases 50%, and inheritance received increases 5%. This difference arises from the constant population growth rate, since the generation taking the inheritance is larger than the bequest leaving generation.

Table 5.3 provides computation results regarding the comparison of certain macroeconomic variables under the base case and the flat tax in long-run equilibrium. It is seen that the output, capital to labour ratio, consumption to GDP ratio all increase under the flat tax. As intended, share of government expenditure in total output re-

mains exactly the same. Wage and interest rate declines under the flat tax, which is expected. Tax revenue that is intended to be kept constant also does not change at all, only 1% decrease is observed.

Table5.3: Base Case and Flat Tax Long-run Equilibriums

Variables	Base Case	Flat Tax
Output	153.74	169.13
Capital Stock to Total Labour Supply Ratio	51.98	61.48
Household Consumption to GDP Ratio	71.17%	74.64%
Tax Revenue	48.29	47.67
Government Expenditure to GDP Ratio	15.72%	15.43%
Interest Rate	5.00%	4.10%
Wage	6.08	6.54

5.3.3 Simulation of the Transition Path

Although the final impact of the proposed tax reform is important, transition path of the economy from the initial state to the reformed state carries much more important information about the implication of the new policy. Duration of the adjustment and the immediate effects of the policy change should be investigated in detail, in order to see the exact path that the economy will face. If the positive impacts are to be seen in the lifetime of the already born households, then it would be individuals can be convinced about the policy change which will prevent any potential social/economic conflict.

Although the modelled economy is provided with 150 years to adjust for the flat tax and reach the new long-run equilibrium; the set-up in this study comes very close to the final long-run equilibrium in less than 50 years and achieves to the exact state in 75 years.

Transition path that the aggregate capital stock K, total labour supply L and aggregate consumption C is demonstrated in Figures 5.7, 5.8 and 5.9 respectively. Aggregate capital stock increases at a decreasing rate for 50 years and completely settles after the 75^{th} period. Total labour supply on the other hand, displays an overshoot in the first place, and then slowly adjusts for the new value. Aggregate consumption increases until the new long-run equilibrium is reached.

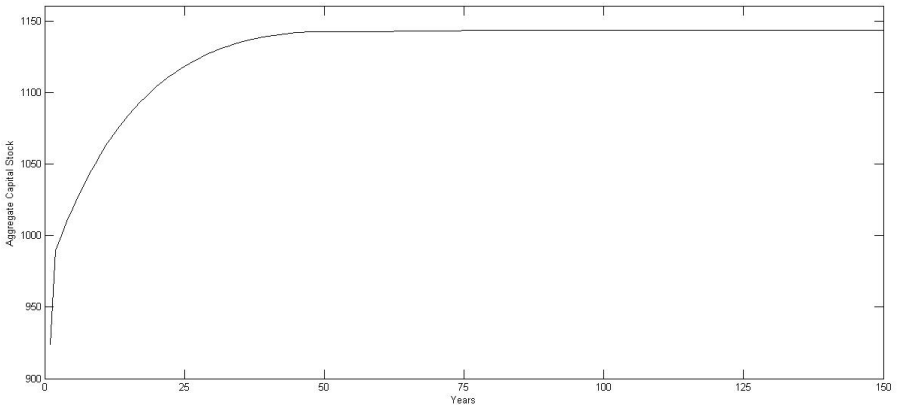

Figure 5.7: Transition Path of Aggregate Capital Stock

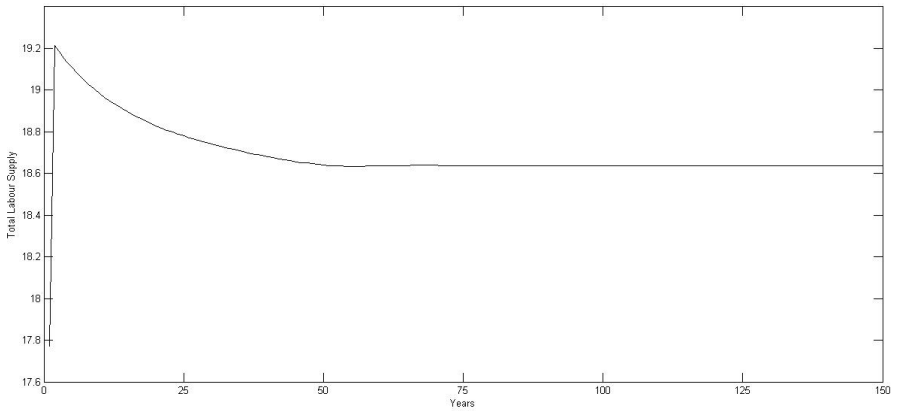

Figure 5.8: Transition Path of Total Labour Supply

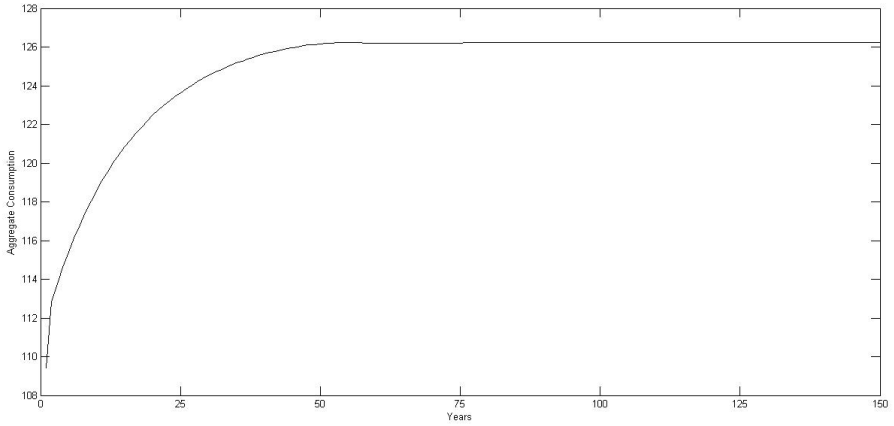

Figure 5.9: Transition Path of Aggregate Consumption

Interest rate which is a function of aggregate capital stock and total labour supply, does not face a sharp change and reaches its long-run equilibrium level in 50 years. Wage rate also does not change much and the increase comes to a halt in 50 years by attaining its long-run level. Figures 5.10 and 5.11 reveal the transition paths of the interest rate and the wage rate, respectively and Table 5.4 provides the exact numerical values of the wage and interest rate for certain years during the transition path.

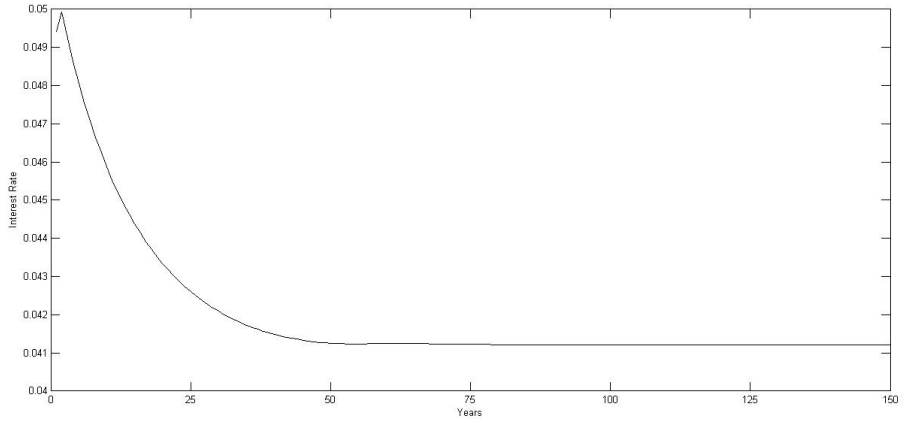

Figure 5.10: Transition Path of Interest Rate

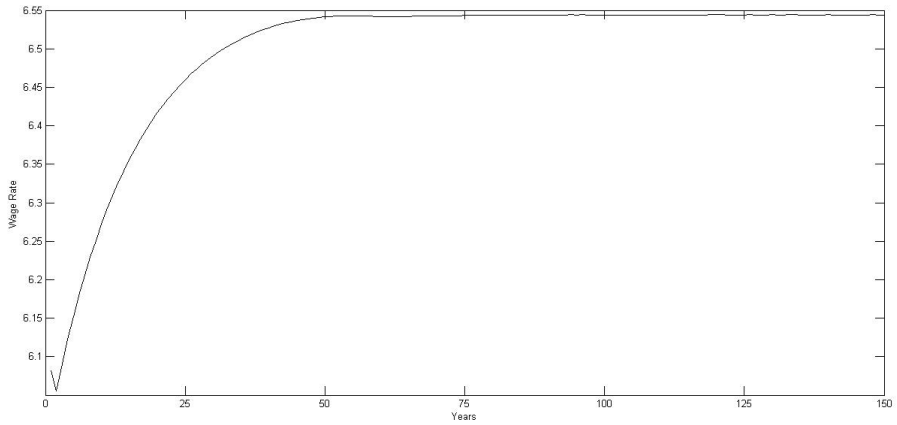

Figure 5.11: Transition Path of Wage Rate

Table5.4: Values of Wage and Interest Rate During the Transition from the Base Case to the Flat Tax System

Year of Transition	Wage	Interest Rate (%)
1	6.08	5.00
5	6.15	4.81
10	6.27	4.60
50	6.54	4.12
150	6.54	4.12

As intended, the proposed tax reform is implemented under revenue neutrality. Figure 5.12 indicates that the total revenue faces a slight fall in the first couple of transition periods. This is because the individuals who were alive before the flat tax system is introduced do not have a full-length lifetime ahead to adjust. However, despite this sudden fall, after 25 years, tax revenue achieves its long-run equilibrium value which is almost equal to the base case.

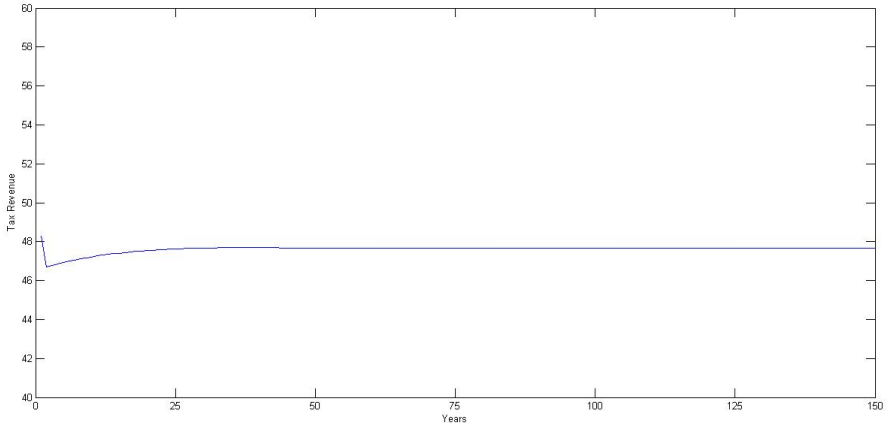

Figure 5.12: Transition Path of Tax Revenue

Lastly, output level in the modelled economy suddenly increases at the very beginning of the transition path. Afterwards, it continues this increase until 25^{th} period, and completely adjusts to the flat tax long-run equilibrium value within 50 periods.

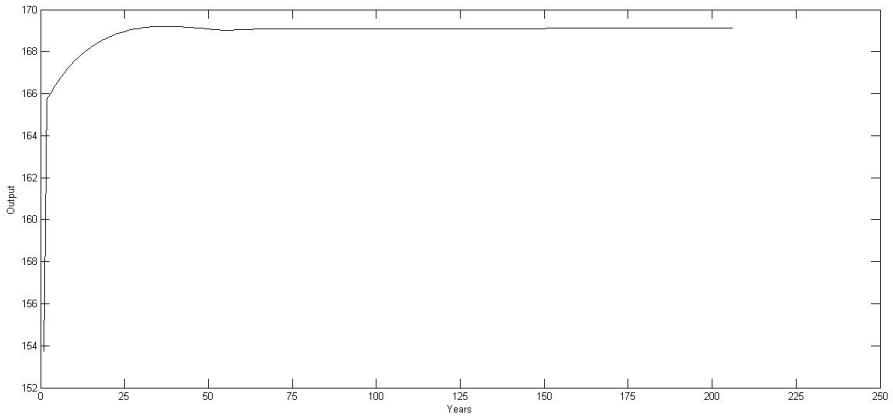

Figure 5.13: Transition Path of Output

5.4 Welfare Analysis

Another and probably the most important issue regarding a policy change is the welfare effects. Utility levels of households of each generation is effected by the changes caused by the reform and one need to measure this change in utility levels in order

to see whether the reform introduced is favourable or not. One way of measuring the difference between the utilities gained by the two systems is to calculate the wealth equivalent of the tax reform. In this study, an equivalent variation measure of how much each cohort's lifetime resources would be increased or decreased in the base case to make the households achieve the utility level in the flat tax case is calculated.

Figure 5.14 reveals the fraction of endowments need to be provided under the base case that generates the same utility level achieved with the flat tax reform. Generations alive during the transition path are given by their year of birth where 0 stands for the point the flat tax reform is introduced.

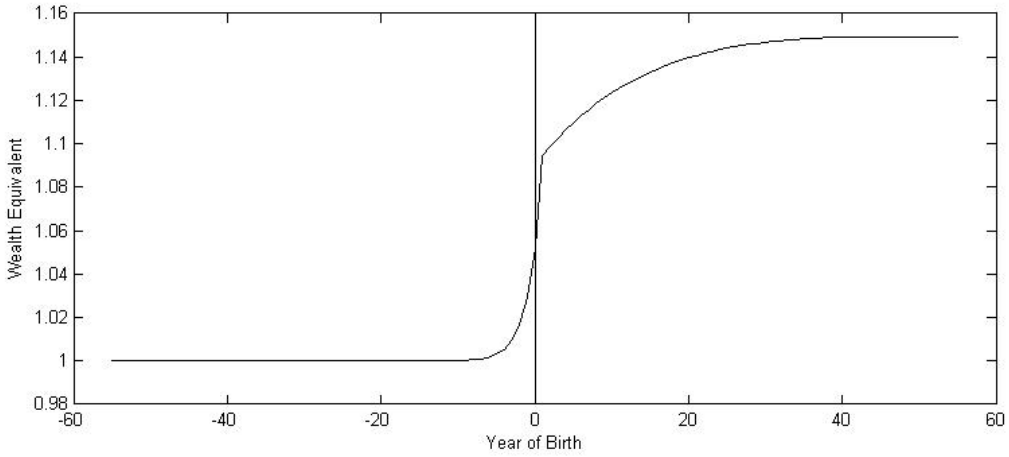

Figure 5.14: The Welfare Effects of Flat Tax Reform

It is seen from the Figure 5.14 that the young generations are subjected to utility gains under the flat tax reform where elderly generations are also not worse off. That is to say, policy change is not made at the expense of a particular group and all individuals are at least as good as their previous position while some are even better. Moreover, welfare analysis not only indicates that the welfare of the individuals is higher in the long-run equilibrium of the flat tax, but also that the flat tax reform has a positive impact on the individuals' welfare who were alive during the transition period, which makes the proposed reform completely favourable.

5.5 Sensitivity Analysis

Sensitivity of the revealed consequences to the parameter choices is important since it points out the robustness of the model. Moreover, since there is ambiguity about the true values of the parameters for Turkey, parameter changes should not effect the results significantly for the model to project real consequences of the tax reform. Table 5.5 examines the impacts of the changes in five parameters for the flat tax reform long run equilibrium levels of aggregate capital stock K, total labour supply L, output Y, wage w and the interest rate r.

Table5.5: Flat Tax Reform - Long-run Equilibrium Sensitivity Analysis

Parameters						Variables				
γ	ρ	σ	δ	α	μ	K	L	Y	w	$r(\%)$
0.75	1.1	0.65	0.016	1.0	0.3	1143.60	18.64	169.13	6.54	4.1
0.65	1.1	0.65	0.016	1.0	0.3	1119.70	18.68	168.43	6.47	4.2
0.85	1.1	0.65	0.016	1.0	0.3	1157.30	18.65	169.75	6.57	4.0
0.75	1.3	0.65	0.016	1.0	0.3	1246.00	21.59	192.55	6.37	4.4
0.75	0.9	0.65	0.016	1.0	0.3	1014.30	15.66	144.23	6.69	3.8
0.75	1.1	0.65	0.020	1.0	0.3	1064.10	18.45	164.50	6.37	4.4
0.75	1.1	0.65	0.030	1.0	0.3	894.40	18.00	153.65	5.95	5.1
0.75	1.1	0.65	0.016	0.8	0.3	1228.40	20.97	187.85	6.41	4.3
0.75	1.1	0.65	0.016	0.5	0.3	1390.40	25.81	225.60	6.17	4.7
0.75	1.1	0.55	0.016	1.0	0.3	495.10	19.02	92.49	3.90	3.6
0.75	1.1	0.75	0.016	1.0	0.3	2855.60	17.56	367.50	12.68	5.0
0.75	1.1	0.65	0.016	1.0	0.1	1123.30	18.53	167.56	6.51	4.1
0.75	1.1	0.65	0.016	1.0	0.5	1163.50	18.75	170.65	6.57	4.0

Throughout the table, ratio of government expenditure to national income remains constant and all changes in the parameters effect the results in the expected direction. Aggregate capital stock declines with lower values of inter-temporal elasticity of substitution, γ and increases with higher values. Higher values of aggregate capital

stock and total labour supply is observed with higher values of elasticity of substitution between consumption and leisure,ρ as expected. A decrease in the intensity of preferences for leisure relative to consumption, α increases total labour supply, since households do not gain utility from leisure as much as before. An increase in the time preference rate, δ decreases consumption patience and causes a decrease in aggregate capital stock. Increaese in utility weight on bequests μ makes consumption bring less utility than before and leads to a higher capital stock. It is also seen that the labour supply does not respond as much as the capital stock to the changes in elasticity parameters. The model is quite sensitive to the choice of elasticity of substitution in production σ parameter. A 0.1 change in σ doubles aggregate capital stock in the expected direction. Aside from this, parameter changes do not bear large differences in the simulation results.

CHAPTER 6

CONCLUSION

Although various studies conducted for the tax system reforms of developed countries, few studies have been conducted so far for the Turkish case. This study attempts to analyse the effects of a fundamental tax reform in Turkey. Flat tax reform whose simulation is made for various countries replaced the current tax structure of Turkey in this model, and the consequences are examined.

Flat tax reform refers to one single rate for the whole income and all types of income are taxed only once under this system. This study also introduces investment expensing to the flat tax reform by not taxing the investments in the period they are made.

A 55-period overlapping generations model is constructed and the Turkish tax system is represented in the model by two main taxes which are levied on wage and capital income and consumption. There are three sectors in the model. Household sector in the model have a bequest motive and leave a fraction of asset holdings to the upcoming generations. Production sector consists of identical firms which are assumed to be perfectly competitive. Lastly, government sector collects the tax revenue and can issue one period debts. The model assumes that government expenditure is unproductive and does ot enter the utility of the households. Model also includes a constant population growth.

Solution of the model is done by using the Gauss-Seidel technique both for the long-run equilibriums and the transition path. Parameters are either drawn from 2013 data of the Turkish economy or taken from the empirical studies. Other parameters are

chosen so as to calibrate the model to the Turkish economy.

Flat tax reform is introduced to the model under revenue neutrality and its impacts are observed through projection provided by the simulation. It is seen that both aggregate capital stock and total labour supply increases under the flat tax reform. Output rises by more than 10%. Moreover, welfare gains provided by the reform does not deteriorate the generations' position who are alive during the transition period.

Since the flat tax system taxes all income regardless of the source with the same rate and only once, it means less restriction on the households side, which increases welfare. Moreover, the investment expensing feature of the flat tax system also stimulates the capital accumulation in the economy.

With all the positive impacts revealed with this study it provides, flat tax system stands as a favourable policy proposal for the Turkish case. Thus, researchers and the policy makers should touch upon this particular reform proposal in the pursuit of a sound taxation system.

Further study based on this subject might be the introduction of heterogeneous agents to the model. One of the important features of the flat tax system is that it aims not to tax the lowest income households until their income increases above a threshold level. Thus, differentiating households according to their income groups would help to use this feature of the flat tax. Another reason to differentiate the households is the fact that impacts of this tax structure on the income distribution is debatable. Flat tax reform is also a respond to the tax evasions originating from the complexity and inefficiency of current systems. Thus, another study might be conducted with the existence of the informal sector, by testing whether the tax evasion decreases or not under the new policy. A more realistic and complex bequest profile with the altruistic behaviour would also be an important extension to the model, especially for the Turkish case. Adding a social security system may also enrich the model. Another issue that is not addressed by this study is the open-economy case, thus analysing the consequences of this reform under open-economy and comparing the consistency of the two results would also be a noteworthy work.

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APPENDIX A

TURKISH SUMMARY

Vergi sistemleri, ülkeden ülkeye biçimleri ve konulma amaçları değişse de bireylerin karar verme süreçlerini etkileyen önemli bir faktördür ve iyi tasarlanmış bir vergi sistemi bir ekonomide canlandırıcı etki yapabilir. Sağlam vergi sistemlerinin sahip olması beklenen özellikler etkili, basit ve adil olmalarıdır. Bu kapsamda ortaya atılan temel vergi reformu önerilerinden biri de Hall ve Rabushka (1995) tarafından önerilen düz vergi sistemidir.

Düz vergi sistemi tüm gelire uygulanan sabit oranlı bir vergidir ve Hall ve Rabushka (1995)'ya göre, taksimatlı -her bir gelir kalemi için ayrı oranlarda ve farklı şekillerde uygulanan- vergi sistemleriyle karşılaştırıldığında bireylere daha fazla özgürlük tanıyarak çalışma güdüsünü ve sermaye birikimini artırır. Düz vergi sisteminin temel prensipleri şunlardır; tüm gelirler aynı oranda ve tek bir kez vergilenmelidir, vergi sisteminin uygulaması kolay olmalıdır, sistem herkesin anlayabileceği basitlikte olmalıdır ve son olarak düşük gelir grupları gelir vergisinden muaf olmalıdır. Bu sistemin olası etkilerini genel denge modelinde ve ABD (Amerika Birleşik Devletleri) ekonomisi için inceleyen Ventura (1999), vergi reformunun önemli sermaye birikimi ve iş gücü arzı getirileri olduğunu göstermiştir. Daha ayrıntılı bir çalışma olan ve beş farklı vergi sisteminin karşılaştırıldığı bir model kullanan Altig vd. (2001) de bu vergi sisteminin refah ve gelir dağılımı üzerindeki etkileri arasında bir karşılaştırmadan bahsetmiştir. Öte yandan Gentry ve Hubbard (1997), düz vergi siteminin diğerlerinden daha fazla eşitsizlik getirmediğini vurgulamıştır.

Türkiye vergi sistemi için reform gereksinimi tartışılan bir konudur. Birtakım değişik-

likler için ilk adımlar 2013'te atılmıştır ve yeni kanun tasarısı Bakanlar Kurulu'nun gündemindedir. Bu çalışmanın amacı da, Türkiye vergi sistemi için, refah düzeyini artıran bir vergi reformu önerisi sunarak – düz vergi sistemi-, bu reformun belli makroekonomik değişkenler üzerindeki etkisini incelemektir.

Vergi sistemlerinin etkilerinin araştırılmasında yaygın olarak kullanılan yöntem, politika değişiminin etkilerini simülasyon yoluyla tahmin eden bir hesaplanabilir genel denge modeli kullanmaktır. Problemin doğası dinamik olduğu için, bu yöntemin kullanımı hem şok öncesi durumun hem de şok sonrası etkilerin düşünülmesi için ve bu iki durum arasındaki geçiş sürecinin *(transition path)* görülmesi için uygun çerçeveyi sağlamaktadır. Bu sebeple bu çalışmada da, Auerbach ve Kotlikoff (1987) tarafından kurulan ardışık nesiller *(overlapping generations)* analizi ile bir dinamik yaşam döngüsü simülasyon modeli kullanılmıştır. Auerbach-Kotlikoff modelinin (A-K model) kökleri Modigliani ve Brumberg (1954) ve Ando ve Modigliani (1963) ile ortaya atılan yaşam döngüsü modeline dayanmaktadır. İçerdiği ardışık nesiller analizi ise köklerini Allais (1947), Samuelson (1958) ve Diamond (1965)'ten almaktadır. Bu analizleri genişleten A-K modele ilk ortaya atıldığı günden bu yana pek çok ilave yapılarak zenginleştirilen model, politikaların etkilerini ölçmeye yarayan ve yaygın kullanılan bir yöntem haline gelmiştir.

ABD ekonomisi için ortaya atılan politika önerileri için pek çok simülasyon çalışması yapılmış olsa da Türkiye için bu yöntemler kullanılarak yapılan araştırmalar oldukça sınırlıdır. A-K model kullanan Türkiye için bilinen ilk çalışma Kenc ve Sayan (1998) çalışmasıdır. Bu çalışmada sosyal güvenlik açıklarının artışını durdurmaya yönelik politikaların etkileri incelenmiştir. Voyvoda ve Yeldan (2005) tarafından yapılan diğer bir çalışmada da IMF programının Türkiye üzerindeki etkileri 30 dönemlik ardışık nesiller modeli çerçevesinde incelenmiştir. Değer (2011) de yine aynı modeli kullanarak Türkiye sosyal güvenlik sisteminin benzetimini yapmış ve yeni uygulamaya konan reformun etkilerini incelemiştir. Son ve bu çalışma ile en ilgili olduğu düşünülen çalışma, İleri ve Derin-Güre (2014)'tür. Türkiye vergi sisteminin simülasyonunun yapıldığı çalışmada katma değer vergisinin azaltılıp, yüksek gelir grubu gelir vergisinin artırılmasının ekonomi üzerinde olumsuz bir etkisinin olmadığı, toplam refahın arttığı ve daha adil bir gelir dağılımının gerçekleştiği gösterilmiştir. Bu yöntem kullanılarak

yapılan ve Türk vergi sistemini inceleyen çalışmalar kısıtlı olduğundan bu çalışma bu boşluğu doldurarak, A-K model çerçevesinde düz vergi sistemi reformunun Türkiye ekonomisi üzerindeki etkilerini incelemektedir. Model, yazındaki diğer çalışmalara göre genişletilmiş, bireyler miras güdüsüyle donatılmış ve ekonomiye sabit büyüme hızı eklenmiştir. Ayrıca, iki uzun dönem dengesinin karşılaştırılması ile yetinilmemiş,bu iki uzun dönem dengesi arasındaki geçiş dönemi de çözümlenmiş ve geçiş döneminde yaşayan temsilciler için refah analizi yapılmıştır.

Türk vergi sistemi dolaylı vergiler ve dolaysız vergiler olmak üzere iki ana başlıkta incelenebilir. Dolaysız vergiler gelir vergisi ve kurumlar vergisinden oluşurken dolaylı vergiler ise başta katma değer vergisi olmak üzere vergi gelirlerinde büyük önem taşımayan diğer vergi türlerinden oluşmaktadır. Bu üç vergi gelirinin toplam vergi gelirine oranının 1988-2013 yılları arasında %60 ve %80 arasında değiştiği görülmektedir. Bu sebeple modelleme aşamasında da tüm vergi türleri modelde içerilemeyeceğinden, yalnızca büyük bileşenler modele dahil edilmiştir. Modelde firmalar özdeş olduğundan kurumlar vergisi de modelin dışında bırakılmıştır. Sonuç olarak Türkiye ekonomisinin modellenmesinde, bireylerin işgücü arz ederek kazandıkları ücret gelirlerinden alınan gelir vergisi, biriktirdikleri sermaye gelirinden alınan sermaye vergisi ve tüketimden alınan tüketim vergisi kullanılmıştır.

Bu çalışmada kullanılan model 55 dönem yaşayan bireylerden oluşmaktadır ve ekonomiye 20 yaşında girip, 75 yaşında ekonomiden ayrıldıkları varsayımı altında kurulmuştur. Bireyler yaşamları boyunca gerçekleşecek faktör fiyatlarının tam öngörüsüne sahiptirler ve fayda maksimizasyonunu bu veri fiyatlara göre yapmaktadırlar. Belirli bir zamanda ekonomide her yaştan bireyler yaşamaktadır ve ekonomide sabit nüfus büyümesi mevcuttur; dolayısıyla belirli bir dönemde yaşayan genç nesillerin sayısı yaşlı olanlardan daima daha fazladır.

Hane halklarının fayda fonksiyonları sabit ikame esnekliği *(constant elasticity of substitution)* formundadır ve bireyler Blinder (1973)'ün önerdiği şekliyle miras güdüsüne sahiptir; bir sonraki nesle miras bıraktıkça toplam faydaları artmaktadır. Tüm hane halkları özdeştir ve tek bir hane halkı tarafından temsil edilmektedir. Hane halkı her bir dönem için tüketim ve işgücü arzı kararı ve hayatının son döbenmi için de bıraka-

cağı miras kararı vermektedir. Bunun için 55 dönemlik toplam faydasının iskonto edilmiş bugünkü değerini bütçe kısıtı altında maksimize etmektedir. Hane halklarının tüketim, işgücü arzı ve miras dizisi üzerine güncel kararları gelecek yıllar için ve tüm yaşamları için alınan kararların bir parçasıdır. Bu yüzden yaşam döngüsü boyunca gerçekleşecek davranışın yörüngesi hayata başladığı ilk anda ve tüm dönemler için tek bir maksimizasyon probleminin parçası olarak belirlenir. Temel durumda hane halklarının bütçe kısıtında, daha önce de belirtildiği gibi gelir vergisi (ücret ve sermaye için ayrı oranlarda olmak üzere) ve tüketim vergisi bulunmaktadır. Önerilen vergi reformu durumunda ise bu vergilerin tamamı kaldırılır ve bunların yerine ücret geliri ve sermaye gelirinden o yıl yapılan tasarruf düşülerek tek bir vergi oranı uygulanır. Vergi sistemleri hane halklarının bütçe kısıtlarını değiştirdiğinden karar profillerini de değiştirir. Hane halklarını bağlayan diğer kısıtlar şunlardır: bireylerin işgücü arzı sahip oldukları toplam zamanı geçemez ve negatif olamaz. Hane halkları yaşamlarına sıfır sermaye ile başlarlar fakat bir önceki neslin bıraktığı mirasın kendilerine düşen miktarını 1 yaşında alırlar. Yaşamlarının son döneminin sonunda (55. yıllarının sonunda) da sahip oldukları tüm varlığı tüketim ya da miras yoluyla bitirmek zorundadırlar. Hane halkları yaşam süreleri bittiğinde ekonomiye borçlu da kalamazlar. Yani 56. dönemde sermaye birikimleri sıfır olmalıdır. Faktör fiyatlarını öngörerek, fayda fonksiyonları ve bütçe kısıtları altında hane halkları fayda maksimizasyonunu yaparlar ve buna uygun tüketim, iş gücü arzı ve miras profillerini belirlerler. Elde edilen profillere göre bu modelde tüketim ve işgücü arzları, ücret seviyesi değişmediği sürece sabit hızda değişir; ücret seviyesi değiştiğinde ise son etki zamanlar arası *(inter-temporal)* ve zaman içi *(intra-temporal)* ikame etkilerinin birleşimiyle belirlenir.

Hane halklarının kararlarının bir araya getirilmesi ile belli bir yılın toplam sermaye stoku ve toplam iş gücü arzı belirlenir. Bu belirleme yapılırken belirli bir yılda yaşayan bireyler yaşlarına göre ağırlıklandırılır; modelde sabit nüfus büyümesi olduğu için genç nesiller daima yaşlılardan sayıca fazla olacak bu nedenle onların bireysel kararları ekonominin toplamında daha büyük bir ağırlığa sahip olacaktır. Toplam sermaye stoku ve iş gücü arzının hesaplanmasıyla birlikte firmalar sabit ikame esnekliği formundaki üretim fonksiyonu kullanılarak üretim yaparlar. Modelde firmalar özdeştir, tam rekabetçi ortamda üretim yapmaktadırlar (faktör fiyatları faktörlerin marjinal verimlil-

iğine eşittir) ve tek bir firma tarafından temsil edilmektedirler. Modele herhangi bir üretkenlik artışı dâhil edilmemiştir. Belirli bir yılın faktör fiyatları da firmaların kâr maksimizasyon probleminin çözümünden elde edilir.

Modelde devlet, vergi gelirlerini toplar ve toplam gelirinin belirli bir oranında harcamalar yapar. Devletin yaptığı harcamalar üretken değildir ve hane halklarına herhangi bir fayda sağlamaz. Devlet aynı zamanda tek dönemlik devlet tahvilleri basarak borçlanabilir. Her dönem alınan borç miktarı ve vergi gelirleri toplamı, o dönemki devlet harcamaları ve bir önceki dönemin borcunun faiziyle olan ödemesine eşit olmak zorundadır; her dönem devlet bütçesinin dengede olması gerekmektedir. Temel durum ve önerilen düz vergi reformu durumunda devlet bütçe kısıtı aynı kalır fakat toplam vergi gelirlerinin bileşimi değişir. Temel durumda toplam vergi gelirleri tüketim vergisi geliri, ücret vergisi geliri ve sermaye gelir vergilerinin toplamı iken, düz vergi sistemi altında toplam vergi gelirleri, kaynağı ne olursa olsun toplam gelirden o yıl yapılan tasarrufun çıkarılması üzerine kalan taban ile vergi oranının çarpımından oluşur.

Modelde denge hane halkı, üretim ve hükümet sektörlerinin, güncel ve gelecek faktör fiyatları içinde tutarlı olduğu ve tüm piyasalarda arz ve talebin eşitlendiği noktadır. Denge durumu tüketim, iş gücü arzı, miras seçimi ve üretim faktör talepleri dizisidir. Faktör fiyatlarını veri alan hane halklarının ve işgücü arzı ve sermaye stokunu kaynak olarak alan firmaların maksimizasyon probleminin çözümü olan değerler için, hükümet bütçe kısıtının sağlandığı durumdur.

Modelde temel durum ve düz vergi reformu sistemi altındaki denge davranış profilleri ayrı ayrı hesaplanmıştır. Önerilen vergi reformunun sonuçlarını incelemek için bu çalışmada gerekli parametrizasyon ile simülasyon yapılmıştır. Modellenen ekonomi öncelikle ilk uzun dönem dengesinde yani temel durumda gözlenmiş, daha sonra düz vergi sisteminin varlığı durumunda model yeniden çözülmüş ve aradaki geçiş süreci de gözlenerek, ikinci uzun dönem dengesi bulunmuştur.

Modellenen ekonominin analitik çözümü üç aşamada –ilk durumdaki uzun dönem dengesi, ikinci durumdaki uzun dönem dengesi ve aradaki geçiş dönemi- yapılmıştır ve Auerbach ve Kotlikoff (1987)'de tanımlanan Gauss Seidel metodu kullanılmıştır. Tekrarlamalı bir teknik olan metodun uygulanmasında ve yapılan diğer simülasyon-

larda MATLAB programı kullanılmıştır.

Uzun dönem dengeleri için yapılan çözümler aynıdır ve geçiş dönemi çözümüne göre daha basittir. Öncelikle, toplam sermaye stoku ve iş gücü arzı için birer tahmin verilir ve uzun dönem dengesinde faktör fiyatları sabit olacağından bu tahminler için üretim fonksiyonu kullanılarak faktör fiyatları bulunur. Bulunan faktör fiyatlarını veri kabul eden hane halkları modelde anlatıldığı şekilde yaşam döngüsü davranışı içinde tüketim, tasarruf, işgücü arzı ve miras kararlarını verirler. Daha sonra bu kararların toplamıyla elde edilen toplam sermaye stoku ve işgücü arzı hesaplanır. Eğer hesaplanan değerler ve yinelemenin *(iteration)* başında verilen tahmin değerleri birbirine eşit ise bulunan değer ekonominin uzun dönem dengesidir. Eğer değilse, yeni bir tahmin değeri ile yineleme tekrarlanır ve yakınsama elde edilene kadar bu işlem devam eder. Yeni bir tahmin verme işlemi de yine tahmin ve hesap değerleri arasındaki farka dayanan bir algoritma ile sağlanır. Temel durumdaki ve düz vergi sistemi durumu altındaki uzun dönem denge seviyeleri bulunduktan sonra, benzer bir algoritma ekonominin iki uzun dönem dengesi arasındaki geçiş süreci için de kullanılır. Ekonominin düz vergi sistemi uygulamasındaki uzun dönem dengesine kavuşması için algoritma 150 yıl için çalıştırılmıştır. Geçiş döneminde faktör fiyatları sabit olmayacağı için tam geçiş yolunu bulabilmek için Gauss Seidel metodunu 150 kez her temsilci için eş zamanlı olacak şekilde uygulamak gerekir ki bu geçiş süreci çözümü hem karmaşık hem de uzun bir süreç haline getirir. Bunu için, ekonominin temel durumdaki toplam sermaye stoku ve işgücü arzı geçiş yolunun ilk tahminini, düz vergi sistemi durumdaki ise son tahminini oluşturur. Aradaki değerlerin her biri için de tahminler verildikten sonra, yine her yıl için ekonomide tüm değişkenlerin tutarlı olduğu çözüm noktaları bulunur. 150 yılın her biri için bu denkliğin sağlandığı noktada algoritma durur ve ekonominin geçiş yolu bulunmuş olur. Geçiş yolu çözümünde dikkat edilmesi gereken bir diğer nokta da, vergi sistemi değiştiğinde hayatta olan insanların problemidir. Bu kişiler politika değişimine kadar olan dönemlerinde temel duruma göre davranmış ve yaşam döngüsü içinde kararlarını buna göre vermişlerdir. Öngöremedikleri bu şokla karşılaştıklarında, problemi çözebilmek için bu bireylerin o yıl ölüp, daha sonra yeni sistemde yeniden doğarak kalan zamanlarını yaşamaya devam ettiğini varsaymak ve yeniden doğduklarında önceki birikimlerini ilk sermaye stoklarına eşit şekilde düşünerek modellemek

gerekir (Auerbach ve Kotlikoff, 1987). Bu da geçiş yolunun çözümünü daha karmaşık hale getirir. Bu çalışmada ilk ve ikinci uzun dönem dengeleri ilk tahminlerden bağımsız olarak yaklaşık 25-30 yinelemede ve geçiş yolu yaklaşık 13500 yinelemede bulunabilmektedir.

Modeli çözebilmek için fayda fonksiyonu, üretim fonksiyonu, nüfus ve mali parametrelerin seçilmesi gerekir. Bunun için parametrelerin bir kısmı Türkiye için daha önce yapılmış ampirik çalışmalardan, bir kısmı da – mali parametreler ve nüfus büyüme hızı- istatistiki verilerden alınmıştır. Kalan tercih parametreleri ise temel durumdaki modeli Türkiye ekonomisine kalibre edecek şekilde seçilmiş veya hesaplanmıştır.

Temel durum altında uzun dönem dengesi çözümlendiğinde Türkiye verileri ile modelin hesapladığı tüketimin gelire oranı, faiz oranı ve devlet harcamalarının gelire oranı değişkenleri eşit bulunmuştur. Temel durumda hane halklarının tasarruf, tüketim ve iş gücü arzı dinamikleri incelenmiştir. Buna göre hane halkları yaşamlarının ilk yıllarında hızlı birikim yaptığı, çalışmaya fazla zaman ayırdığı ve az tüketim yaptığı gözlenmiştir. Yaşamlarının son yıllarına doğru ise bireylerin birikimleri azalmakta, tüketimleri artmaktadır. İşgücü arzları ise azalmakta ve 50. dönemde sıfıra inmektedir; hane halkları son 5 yılda emekli olmayı seçmektedir.

Düz vergi sistemi ile ulaşılan uzun dönem dengesinde de hane halklarının davranış profilleri temel durumdakine benzerdir. Düz vergi sistemi altında birikim ve tüketim seviyeleri temel duruma kıyasla her dönem için artarken işgücü arzı yaşamlarının ilk yıllarında temel duruma göre daha düşük seviyededir. İlerleyen yıllarda ise temel durumun üzerine çıkan işgücü arzı düz vergi sistemi durumunda sıfıra inmemekte, yani hane halkları yaşamlarının sonuna dek çalışmayı seçmektedirler. Aynı zamanda, düz vergi sistemi durumunda bırakılan miras miktarı temel duruma göre %50, alınan miras miktarı da %5 artmıştır. Aradaki fark sabit nüfus büyümesinden, yani genç nesillerin daha kalabalık olmasından kaynaklanmaktadır.

İki durumdaki makroekonomik değişkenler karşılaştırıldığında ekonomideki toplam üretimin düz vergi sistemi altında temel duruma göre %10 arttığı görülmektedir. Çalışan başına sermaye stoku %18 hane halkları tüketiminin yurt içi hasılaya oranı ise %5 artmıştır. Vergi geliri miktarı ve devlet harcamalarının gelire oranı hemen

hemen aynı kalmıştır. Faiz oranı azalmış ve ücretler artmıştır.

Her ne kadar uzun dönem dengelerindeki farklılıklar reformla ilgili bilgi verse de ekonominin iki uzun dönem dengesi arasında deneyimlediği geçiş süreci de çok önemlidir. Uyum süreci ve ilk etkiler yeni politikanın uygulanmasıyla ilgili önemli bilgiler içerir. Model ekonomide vergi reformu uygulanmaya başladıktan sonra yeni uzun dönem dengesine ulaşması için 150 yıllık bir süreç verilmiş olsa da, 50 yıl içinde ekonomi uzun dönem dengesine çok yakın noktalara gelmekte ve 75. yılda tamamen kararlı duruma ulaşmaktadır. Geçiş sürecinde, toplam sermaye stoku ilk 50 yıl devamlı olarak artmakta ve daha sonra ikinci uzun dönem dengesine geldikten sonra sabit kalmaktadır. Toplam iş gücü arzı ise ilk birkaç ikinci uzun dönem dengesi düzeyini de aşarak hızlı bir artış sergilemekte ve daha sonra yavaşça azalarak 50. yılın sonunda ikinci uzun dönem dengesine ulaşmaktadır. Toplam tüketim de 75. yıla kadar yavaş bir artış göstermekte ve daha sonra uzun dönem dengesinde sabit kalmaktadır. Faiz oranı yavaşça artarak ve ücretler yavaşça azalarak 75 yılın sonunda ikinci uzun dönem dengesine ulaşmaktadır. Ulaşılmak istendiği şekilde, vergi reformu gelir nötrlüğü altında uygulanmış ve toplam vergi gelirlerinin sabit tutulmasına çalışılmıştır. Vergi gelirleri yeni vergi sistemi uygulanmaya başlandığında önce bir düşüş sergilemiş olsa da daha sonra artarak eski seviyesine ulaşmıştır. Bazı makroekonomik değişkenlerde gözlenen geçiş sürecinin ilk birkaç yılındaki ani değişimler, vergi sistemi uygulanmaya başlandığında hayatta olan ve bu yeni durumun yarattığı faktör fiyatları ile yeni maksimizasyonunu yapan bireyler sebebiyledir. Bu bireyler için karar verilecek kalan zaman ufku kısa olduğundan verdikleri kararlar kısa dönemde dalgalanmalara neden olmaktadır. Son olarak ekonomideki toplam gelir ilk yıllardan başlayarak çok hızlı bir artış göstermiş ve 25 yılın sonunda yeni uzun dönem dengesine yakınsamıştır.

Bir politika değişiminin en önemli unsurlarından biri de refah analizidir. Önerilen vergi reformunun toplum tarafından kabul edilebilir olup olmadığının belirlenmesi için her hane halkının fayda düzeylerinin yeni vergi sisteminden nasıl etkilendiğini bulmak gerekir. Bu etkiyi ölçmenin bir yolu olan eşdeğer değişim *(equivalent variation)* bu çalışmada geçiş sürecinde yaşayan hane halkları için hesaplanmıştır. Bu değer, geçiş sürecinde hayatta olan nesillerin, temel durum altında, gerçekte yani düz vergi sistemi durumunda sahip oldukları fayda düzeyine ulaşmaları için onlara aktarılması gereken

kaynak miktarını gösterir. Düz vergi sistemine geçildiği yıldan 55 yıl önce doğan nesillerden başlayarak, reformdan 55 yıl sonraya kadar hesaplanan bu değerlere göre, geçiş sürecinde yaşayan hiç bir neslin durumunda kötüleşme görülmemiştir. Zaman ilerledikçe de aktarılması gereken kaynak miktarı artmış, yani refah düzeyleri kademeli olarak artarak uzun dönem denge noktasında sabit kalmıştır. Buna dayanarak, önerilen vergi sisteminin uygulanmasının uzun vadede refah artışına yol açtığı ve kısa vadede de refah düzeyi üzerinde herhangi bir olumsuz etkisi olmayacağı söylenebilir.

Model ve simülasyon sonuçları kuşkusuz seçilen parametrelere dayanmaktadır ve bu sonuçların parametre seçimine karşı aşırı duyarlılık gösterip göstermeyeceği modelin sağlamlığı açısından önem taşımaktadır. Yapılan duyarlılık analizinde modelde kullanılan fayda ve üretim fonksiyonu parametrelerindeki değişimlerin toplam sermaye stoku, iş gücü arzı, yurtiçi hâsıla, ücretler ve faiz oranı üzerindeki etkileri incelenmiş ve modelin parametrelere karşı aşırı hassasiyeti gözlenmemiştir.

Sonuç olarak, bu çalışma ile gösterilen ekonomi üzerindeki olumlu etkileri göz önüne alındığında, düz vergi sisteminin Türkiye için bir vergi reformu önerisi olabileceği görülmüştür; bu sebeple konuyla ilgili daha ayrıntılı ve kapsamlı çalışmaların yapılması faydalı olacaktır. İleride yapılabilecek çalışmalardan biri modele heterojen temsilciler ekleyerek hane halklarını gelir gruplarına göre farklılaştırmak olacaktır. Bu şekilde hem modele düz vergi sisteminin düşük gelir gruplarını vergiden muaf tutma özelliği eklenebilir hem de önerilen vergi sisteminin gelir dağılımı üzerindeki etkileri incelenebilir. Diğer bir çalışma da Türkiye için politika yapıcıların göz ardı edemeyeceği kayıt dışı sektörü modele dahil etmektir.

APPENDIX B

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü [ ]

Sosyal Bilimler Enstitüsü [X]

Uygulamalı Matematik Enstitüsü [ ]

Enformatik Enstitüsü [ ]

Deniz Bilimleri Enstitüsü [ ]

YAZARIN

Soyadı : ÖZGÜN
Adı : BURCU
Bölümü : İKTİSAT

TEZİN ADI (İngilizce) : A Tax Reform Proposal For Turkey: Flat Tax System

TEZİN TÜRÜ : Yüksek Lisans [X] Doktora [ ]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [X]
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
3. Tezimden bir (1) yıl süreyle fotokopi alınamaz. [ ]

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: