Relative Stagnation *alla Turca*

Tasso Adamopoulos
York University

Ahmet Akyol
York University

February 15, 2006

Abstract

Turkey is the only founding member of the OECD that has not converged to the US in terms of per-capita GDP since 1950: its real GDP per capita is stuck at 20% of that of the US. At a proximate level, we show that Turkey's *relative* stagnation over the past 50 years is due to: (1) the relative decline in its labor force participation, and (2) the relative stagnation of its TFP. We argue that the first fact is due to policies of high personal income taxation, and high social security contributions for both employees and employers. The second fact we argue is due to price support policies in agriculture, which distorted the allocation of resources in favor of agriculture, thereby delayed the process of the structural transformation. We develop a dynamic general equilibrium model with agricultural and non–agricultural sectors. The production of the non–agricultural good can take place in the market or the household sector. We show the extent to which these policies can account quantitatively for Turkey's relative stagnation.

JEL Classification Codes: O41; J21; O52.

1 Introduction

Since 1950s, Turkey has experienced a stagnation in its *relative* economic performance. Using real GDP per capita as a measure of performance, Turkey has not managed to catch up to the industrial leader, the United States. The ratio of Turkish per–capita GDP to the U.S. per–capita GDP was 20% in 1950, and stayed at that level since then. Even though Turkey has maintained its income relative to the United States, in the second half of the 20th century, it has lost ground relative to countries in the European Union and the OECD. During this period Turkey has been part of Western international organizations, has adopted Western institutions, has had a market oriented economy, and has been a secular and democratic state. Yet, Turkey has failed to catch up relative to the economic leaders and has been outperformed by countries that had the same relative position as Turkey in the world income distribution in 1950 (see ??). Furthermore, Turkey is the only founding member of the OECD that has not improved its relative economic position. This discrepancy between reasonable expectations and actual performance is what makes Turkey an interesting case study of relative stagnation.

A number of hypotheses have been proposed for Turkey's relative under-performance: oil price shocks in 1970s, persistently high inflation rates between mid 1970s and 2000, foreign exchange crises, natural disasters, and recurrent political instability (see Yeldan, 1998). While each one of these may have some merit for a part of Turkey's recent history none can account for the continuous lack of convergence of Turkey's per–capita GDP to that of the world's industrial leaders.

In this paper, we document the relative stagnation of Turkey and we investigate its *proximate* and *fundamental* causes, under the prism of the neoclassical tradition. First, we ask what the proximate sources of Turkey's relative stagnation are. To answer this question, we decompose per capita income into three components: physical capital intensity, labor force participation and total factor productivity (TFP). We find that physical capital accumulation has been strong, and therefore, is not the source of Turkey's relative stagnation. Instead we find that since 1950, Turkey has experienced a dramatic decline in labor force participation, both in absolute terms and relative to that in the United States. In addition, Turkey's TFP growth did not catch up relative to the US. We conclude that any explanation about why Turkey has not strengthened its relative economic position, should account for the dramatic decline in the relative labor force participation rate *and* the relative stagnation of its TFP.

Poor economic performance is not unique to Turkey. As Cole et al. (2005) argue, no Latin American country has made any significant progress in catching up to the United States since 1950. They report that stagnant TFP is the key determinant of relative stagnation, while labor force participation rate stayed constant, and did not contribute to the stagnation in living standards in Latin America. In contrast, as this growth accounting exercise above unveils, the unique feature of Turkish economic relative under–performance is the sharp decline in labor force participation rates during the same time span, a significant contribution to the relative sluggishness in economic growth.

Second, we delve further into the underlying reasons behind the the proximate causes of Turkey's relative stagnation. We show that the structure of Turkey's economy differs markedly from those of all other OECD countries, with Turkey having by far the highest share of economic activity in agriculture, both in terms of employment and GDP share. The data indicate that Turkey has been slow in moving resources, especially labor, out of agriculture. Furthermore, the resources that have moved out of agriculture have not fully found their way to the market sector, as evidenced by the continuous decline in labor force participation rates. We conclude that understanding Turkey's low labor force participation and low TFP, one has to understand why Turkey has not reallocated labor into the market non-agricultural sector at a faster rate.

Third, we argue that economic policies followed by Turkish governments since 1950 can explain why resources have remained for so long in agriculture and why the resources that left the agricultural sector withdrew from the market economy all together. The three main sets of policies we emphasize are: (1) high subsidization of agricultural products, (2) high effective tax rate on labor, (3) high effective tax rate on (non–agricultural) employers (which includes labor market restrictions). Even though Turkey is not the only OECD country with large subsidies to agriculture, it is the only OECD country with such a large agricultural sector. We argue that subsidization of agriculture can delay the structural transformation if it is pursued before a sufficient amount of resources have moved out of agriculture. Notice that the second policy interacts with the first one by decreasing the incentives to supply labor in the non–agricultural market. Finally, the third policy distorts the incentives to hire labor, exacerbating the second policy in the labor market.

To assess the quantitative effects of these policies for Turkey's under–performance, we develop a model of the structural transformation with household production, in which non-agricultural output can be produced either in the market or the household sector.

The focus of this paper is on the relative, not the absolute performance of Turkey. See for example, Prescott (2002), and Cole, Ohanian, Riascos, Schmitz (2004).

The structural transformation refers to the reallocation of economic activity from agriculture, to industry and then to services, as described by Kuznets, Chenery, etc.

There are generally two classes of models used to generate a structural transformation: (1) non-homothetic preferences with the income elasticity of agricultural goods being less than one and greater than one for services: Laitner, Echevarria, Kongsamut Rebelo and Xie. This preference structure will deliver a structural transformation even with neutral technological progress. (2) different rates of technological progress, with the fastest growth in agriculture and the slowest in services: Baumol, Ngai and Pissarides, Acemoglu and Guttieri. With this approach you can generate a structural transformation with homothetic preferences as long as the elasticity of substitution between goods is not unity.

We opt for the first approach. This is motivated by the results in Ngai and Pissarides (2005) who find that uneven technological progress cannot account for the re-allocation of economic activity away from agriculture.

According to Schiff and Valdes (1998) developing countries usually tax agriculture and developed countries usually favor agriculture. In this sense Turkey is unique, because it is one of the few countries that has favored agriculture so much before undergoing a structural transformation.

2 Turkey's Relative Economic Position

In this section we document Turkey's performance relative to the United States, and other major countries, over the period 1950-2000. The main measure of economic performance we use is real GDP per capita from the Penn World Table (Mark 6.1).

Turkey started off with low income per capita in 1950 and has not improved its position relative to the United States in the second half of the twentieth century. In 1950, Turkey's real GDP per capita was 20% that of the United States. In 2000, Turkey still had only 20% of the US income per capita. Furthermore, Turkey has lost ground relative to the European Union of 12,[1] especially over the period 1950 – 1980. In Figure 1, we document the stagnation of Turkey relative to the United States and its falling behind relative to the European Union.

Turkey was one of the founding members of the Organisation for Economic Co-Operation and Development (OECD) in 1961.[2] The OECD is considered a forum of relatively rich nations, which share similar political and economic institutions. One of its objectives has been to promote and further the prosperity of its member countries. As Figure 2 indicates, the OECD has managed, overall, to succeed in this goal since it has exhibited considerable convergence relative to the United States in the second half of the 20th century. Turkey is the only founding member that has not shown any sign of convergence over this period. Figure 2 plots income relative to the US, for Turkey, the OECD, the EU, and a group of South East Asian Economies (Japan, Korea, Taiwan). The most dramatic improvement in living standards has been displayed by the average of Japan, Korea, Taiwan: they started off from 18% of US income in 1950, and reached 58% by 2000. What is noteworthy, is that these countries had an average income that was almost the same as Turkey's in 1950.

In Figure 3, we plot relative real GDP per capita for the OECD countries that had a similar income level as Turkey in 1950. All these countries have managed to improve their relative position over the second half of the 20th century. All these countries managed to perform better than Turkey, with the exception of Mexico. Mexico however did not join the OECD until 1994, and therefore did not share the same burden of expectation as Turkey. Even though much has been written about Mexico's falling behind, very little has been written about Turkey. Out of the countries in Figure 3, we take three to be Turkey's closest

[1]The European Union of 12 consists of the countries that had joined by 1986: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, United Kingdom. We note here, that the predecessor of the European Union, the European Economic Community, was not established until 1958, and several members joined much later.

[2]The other founding members were, Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

peer group: Greece, Portugal, Spain. The performance of these countries is an indicator about what Turkey's performance could have been, but is not. Even though the country of reference, relative to which we assess the performance of Turkey, is the US, we will compare Turkey to Greece, Portugal and Spain, whenever possible.

Next, as a first step to evaluating the sources of Turkey's stagnant relative income, we decompose output per capita (Y/N) into two components: output per working age person – between the ages of 15-64 (Y/N_{15-64}), and the share of the population between the ages of 15-64 (N_{15-64}/N):

$$\frac{Y}{N} = \frac{Y}{N_{15-64}} \cdot \frac{N_{15-64}}{N}$$

This decomposition would attribute Turkey's relative stagnation to either low real GDP per working age person relative to the US or low share of working age persons in the total population relative to the US. Since the PWT do not report data on working age population, we complement the PWT with data from the OECD, which start in 1960. Figure 4 displays relative GDP per capita and its decomposition into working age population and share of working age population. Figure 4, clearly shows that Turkey's relative stagnation comes from its output per working age person. In fact, Turkish Y/N_{15-64} has exhibited a deterioration relative to the US in the past 40 years: it dropped from 24% in 1960 to 20% in 2000. We conclude that the focus of our investigation should be understanding Turkey's relative real GDP per working age person.

3 Aggregate Growth Accounting

First, we investigate the proximate causes of Turkey's relative stagnation at the aggregate level. We also compare Turkey's relative performance to that of Greece, Portugal and Spain, which we take to be a close peer group of countries. The results indicate that the source of Turkey's under–performance is not under–accumulation of capital but instead the decline in the labor force participation rate and the relative stagnation of Turkish TFP at a very low level.

3.1 Aggregate Framework

We assume a Cobb-Douglas aggregate production function of the following form,

$$Y_{it} = A_{it} K_{it}^{\theta} L_{it}^{1-\theta} \tag{1}$$

where, for each country i at time t, Y_{it} is real GDP, K_{it} is the capital stock, L_{it} is the economically active population, and A_{it} is TFP. We assume that TFP is the product of two terms[3]: $A_{it} = \pi_{it} A_t$. We interpret A_t as the world technological frontier, which is common across all nations, and π_{it} as the idiosyncratic component of productivity which is country specific. $0 < \pi_{it} \leq 1$ indicates how close a country is to the frontier.

Using (1) and denoting total population in country i at time t by N_{it}, we decompose output per capita as follows,

$$\frac{Y_{it}}{N_{it}} = (\pi_{it} A_t)^{\frac{1}{1-\theta}} \left(\frac{K_{it}}{Y_{it}}\right)^{\frac{\theta}{1-\theta}} \frac{L_{it}}{N_{it}}$$

where Y_{it}/N_{it} is output per capita, K_{it}/Y_{it} is capital intensity, and L_{it}/N_{it} is the labor force participation rate.

In what follows we interpret the behavior of the TFP term in the US as reflecting the behavior of the technological frontier. In other words, we assume that $\pi_{USt} = 1$ for all t.

3.2 Growth Accounting Results

The data used for this decomposition come from the PWT 6.1. More details on the data used are provided in the Appendix. In Tables 1, 2, and 3 we provide the average annual growth rates by decade of output per capita, the capital intensity factor, the labor force participation factor, and the TFP factor for Turkey, the US and the ratio of Turkey over the US over the period 1950-2000. Figure 6 displays the time-series decomposition of Turkey's relative income into the capital factor, the labor force factor and the TFP factor.

Over the second half of the 20th century Turkish income did not exhibit almost any catching up to the US: real GDP per capita in the US grew at an annual average rate of 2.3% while in Turkey the corresponding number was 2.69%. The first column in Tables 1, 2 and 3 provide the average annual growth rates of Turkish real GDP per capita, US real GDP per capita and their ratio, by decade. The high growth rate in the decade 1950-1960 for Turkey is accounted for by a large jump in income in the first two years. As a first approximation we are interested in uncovering the sources of the relative constancy of living standards in Turkey over the post-war period.

The second column of each table contains the contribution of the capital intensity factor to real income growth, the third column contains the contribution of the labor force participation rate and the fourth column contains the contribution of the TFP factor.

Table1: Accounting for Turkish Growth of Real GDP per Capita

[3] Here we follow, Parente and Prescott (2004) and Cole, Ohanian, Riascos and Schmitz (2004).

	growth rate of income per capita	growth rate of capital intensity factor	growth rate of labor force participation	growth rate of TFP factor
1950 -1960	4.04%	2.13%	-1.22%	3.13%
1960 -1970	3.02%	1.29%	-1.10%	2.84%
1970 -1980	1.67%	2.20%	-0.57%	0.06%
1980 -1990	3.00%	-0.33%	0.09%	3.25%
1990 -2000	1.76%	1.81%	0.36%	-0.41%
1950 -2000	2.69%	1.41%	-0.49%	1.76%

The post-war period was one of considerable capital deepening in Turkey, especially until the 1980s. In fact, as Table 3 and Figure 6 reveal Turkey achieved considerable cathing up relative to the US, in capital accumulation.

Turkish TFP grew at an average annual rate of 1.76% over 1950-2000. However, the US TFP grew even higher, at an average annual rate of 1.81%. Effectively the country specific component of technology for Turkey, π_{TURt}, was not only low - 20% of the US - but remained at roughly the same level over the entire period.

Table 2: Accounting for U.S. Growth of Real GDP per Capita

	growth rate of income per capita	growth rate of capital intensity factor	growth rate of labor force participation	growth rate of TFP factor
1950 -1960	1.38%	-0.47%	-0.55%	2.42%
1960 -1970	2.91%	-0.33%	0.49%	2.74%
1970 -1980	2.70%	0.46%	1.27%	0.94%
1980 -1990	2.18%	0.53%	0.17%	1.46%
1990 -2000	2.32%	0.32%	0.50%	1.50%
1950 -2000	2.30%	0.10%	0.37%	1.81%

The growth accounting exercise indicates that the main reason for Turkey's relative stagnation in living standards lies in the decline in its relative labor force participation: -0.86% per annum. Tables 1 and 2 reveal that the relative labor force participation in Turkey declined because fewer Turks started participating in the Turkish labor force and more Americans participated in the US labor force. As Figure 6 indicates the drop in the relative labor force participation was dramatic until the 1980s, while it flattened out a bit after that.

Table 3: Accounting for the Growth of Real GDP per Capita in Turkey Relative to the US

	growth rate of income per capita	growth rate of capital intensity factor	growth rate of labor force participation	growth rate of TFP factor
1950 -1960	2.63%	2.62%	-0.68%	0.69%
1960 -1970	0.10%	1.62%	-1.58%	0.09%
1970 -1980	-1.00%	1.73%	-1.82%	-0.88%
1980 -1990	0.81%	-0.86%	-0.08%	1.76%
1990 -2000	-0.55%	1.48%	-0.13%	-1.88%
1950 -2000	0.39%	1.31%	-0.86%	-0.05%

In fact, as is clear from Fig.4 and Table 1, Turkish real GDP per worker has been catching up to the US since over the period in question it has been increasing relative to the US at an annual rate of 0.9%. This is still low however compared to Turkey's peer group which managed to achieve considerable catchup over the post-war period in real GDP per worker.

3.3 Comparison to Peer Group

We conduct growth accounting decompositions for the three countries which we take to belong to Turkey's peer group in 1950: Greece, Portugal, Spain. In Figures 7-10 we plot the evolution of real GDP per capita, the labor force participation rate, the capital intensity factor, the TFP factor relative to the US, for Turkey and its peers.

All these countries who were to later join the OECD, started from approximately the same level of living standards, around 20% of US living standards in 1950. 50 years later, the three of them - Greece, Portugal, Spain - managed to raise their income relative to the US bringing it closer to 50% of the US one. Turkey on the other hand remained at 20% after five decades. See Fig.7.

Fig. 8 indicates that the capital intensity increased at roughly the same rate in all four countries, although Turkey started off at a lower level than its peer group. Therefore, this factor is not to blame for Turkey's relative stagnation.

Fig.9 reveals that the labor force participation rate declined in the Greece, Portugal and Spain relative to the US. However, the decline in Turkey's relative participation rate was much more dramatic than in its peer group, being particularly emphatic until the 1980s. All four countries converged to a participation rate of around 80% of the US one. Thus, Turkey's relative decline has to do with the fact that Turkey started off with an unusually high relative participation rate.

Finally, Fig. 10 shows that Greece, Portugal and Spain achieved considerable catching-up in TFP relative to the US while Turkey did not. Turkey remained at around 40% of US

TFP while its peer group achieved TFP levels of 60%-70% of the US ones, even though the departure point was similar in 1950.

3.4 Could it be Human Capital?

Does the relative stagnation of TFP have to with human capital differences? Need data at the aggregate level on human capital for Turkey and the US. If not very different: Our analysis suggest that the source of Turkey's relative stagnation does not lie in lack of physical or human capital accumulation. The contrary. Our analysis suggests that to understand the relative stagnation in Turkey's living standards we must understand why the labor force participation rate dropped so dramatically and why TFP did not gain any ground relative to the US over a period of half a century.

Table 4: Average Years of Schooling
(relative to the US)

	Greece	Portugal	Spain	Turkey
1950	0.47			0.13
1960	0.54	0.22	0.42	0.23
1965	0.54	0.24	0.41	0.22
1970	0.53	0.25	0.48	0.22
1975	0.57	0.28	0.45	0.23
1980	0.55	0.27	0.43	0.24
1985	0.59	0.30	0.45	0.29
1990	0.64	0.36	0.51	0.33
1995	0.66	0.37	0.54	0.38
2000	0.69	0.40	0.59	0.39

Source: Barro-Lee (2000)

It would be good if we can get Bils and Klenow (2000) measures of human capital and the Manuelli and Sheshardi (2004) quality adjusted measures of human capital, to complete our argument that it is not human capital differences.

The aggregate analysis indicates that if we want to understand why Turkey did not manage to catch up at all to US living standards we have to understand: (1) why did so many people drop out or failed to enter the Turkish labor force in the post-war era, and (2) Why didn't Turkey manage to improve its country-specific productivity component over this period. This is our task for the remainder of this paper.

4 Labor Market Dynamics

4.1 Overall Employment

We emphasize the decline in persons employed/participating rather than hours worked because these do not seem to vary systematically across countries. See Fig.10, where the relative annual hours worked per person employed have fairly constant for Turkey and its peer group fo countries over the past 50 years and at relative par with the hours worked in the US over this period.

Using data from the OECD Labor Market Statistics we calculate over the period 1960-2002: (1) the labor force participation as the fraction of persons participating in the labor force in the total working age population (aged 15-64), (2) the employment rate as the total number of persons employed over the total population aged 15-64, (3) the civilian labor force participation rate (excludes armed forces), (4) the civilian employment rate (excludes armed forces). In Fig.11 we report these aggregate labor market statistics for Turkey relative to the US values. What is clear is that all the above relative measures decreased, both because the absolute measures declined in Turkey and increased in the US.

In Turkey, the civilian labor force participation rate declined from 85% in 1960 to 51% by 2003! In the United States on the other hand, labor force participation increased from 65% in 1960 to 75% in 2003. Over the same period, labor input as measured by the civilian employment rate declined in Turkey from 77% to 46% and increased in the US from 62% to 71%. In fact the labor force participation rate and the employment rate moved almost one for one in both countries. Consequently in order to understand why labor force participation declined so dramatically both in absolute and relative terms we have to understand why Turks dropped massively out of the formal market economy, i.e., why labor input declined.

Two natural questions emerge: (1) Which activities are not being performed?, (2) Which individuals that were working before are unwilling to work now in the market sector?

To answer the first question we use OECD data for the period 1960-2002 to calculate sectoral employment rates for the three broad sectors, agriculture, industry, services. We measure the sectoral employment rate as the total civilian employment in a given sector over the total working age population between 15-64 years old. Fig.12 plots the sectoral employment rates for Turkey. We observe a dramatic decline in the labor input in agriculture over the period: the fraction of working age persons employed in agriculture dropped from 60% in 1960 to 16.5% in 2002. What is remarkable however is that the loss of labor input in agriculture did not translate into a gain of labor input in industry or services. The employment rate in industry and services increased by only 2% and 6% respectively. Thus a very large part of the Turkish working age population dropped out of the market agricultural sector without being re-allocated to the market sector of industry or services.

In Fig.13 we plot the Turkish relative employment rates by sector relative to the US ones for the period 1960-2002. If Turkey was catching up to the US over the period 1960-2002 we would expect the relative employment rates in agriculture and industry to decline and that in services to increase. This would be consistent with the Kuznets stylized facts about the structural transformation which accompanies the process of a country's development.

In the 1950s more Turks worked in the market sector than Americans but today Americans work more in market activities than Turks. There has been a large change in the relative labor supply over the past fifty years. We believe that differences in labor supply between Turkey and the US can be accounted to a large degree by differences in the effective marginal tax rate on labor income.

There are three factors, the combination of which, we identify as being important in understanding the low employment rate and labor force participation in Turkey:

- High income taxation.
- High Social Security contributions.
- Tight labor market regulations –especially high minimum wages–.

These factors which we identify by the stand-in effective tax on labor τ induce people to work in the informal sector instead of the market sector.

Given that people work in the informal sector it is better for them to work in the rural sector, because home production is more productive in rural vs. in urban areas.

Labor market distortions labor out of market activity and into household production. The additional effect is that these distortions induce people to stay in the rural area, where they devote much of their time to home production. The intuition is that, conditional on spending more time in the non-market sector, individuals would prefer to be in the rural area because household production opportunities are better there.

We can also show that subsidies to agriculture prevent people from moving out of the agricultural sector, and provided they stay in agriculture the informal sector is better because of the high distortionary labor policies.

Personal income tax + employee social security contributions.

4.2 Informal Employment

The informal sector includes wage earners and the self–employed who do not pay income taxes, are not covered by a social security program, and are not subject to other employment regulations.

Social security coverage for civil employees is provided by the Retirement Fund (ES). The Social Security Organizations (SSK), which was established in 1964, provides coverage for workers at state owned enterprises and private sector employees. Both ES and SSK provide health benefits and retirement benefits. Bagkur provides health and retirement benefits for the self employed in Turkey.

The size of uncovered employment is still a large part of the labor force in Turkey although it has been declining over time.

Tansel (2000) using individual level survey data from the 1994 Turkish Household Expenditure Survey of the State Institute of Statistics in Turkey reports that 34% of male wage earners and 35% of female wage earners do not have social security coverage and thus work in the informal sector. This is consistent with the evidence in Bulutay (1997) who reports that 35% of wage earners are not under social security coverage, based on data from Household Labor Force Survey of April 1996. Tansel (1997) reports that 42% of self employed men and 82% of self employed women have no social security coverage according to the 1989 Labor Force Survey. According to Turkish census data the proportion of self–employed males declined from 44% in 1955 to about 31% in 1990, while the proportion of wage earner males increased from 21% in 1955 to about 50% in 1950.

5 Policies

5.1 Tax and Social Security Policies

According to the OECD one of the priorities for the Turkish economy is to reduce the tax wedge on labor income: "Social security contribution rates are among the highest in OECD and create a vicious cycle encouraging unregistered activities, which already account for more than half of all employment and contribute to the steady decline in recorded participation rates" (OECD,...).

5.2 Labor Market Policies

Employment Protection Legislation (EPL) is one of the main reasons cited by employers for avoiding hiring in the official registered economy.

5.2.1 Severance Pay

Severance pay is introduced in Turkey first in 1936. Over time it has been changed several times, mostly, in favor of employees. The first legislation in 1936 restricted the severance pay to those who worked for five years. For each year of tenure, the employee was eligible for a severance pay of regular pay of 15 days. In 1950, the eligibility requirements have been made less strict. The minimum tenure of the employee was reduced to three years from five years. In 1967, beneficiaries became eligible to receive severance pay in the event of the employee's death. In 1975, the minimum tenure was reduced from three years to one year. In addition, the severance pay is doubled by increasing the regular pay factor from 15 to 30. For the first time, it has introduced a maximum level of severance pay which amounted to 7.5 times the regular pay of 30 days.[4]

5.3 Agricultural Policies

According to Schiff and Valdes (1998) developed countries subsidize agriculture and developing countries tax agriculture. Even though Turkey was not a developed country it pursued policies that subsidized agriculture heavily, going back to the 1950s.

Agricultural policies that subsidize farmers and the agricultural sector as a whole involve market price supports, direct transfer payments, subsidization of input use, and general services to the sector. Since 1987 the OECD has been systematically organizing monetary transfers to agriculture constructing four main indicators: (1) Producer Support Estimate (PSE), (2) Consumer Support Estimate (CSE), (3) General Services Support Estimate (GSSE), and (4) Total Support Estimate (TSE). These indicators measure transfers from consumers or taxpayers to farmers, arising from agricultural policies. The PSE measures the total value of gross transfers at the farm gate, from consumers and taxpayers to support agricultural producers. The PSE includes the Market Price Support (MPS) which measures transfers arising from policy measures that create a gap between domestic market prices and border prices. PSE also includes transfers from taxpayers to farmers in the form of payments based on, output, area planted or animal numbers, historical entitlements, input use, input constraints, overall farming income, and miscellaneous payments. CSE is an indicator of the gross transfer to (from) consumers of agricultural commodtities, measured at the farm gate level. The CSE includes transfers to producers from consumers, other transfers from consumers, transfers to consumers from taxpayers, excess feed cost. If negative the CSE measures the burden on consumers by agricultural policies, from higher prices and consumer charges or subsidies that lower prices to consumers. GSSE measures the gross transfers to general services provided to agriculture collectively and not individually to farmers. These include research and development, agricultural training, inspection services, infrastructures, marketing and promotion, public stockholding. TSE measures the value of all explicit and implicit gross transfers from taxpayers and consumers to agriculture net of associated bud-

[4]The Supreme Court has annulled this upper bound on severance pay. Later, the Military government in 1980 has reintroduced this maximum.

getary receipts (import receipts).

OECD countries in general provide high levels of support to agriculture, although there are large differences in the overall level and the composition of agricultural policies across member countries. Table 1 compares PSE and CSE as shares of gross farm receipts[5], over the periods 1986-88 and 2001-03, for a number of OECD countries. The CSE as a percentage, measures the implicit tax (or subsidy, if CSE is positive) on consumers as a share of consumption expenditure at the farm gate. A glance at these numbers suggests that Turkey did not subsidize agriculture as much as other OECD countries over the past 20 years. Fig.1 and Fig.2 indicate that for almost every year since 1986 Turkey has had PSE and CSE shares that were lower than the OECD averages.

These numbers however are misleading regarding the subsidization of agriculture because they do not include the general services provided by the government to farm sector. TSE as a percentage of GDP measures the overall transfers to agriculture including general services. Taking such services into account, Turkey is the country with the highest rate of agricultural protection in the OECD today. This is illustrated in Fig.3, which compares TSE as a share of GDP between periods 1986-88 and 2002-04, for a number of OECD countries. Fig.4 indicates that the overall subsidization of agriculture in Turkey has been considerably higher than the OECD average in every year since 1986. Caveat: these numbers are high in Turkey because the share of agriculture in total GDP and employment is very high.

We believe that TSE as a percentage of GDP is the relevant measure of farm support for our purpose. Although it is important to distinguish between transfers to farmers and general service transfers, we are concerned with the overall protection that agricultural policies impart on the farm sector as a whole, and how these policies affect the decision of an individual to remain in agriculture vs. non–agriculture.

The overall level of support in the OECD has not changed much over a 20 year period but the composition has: with a movement towards less distorting forms of support. For example, there has been a decline in the price support transfers and transfers linked to output and input use and an increase in budgetary transfers for general services to the agricultural sector (see Table 2).

Agriculture has long been a net receiver in Turkey. Transfers from consumers to farmers came through support purchases of major crops backed by high import tariffs.

Turkish governments pursued protective trade policies for major crops, government procurement, input subsidies, subsidized credit to farmers through the Agricultural Bank (in

[5]PSE and CSE are calculated in the same currency for all countries (usually US dollars or euros). Consequently any movements over time in these measures could reflect both movements in policy and/or exchange rates. Expressing them as a percentage of gross farm receipts (also expressed in a common currency) eliminates the exchange rate effects.

many cases without pay back in due time).

6 Model

In this section we develop a model of the structural transformation and introduce policy frictions to rationalize the relative stagnation of Turkey's economy over the period 1950-2000. The model is closely related to those in Echevarria (1995, 1997), Kongsamut, Rebelo and Xie (2001), Caselli and Coleman (2001), and Rogerson (2004). Similar to these papers, non-homothetic preferences and technological progress deliver a structural transformation over time, with a shift of resources from agriculture to non-agriculture. Unlike these authors: (1) we allow for the possibility that nonagricultural goods can be produced either in the market sector or the household sector, and (2) we emphasize particular policy frictions that are capable of altering the process of the structural transformation.

6.1 Environment

Consider an economy with two consumption goods, agricultural and non-agricultural, and three factors of production, capital, labor and arable land (used only for the production of the agricultural good). The non-agricultural good can be produced either in the market sector or the home production sector. Output produced in the home sector is directly consumed by households and household members occupied in household production are not subject to government tax and social security policies. Our modelling of the household sector is similar to Greenwood, Rogerson, Wright (1995), Parente, Rogerson and Wright (2001), and Gollin, Parente, Rogerson (2004).

In our model, we do not emphasize policies that discourage capital accumulation. Instead we put structure on policies that inhibit the movement of labor from agriculture to non-agriculture and policies that affect the return to working in the market vs. the household sector. The policies we introduce are the ones that the data have led us to suspect are important for understanding Turkey's relative stagnation. For this reason there are no taxes on consumption expenditures, investment expenditures, or capital income.

Preferences The economy is populated by a large number of identical, infinitely-lived households with log-linear preferences over sequences of agricultural consumption, non-agricultural consumption and leisure,

$$\sum_{t=0}^{\infty} \beta^t \left\{ \rho \log\left(a_t - \overline{a}\right) + (1-\rho) \log c_t + \phi \log l_t \right\} N_t \tag{2}$$

where a_t is per capita consumption of the agricultural good, c_t is an index of per capita consumption of the non-agricultural good, and l_t is per capita leisure, all at time t. The share of the agricultural good in the household's consumption basket is determined by the parameter $\rho \in (0,1)$. The parameter $\phi > 0$ specifies the value of leisure for the household.

The presence of the subsistence term $\overline{a} \geq 0$ makes these preferences non-homothetic, and implies that the income elasticity with respect to agricultural goods is less than one[6]. This preference structure along with exogenous technological progress is capable of producing a structural transformation.

Non-agricultural consumption is an aggregate of market (c_{mt}) and non-market consumption (c_{ht}), described by the CES aggregator,

$$c_t = \left[\mu c_{mt}^{\varepsilon} + (1-\mu) c_{ht}^{\varepsilon}\right]^{\frac{1}{\varepsilon}} \tag{3}$$

In the CES aggregator, μ measures the relative importance of market and home goods in the non-agricultural consumption basket, and ε determines the elasticity of substitution, $1/(1-\varepsilon)$, between goods produced in the market and home sectors.

The total amount of time available to a household is normalized to one. The amount of time devoted to business activities is the sum of the time devoted to agricultural production and the time devoted to market non-agricultural production

$$n_{bt} = n_{at} + n_{mt} \tag{4}$$

Leisure is the amount of time remaining after a household member has worked in the business sectors (n_{bt}) and the non-market sector (n_{ht})

$$l_t = 1 - n_{bt} - n_{ht} \tag{5}$$

The population is assumed to grow exogenously at a rate $\eta - 1$. With an initial population level of N_0 the population dynamics are described by $N_t = N_0 \eta^t$. Households own the capital and the arable land, both of which they rent out to the firms. Households are initially endowed with K_0 units of capital and T_a units of arable land.

Production Technologies The agricultural good is produced solely in the business sector. The non-agricultural good can be produced either in the market (business) sector or in the household sector. Work time devoted to the household sector is not subject to any form of taxation.

[6]This means that as the consumer's income rises she will consume a disproportionate amount of non-agricultural goods. This is simply Engel's law. If $\overline{a} = 0$, then as income rises the consumer would increase her consumption of both the agricultural and the non-agricultural goods proportionately.

The agricultural good is produced according to a production function that exhibits constant returns to scale in capital (K_{at}), labor input (N_{at}), and arable land (T_a),

$$Y_{at} = A_{at} \left(K_{at}^{\alpha} T_a^{1-\alpha} \right)^{\psi} N_{at}^{1-\psi}$$

where the TFP term A_{at} grows exogenously at a rate $\gamma_a - 1$, and hence with an initial level of agricultural TFP of A_a, its dynamics are described by $A_{at} = A_a \gamma_a^t$. The parameters α, $\psi \in (0, 1)$ determine the shares of the three factors in the production of the agricultural good.

The market non-agricultural good is produced according to the following constant returns to scale technology in capital and labor input,

$$Y_{mt} = A_{mt} K_{mt}^{\theta} N_{mt}^{1-\theta}$$

where the TFP factor A_{mt} grows exogenously at a rate $\gamma_m - 1$ and $A_{mt} = A_m \gamma_m^t$.

The home, non-agricultural good is produced according to the constant returns to scale production technology,

$$c_{ht} N_t = A_{ht} K_{ht}^{\sigma} (N_t n_{ht})^{1-\sigma} \tag{6}$$

where h denotes output and factor inputs used in the home sector. Notice that we allow the labor compensation shares to differ across the market and non-market technologies, with the non-market technology being more labor intensive, $\sigma < \theta$. TFP in the non-market sector grows exogenously at rate $\gamma_h - 1$.

Policies We emphasize two kinds of policies: (1) policies that distort the allocation of labor input between the business and the non-market sectors, (2) policies that distort the allocation of resources between agriculture and non-agriculture. In particular we assume that time devoted to the business sectors is taxed at a rate of $\tau_{et} < 1$ for every dollar of real wage earned. The tax τ_{et} reflects what the employee pays out of her labor income in personal income taxes and employee social security contributions. Firms are also assumed to incur costs when hiring labor. These costs involve employer social security contributions and other labor costs associated with labor market restrictions on hiring and firing. We denote the additional labor costs for the firm by the stand-in tax $\tau_{ft} < 1$ for every dollar paid in net real wages. Denoting the real wage rate paid per unit of time devoted to the business sectors by w_t the overall labor cost accruing to the firm is $w_t (1 + \tau_{ft})$. Consequently, the total wedge between what the firm pays and the employee receives is equal to $\frac{w_t(1+\tau_{ft})}{w_t(1-\tau_{et})} = \frac{(1+\tau_{ft})}{(1-\tau_{et})}$. We will denote this wedge by $(1 + \tau_t) \equiv \frac{(1+\tau_{ft})}{(1-\tau_{et})}$. Finally, agricultural firms receive a subsidy $s_t < 1$ per unit of output. This subsidy reflects price support levels determined by the government for agricultural products. The consumer and the producer price of food will differ by the size of the subsidy.

Resource constraints The economy's total capital stock, K_t, is perfectly mobile at a given point in time and is allocated across the business sector technologies and the home non-agricultural technology,

$$K_t = K_{bt} + K_{ht} \tag{7}$$

Business capital, which consists of the capital allocated to the agricultural sector and the market non-agricultural sector, is given by

$$K_{bt} = K_{at} + K_{mt} \tag{8}$$

Business capital depreciates geometrically at a rate δ_b, and the law of motion governing this capital stock is,

$$K_{bt+1} = (1 - \delta_b) K_{bt} + X_{bt} \tag{9}$$

where X_{bt} is business capital investment at time t.

Home capital depreciates geometrically at the rate δ_h. The capital accumulation equation for home capital is,

$$K_{ht+1} = (1 - \delta_h) K_{ht} + X_{ht} \tag{10}$$

where X_{ht} is home capital investment at time t.

At any point in time, labor input is allocated across the business and home technologies and leisure,

$$N_t = N_{at} + N_{mt} + N_t n_{ht} + N_t l_t \tag{11}$$

The agricultural good can only be used for consumption purposes,

$$a_t N_t = Y_{at} \tag{12}$$

The market non-agricultural good can be used for consumption or investment purposes,

$$c_{mt} N_t + X_{bt} + X_{ht} = Y_{mt} \tag{13}$$

The government is assumed to balance its budget from the policy activities each period. Any excess revenues are returned to consumers in a lump-sum fashion (if there is excess spending, consumers are taxed lump-sum),

$$TR_t = (\tau_{et} + \tau_{ft}) w_t n_{bt} - s_t p_t Y_{at} \tag{14}$$

6.2 Equilibrium

We let the market non-agricultural good be the numeraire, and denote the relative price of the agricultural good by p_t.

An equilibrium for this economy is a sequence of output and factor prices $\{p_t,\ w_t,\ r_t,\ q_t\}_{t=0}^{\infty}$, a sequence of policies $\{\tau_{et},\ \tau_{ft},\ s_t,\ TR_t\}_{t=0}^{\infty}$, a sequence of allocations for the firms $\{Y_{at},\ Y_{mt},\ K_{at},\ K_{mt},\ N_{at},\ N_{mt},\ T_a\}_{t=0}^{\infty}$, a sequence of allocations for the household $\{a_t,\ c_{mt},\ c_{ht},\ n_{at},\ n_{mt},\ n_{ht},\ l_t,\ K_{ht}\}_{t=0}^{\infty}$, such that (1) given prices and policies, $\{a_t,\ c_{mt},\ c_{ht},\ n_{at},\ n_{mt},\ n_{ht},\ l_t,\ K_{ht}\}_{t=0}^{\infty}$ solves the household problem, (2) factor prices are competitive, (3) markets clear, (4) the government satisfies its period by period budget constraint.

Household Optimization The household faces a labor - leisure decision, a consumption - savings decision, and a sectoral allocation decision. The household's date t budget constraint is,

$$[p_t a_t + c_{mt}]\, N_t + X_{bt} + X_{ht} = r_t K_{bt} + w_t\,(1-\tau_{et})\, n_{bt} N_t + q_t T_a + TR_t \tag{15}$$

where w_t is the real wage rate paid in the business sector, r_t is the rental price of capital, q_t is the rental price of land, and TR_t are lump sum transfers/taxes to the stand-in household. The household maximizes (2), subject to (3), (5),(6),(9),(10), and (15).

The first order conditions to the household's problem imply the following optimality conditions,

$$\frac{\rho}{1-\rho}\cdot\frac{\left[\mu c_{mt}^{\varepsilon}+(1-\mu)\,c_{ht}^{\varepsilon}\right]/c_{mt}^{\varepsilon-1}}{a_t-\overline{a}} = \mu p_t$$

$$\frac{\left[\mu c_{mt}^{\varepsilon}+(1-\mu)\,c_{ht}^{\varepsilon}\right]/c_{mt}^{\varepsilon-1}}{l_t} = \frac{\mu\,(1-\rho)}{\phi} w_t\,(1-\tau_{et})$$

$$\frac{\left[\mu c_{mt}^{\varepsilon}+(1-\mu)\,c_{ht}^{\varepsilon}\right]/c_{ht}^{\varepsilon-1}}{l_t} = \frac{(1-\mu)\,(1-\rho)\,(1-\sigma)}{\phi} A_{ht}\left(\frac{K_{ht}}{n_{ht}N_t}\right)^{\sigma}$$

$$\frac{c_{mt}^{\varepsilon-1}}{\mu c_{mt}^{\varepsilon}+(1-\mu)\,c_{ht}^{\varepsilon}} = \beta\frac{c_{mt+1}^{\varepsilon-1}}{\mu c_{mt+1}^{\varepsilon}+(1-\mu)\,c_{ht+1}^{\varepsilon}}\left[r_{t+1}+1-\delta_b\right]$$

$$\frac{c_{mt}^{\varepsilon-1}}{\mu c_{mt}^{\varepsilon}+(1-\mu)\,c_{ht}^{\varepsilon}} = \beta\left[\frac{(1-\delta_h)\,c_{mt+1}^{\varepsilon-1}}{\mu c_{mt+1}^{\varepsilon}+(1-\mu)\,c_{ht+1}^{\varepsilon}} + \frac{(1-\mu)\,\sigma c_{ht+1}^{\varepsilon-1}}{\mu c_{mt+1}^{\varepsilon}+(1-\mu)\,c_{ht+1}^{\varepsilon}}\frac{A_{ht+1}}{\mu}\left(\frac{K_{ht+1}}{n_{ht+1}N_{t+1}}\right)^{\sigma-1}\right]$$

The first condition says that in equilibrium the ratio of marginal utilities between the agricultural and non-agricultural market goods is equalized to the relative price ratio. The second equation says that household members will allocate their time to the market sector until the marginal rate of substitution between consumption and leisure is equal to the real wage rate: at the margin the consumer is indifferent between working a bit more in the market and taking a bit more leisure. The third equation says that household members will work in the home sector until the marginal rate of substitution between home consumption and leisure is equal to the marginal rate of transformation between home production and leisure. The fourth equation suggests that the marginal cost in terms of utility, from sacrificing one unit of consumption today should be equal to the present discounted utility benefit of extra consumption tomorrow. The last equation says that the utility cost sacrificing one unit of market consumption today should be equal to the discounted future utility benefit of more market and household consumption.

Firm Optimization The representative firm in each sector solves a sequence of static problems at each date: the firm chooses the factor inputs it will hire to maximize profits, taking prices and government policy as given. Capital and labor can move across all three sectors, while arable land can be used only in the agricultural sector.

The problems of the representative firms in the agricultural and the market non-agricultural sectors are,

$$\max_{K_{at},N_{at},T_a} \left\{ p_t \left(1+s_t\right) A_{at} \left(K_{at}^{\alpha} T_a^{1-\alpha}\right)^{\psi} N_{at}^{1-\theta} - w_t \left(1+\tau_{ft}\right) N_{at} - r_t K_{at} - q_t T_a \right\}$$

$$\max_{K_{mt},N_{mt}} \left\{ A_{mt} K_{mt}^{\theta} N_{mt}^{1-\theta} - w_t \left(1+\tau_{ft}\right) N_{mt} - r_t K_{mt} \right\}$$

The mobility of labor and capital across the two technologies in the business sector implies that in equilibrium the net returns to these factors must be equalized. Consequently capital to labor ratios are proportional to each other in equilibrium,

$$\frac{K_{amt}}{N_{amt}} = \varphi \frac{K_{mt}}{N_{mt}} \tag{16}$$

where $\varphi \equiv \frac{(1-\theta)\alpha\psi}{(1-\psi)\theta}$.

Balanced Growth Path Equilibrium A balanced growth path equilibrium is an equilibrium as defined above with the property that aggregate variables grow at constant rates. The existence of a balanced growth path with a constant real interest rate and a constant relative price of the agricultural good p, requires that

$$\gamma_a = \gamma_m^{\frac{1-\alpha\psi}{1-\theta}} \eta^{\psi(1-\alpha)}$$

$$\gamma_h = \gamma_m^{\frac{1-\sigma}{1-\theta}}$$

In this balanced growth path equilibrium, aggregate output and capital variables $\{Y_{mt}$, Y_{at}, K_{mt} , K_{at}, K_{ht}, $K_t\}$ and the rental price of land q_t, grow at rate $\gamma_m^{\frac{1}{1-\theta}}\eta - 1$, per capita variables $\{c_{mt}$, c_{ht}, $a_t\}$ and the wage rate w_t grow at rate $\gamma_m^{\frac{1}{1-\theta}} - 1$, and labor input variables $\{N_{mt}$, N_{at}, $N_t n_{ht}\}$ grow at rate $\eta - 1$. The rental price of capital r_t, the relative output price p_t, and per capita leisure l_t are constant along the balanced growth path.

Asymptotically the economy will converge to this balanced growth path. It is useful to transform all growing variables by dividing them with their growth factors along the balanced growth path. We denote the transformed variables by hats, for example K_t is transformed to $\widehat{k}_t = \frac{K_t}{A_{mt}^{\frac{1}{1-\theta}} N_t}$. The labor inputs N_{it} for $i \in \{a, m\}$ are transformed to $n_{it} = \frac{N_{it}}{N_t}$.

From the Euler equation, along a balanced growth path, the rental price of capital is $r = \gamma_m^{\frac{1}{1-\theta}} \beta^{-1} - 1 + \delta_b$. Along with the first order condition with respect to the capital input in the market non-agricultural sector, the capital - labor ratio in that sector is,

$$\frac{\widehat{k}_m}{n_m} = \left(\frac{\beta \theta A_m}{\gamma_m^{\frac{1}{1-\theta}} - \beta (1 - \delta_b)} \right)^{\frac{1}{1-\theta}}$$

We solve for the values of the other variables in the steady state numerically, due to the non-linearities in the model.

Transitional Dynamics The following set of equations fully describes the dynamics of the transformed economy. These relationships will hold at all points in time, including the balanced growth path.

The first order conditions to the household's problem in terms of the transformed variables can be written as,

$$\widehat{c}_{ht} = \widehat{c}_{mt} \left(\frac{\mu_c}{1 - \mu_c} p_{ct} \right)^{\frac{1}{\varepsilon_c - 1}}$$

$$\widehat{a}_{ht} = \widehat{a}_{mt} \left(\frac{\mu_a}{1 - \mu_a} \frac{p_{ht}}{p_{mt}} \right)^{\frac{1}{\varepsilon_a - 1}}$$

$$\frac{\left[\mu_c \widehat{c}_{mt}^{\varepsilon_c} + (1 - \mu_c) \widehat{c}_{ht}^{\varepsilon_c} \right] / \widehat{c}_{mt}^{\varepsilon_c - 1}}{1 - n_{amt} - n_{aht} - n_{cmt} - n_{cht}} = \widehat{w}_t \frac{(1 - \rho) \mu_c}{\phi}$$

$$\gamma_{cm}^{\frac{1}{1-\theta}} \frac{\widehat{c}_{mt}^{\varepsilon_c - 1}}{\mu_c \widehat{c}_{mt}^{\varepsilon_c} + (1 - \mu_c) \widehat{c}_{ht}^{\varepsilon_c}} = \beta \frac{\widehat{c}_{mt+1}^{\varepsilon_c - 1}}{\mu_c \widehat{c}_{mt+1}^{\varepsilon_c} + (1 - \mu_c) \widehat{c}_{ht+1}^{\varepsilon_c}} \left[r_{t+1} + 1 - \delta \right]$$

$$\frac{\rho}{1 - \rho} \cdot \frac{\mu_a}{\mu_c} \cdot \frac{\widehat{a}_{mt}^{\varepsilon_a - 1} / \left[\mu_a \widehat{a}_{mt}^{\varepsilon_a} + (1 - \mu_a) \widehat{a}_{ht}^{\varepsilon_a} \right] \left(1 - \frac{\overline{a} / A_{cmt}^{\frac{1}{1-\theta}}}{\widehat{a}_t} \right)}{\widehat{c}_{mt}^{\varepsilon_c - 1} / \left[\mu_c \widehat{c}_{mt}^{\varepsilon_c} + (1 - \mu_c) \widehat{c}_{ht}^{\varepsilon_c} \right]} = p_{mt}$$

The equalization of net wages across sectors in equilibrium, allows to solve for the relative prices of the agricultural market good, the agricultural non-market good, and the non-agricultural non-market good, in terms of the capital labor ratio in the non-agricultural market sector and the labor and land inputs,

$$p_{ct} = \left(\frac{1 - \theta}{1 - \sigma} \cdot \frac{1 - \tau_{et}}{1 + \tau_{ft}} \right)^{1 - \sigma} \left(\frac{\theta}{\sigma} \right)^{\sigma} \left(\frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\theta - \sigma}$$

$$p_{mt} = \frac{1}{(1 + s_t) \alpha^{\alpha \theta}} \left(\frac{n_{amt}}{T_{mt}} \right)^{\theta (1 - \alpha)} \left(\frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\theta (1 - \alpha)}$$

$$p_{ht} = \frac{1}{(1+s_t)} \left(\frac{1-\theta}{1-\sigma} \cdot \frac{1-\tau_{et}}{1+\tau_{ft}} \right)^{1-\alpha\sigma} \left(\frac{\theta}{\alpha\sigma} \right)^{\alpha\sigma} \left(\frac{n_{aht}}{T-T_{mt}} \right)^{\sigma(1-\alpha)} \left(\frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\theta-\alpha\sigma}$$

where I have also used (16) to substitute the capital labor ratios in all other sectors with that in the non-agricultural market sector which is our numeraire.

Since arable land can be used to produce agricultural goods either in the formal or the informal sector, in equilibrium the rental price of land must be equal across sectors. Exploiting this relationship along with land market clearing we get the following condition for the share of land allocated to the market agricultural sector,

$$\frac{T_{mt}^{1-\theta(1-\alpha)}}{(T-T_{mt})^{1-\sigma(1-\alpha)}} = \frac{p_{mt}}{p_{ht}} \left[\frac{1-\sigma}{1-\theta} \frac{1+\tau_{ft}}{1-\tau_{et}} \right]^{\alpha\sigma} \left(\alpha \frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\alpha(\theta-\sigma)} \frac{n_{amt}^{1-\theta(1-\alpha)}}{n_{aht}^{1-\sigma(1-\alpha)}}$$

Market clearing for the non-agricultural good produced in the formal sector produces,

$$\widehat{c}_{mt} = (1-\delta)\, \widehat{k}_t + \left(\frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\theta} n_{cmt} - \gamma_{cm}^{\frac{1}{1-\theta}} \eta \widehat{k}_{t+1}$$

The requirement that the agricultural goods (market and non-market) and the non-agricultural non-market good can be used only for consumption purposes is reflected in the following three equations,

$$\widehat{a}_{mt} = \left(\alpha \frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\alpha\theta} n_{amt}^{1-\theta(1-\alpha)} T_{mt}^{\theta(1-\alpha)}$$

$$\widehat{a}_{ht} = \left(\frac{1-\theta}{1-\sigma} \cdot \frac{1-\tau_{et}}{1+\tau_{ft}} \cdot \frac{\alpha\sigma}{\theta} \cdot \frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\alpha\sigma} n_{aht}^{1-\sigma(1-\alpha)} (T-T_{mt})^{\sigma(1-\alpha)}$$

$$\widehat{c}_{ht} = \left(\frac{1-\theta}{1-\sigma} \cdot \frac{1-\tau_{et}}{1+\tau_{ft}} \cdot \frac{\sigma}{\theta} \cdot \frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\sigma} n_{cht}$$

The rental price of capital can be solved for from the first order conditions of the non-agricultural market firm,

$$r_t = \theta \left(\frac{\widehat{k}_{cmt}}{n_{cmt}} \right)^{\theta-1}$$

Finally capital and labor market clearing, along with (16) produces the final equation required to solve the system,

$$\widehat{k}_t = \frac{\widehat{k}_{cmt}}{n_{cmt}} \left[n_{cmt} + \frac{(1-\theta)\,\sigma}{(1-\sigma)\,\theta} \frac{1-\tau_{et}}{1+\tau_{ft}} n_{cht} + \alpha n_{amt} + \frac{(1-\theta)\,\alpha\sigma}{(1-\sigma)\,\theta} \frac{1-\tau_{et}}{1+\tau_{ft}} n_{aht} \right]$$

In the quantitative section we solve for transitions to the balanced growth path numerically.

Effects of Policies The personal income taxes and the employee social security contributions affect the household's supply of labor to the market sector, while the social security contributions by the employer, affect the demand for labor by the firms.

7 Quantitative Analysis

7.1 Calibration

We parameterize the model so that it matches data for the US economy and key features of its structural transformation over the period 1950 - 2000.

We normalize the intital population level, initial arable land and the initial TFPs in all sectors to one for the US economy in 1950, $N_0 = T_a = A_m = A_h = A_a = 1$. These normalizations correspond to a choice of units.

We choose the population growth rate $\eta - 1$ to match an average annual population growth rate of 1.2% over the period 1950-2000 as calculated from the POP series in PWT6.1.

We choose the weight of farm goods in the household's consumption basket, ρ, to match an average share of farm value in total consumption expenditures of 0.035 over the period 1990-95. This is because in a balanced growth path equilibrium $\rho = p\widehat{a}/(p\widehat{a} + \widehat{c})$. From the Economic Report of the President, the average over 1990-95 of the share of food expenditures in total consumption expenditures is 0.16. From the USDA the share of farm value in total consumer expenditures on food is only 0.22 (average over 1990-95). The product of the two numbers gives us the value of ρ.

We set the parameter ϵ, that determines the elasticity of substitution between goods produced in the market and at home, up front. Micro and macro studies find this parameter to be between 0.4-0.45 (see for example). Following Rogerson (2005) we set this parameter equal to 0.45, which implies a fairly large degree of substitutability between market and home goods.

The average annual growth rate of US real GDP per hour (or worker) over the post war period is 2%. In terms of the model this implies $\gamma_m^{\frac{1}{1-\theta}} = 1.02$ and given a value for θ, the growth rate of TFP in the market non-agricultural sector, γ_m, is determined.

In the model there are two types of capital, business capital and household capital. Business capital includes capital allocated to both the agricultural and the market non-agricultural sector. We need to allign our targets in the NIPA with the variables in our model. We take household investment to include only expenditures on consumer durables. Business investment consists of residential expenditures, non-residential expenditures (structures and producer durables), changes in inventories, and 25% of government expenditures. Household capital is the stock of consumer durables, and business capital is the sum of residential capital, non-residential capital and government capital. The investment variables are calculated from NIPA as averages over the period 1950-2000. The capital variables are the 1990 stocks from Musgrave (1997).

We choose the depreciation rate of business capital, $\delta_b = 0.044$, to match a target for the business investment to capital ratio of $\widehat{x}_b/\widehat{k}_b = 0.076$, as calculated above. We set the depreciation rate of household capital, δ_h, equal to δ_b.

The share of capital in the market non-agricultural technology, θ, is set to 0.31 to match a target for the capital to output ratio in the market non-agricultural sector of $\widehat{k}_m/\widehat{y}_m = 2.83$. Non-agricultural market capital is calculated as the 1990 stock of business capital as described above minus the 1990 stock of non-residential farm capital. Market non-agricultural output is calculated as the product of GDP from NIPA and one minus the share of farm output in GDP. The share of farm output in GDP is calculated from the Industry Accounts of the BEA.

We set the subjective discount factor, β, equal to 0.9577 to match an asymptotic real interest rate of $R = 6.5\%$ (see Siegel (1995)). On the balanced growth path, the Euler equation implies that $\beta = \gamma_m^{\frac{1}{1-\theta}}/(1+R)$, where $R = r - \delta_b$.

The share of capital (reproducible and non-reproducible) in the agricultural technology, ψ is chosen to match the labor compensation share for agriculture. The agricultural labor compensation share is calculated as compensation of employees over agricultural value added minus indirect taxes and non-tax liability. It is calculated from the benchmark data (use tables) of the US Input-Output Tables, as the simple average of the 1987, 1992 and 1997 tables (weighted averages delivered similar results). The share of reproducible capital in total capital in agriculture, α, is chosen to match the fraction of the total rental cost of capital that goes to non-reproducible capital (land), 0.4754, as reported by the Bureau of Labor Statistics (see Caselli and Coleman (2001)). This number implies an income elasticity with respect to land of 0.31 which is within the range of values obtained from cross-country estimation of agricultural production functions (0.1-0.4). See for example Hayami and Ruttan (1985).

We set the labor income tax rate τ_e, in the balanced growth path, equal to 0.4 in accordance with the calculations of Prescott (2004) for the period 1993-96. Assuming that there are no labor market restrictions in the US, we set the employer tax rate equal to 0.07, which are the social security contributions paid by the employer as a fraction of the total labor costs (OECD, 1998). We set the subsidy to agriculture s equal to 0.18, which is the average producer support estimate as a share of farmer income, reported for the US economy by the OECD over the period 1990-2000.

Time use studies for the US find that households devote 25% of their total time to home production activities and 33% of their time to market activities. These two numbers determine two targets in the context of our model: $n_h = 0.25$ and $n_b = 0.33$. The ratio of normalized total hours in agriculture over normalized total hours in market non-agriculture, n_a/n_m, is equal to the ratio of hours worked per employee in agriculture over market non-agriculture times the ratio of employment rates in agriculture over market non-agriculture. The ratio of hours worked per employee in agriculture vs. market non-agriculture has a exhibited a downward trend in the past 50 years in the US: it declined from 1.34 in 1950 to 1.04 in the 1990s (average of 1990-97). The ratio of employment rates declined from 0.135 in 1950 to 0.029 in the 1990s. This implies that the ratio of total hours in agriculture vs. market non-agriculture, n_a/n_m in our model, declined from $(1.34)(0.135) = 0.18$ in 1950 to $(1.04)(0.029) = 0.03016$ in 1990-97. This occured both because the ratio of hours declined and because the ratio of employment rates declined. If n_b has remained roughly constant over the post-war period then the above numbers imply that the allocation of total business hours in 1950 was $n_{a,1950} = 0.0504$ and $n_{m,1950} = 0.2796$ while over 1990-97 it was $n_{a,1990s} = 0.0097$ and $n_{m,1990s} = 0.3203$.

The share of capital in the home production technology σ, the share of market produced goods in the non-agricultural consumption basket μ, and the weight of leisure in the household's utility ϕ, are chosen to match three targets in the balanced growth path: the share of home capital to market non-agricultural output $\widehat{k}_h/\widehat{y}_m = 0.32$, the fraction of hours in home production $n_h = 0.25$, and the fraction of hours in market non-agricultural production $n_m = 0.3203$. These targets imply values for σ, μ, and ϕ of 0.1035, 0.64, 0.425 respectively.

Finally we choose the parameter $\overline{a} = 0.17$ to match the fraction of total hours in agriculture in 1950.

7.2 The Experiment

The experiment we do is the following. We ask whether the differences in taxes and subsidies between the US and Turkey can account for the relative stagnation of Turkish economy over the post war period. In particular we ask how much of the relative stagnation can we account for with exogenous differences in taxes, subsidies equal to the ones we see in the data.

We want τ_f to capture all forms of government regulation, interference, or any other institutional disincentive to hire labor in the market sector, not only direct employer contributions.

8 Discussion

The next natural question is whether the drop in labor force participation is concentrated among a specific group of the population. This may inform policy analysis.

One question we have not explored is: which subgroup of the population is not working?

References

Bils, M., and Klenow, P., 2000. “Does Schooling Cause Growth?” *American Economic Review* 90, 1160-1183.

Cole, H., Ohanian, L., Riascos, A., and Schmitz, J., 2005. “Latin America in the Rearview Mirror.” *Journal of Monetary Economics*, 52, 69-107.

De Soto, H. 1990. *The Other Path.* New York, NY. Harper and Row.

Djankov, S., La Porta R., Lopez-De-Silanes F., Shleifer, A. 2002. “The Regulation of Entry.” *Quarterly Journal of Economics* 117, 1-37.

Manuelli, R., and Seshadri, A., 2005. “Human Capital and Wealth of Nations.” University of Wisconsin, working paper.

Prescott, E., 2004. “Why Do Americans Work So Much More Than Europeans?” *Federal Reserve Bank of Minneapolis Quarterly Review* 28, 2-13.

Yeldan, A. E., 1998. “On structural sources of the 1994 Turkish crisis: A CGE modelling analysis,” *International Review of Applied Economics* 12, 397-414.

A Data Description

PWT 6.1 The following variables have been obtained from the PWT 6.1. *POP*: Population (the source is the WDI 2001 and the UN Development Center). *RGDPCH*: Real GDP per capita (Constant price: Chain series). *RGDPWOK*: Real GDP per worker (Constant price: Chain series), where workers refer to the economically active population (according to the ILO definition). *KI*: Constant price share of investment in real GDP. We calculate *real GDP* as $RGDPCH \times POP$ and the real investment series as *real GDP*$\times KI$. The labor force participation rate is calculated as $RGDPCH/RGDPWOK$. The capital stock series are calculated using the a law of motion with geometric depreciation, as follows:

$$K_{t+1} = (1-\delta) K_t + X_t$$

where X_t is the real investment series calculated above. For a given depreciation rate δ and initial condition for the capital stock K_0, the above equation can be used to generate the capital stock series for the entire period. Following Caselli (2004) we set $\delta = 0.06$ and we calculate the initial condition for the capital stock series as $K_0 = X_0/(\delta + g_X)$, where X_0 is the value of the investment series in the first sample year, and g_X is the average annual growth rate of the investment series for each country between the first sample year and 1970.

OECD Corporate Data Environment, Labor Market Statistics From this OECD publication we have obtained the following variables. *Population between 15-64*: working age population. *Labor Force*: economically active population (employed and unemployed). *Civilian Labor Force*: labor force minus armed forces. *Employment*: employed persons based on ILO definition. *Civilian Employment*: employed persons except for those in armed forces.

Groningen Growth and Development Centre Annual Hours worked per person employed.

References

Bils, M., and Klenow, P., 2000. "Does Schooling Cause Growth?" *American Economic Review* 90, 1160-1183.

Cole, H., Ohanian, L., Riascos, A., and Schmitz, J., 2005. "Latin America in the Rearview Mirror." *Journal of Monetary Economics*, 52, 69-107.

De Soto, H. 1990. *The Other Path.* New York, NY. Harper and Row.

Djankov, S., La Porta R., Lopez-De-Silanes F., Shleifer, A. 2002. "The Regulation of Entry." *Quarterly Journal of Economics* 117, 1-37.

Manuelli, R., and Seshadri, A., 2005. "Human Capital and Wealth of Nations." University of Wisconsin, working paper.

Prescott, E., 2004. "Why Do Americans Work So Much More Than Europeans?" *Federal Reserve Bank of Minneapolis Quarterly Review* 28, 2-13.

Yeldan, A Erinc., 1998. "On structural sources of the 1994 Turkish crisis: A CGE modelling analysis," *International Review of Applied Economics* 12, 397-414.

B Figures

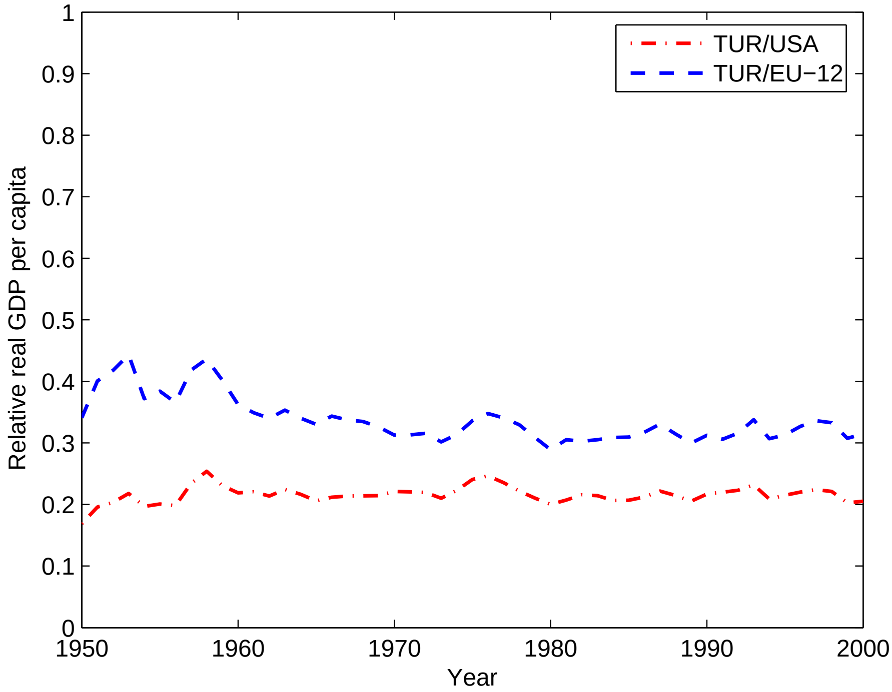

Figure 1: Turkey's Relative Real GDP per capita

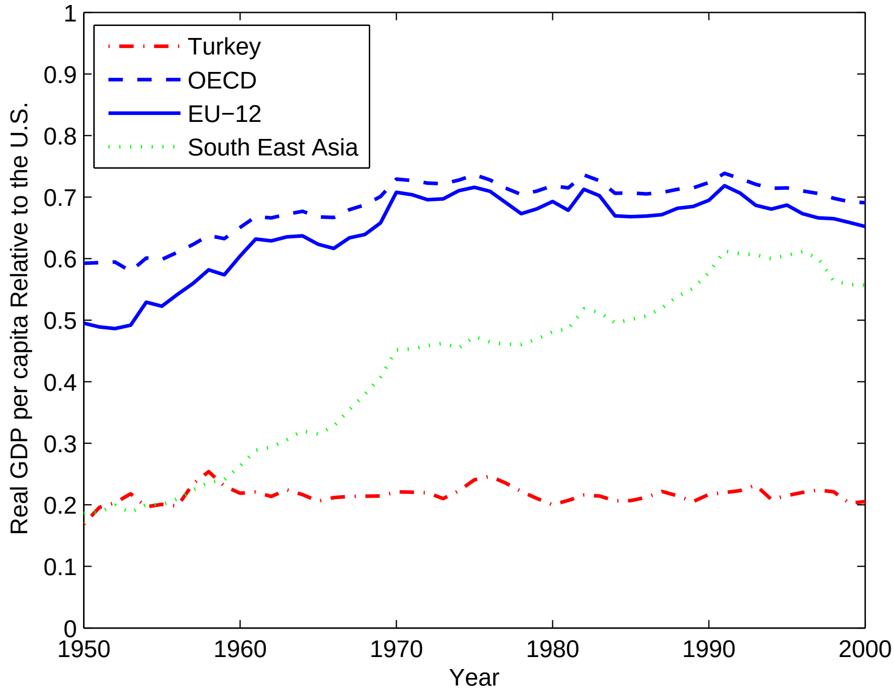

Figure 2: Relative Real GDP per capita: Turkey and Groups of Countries

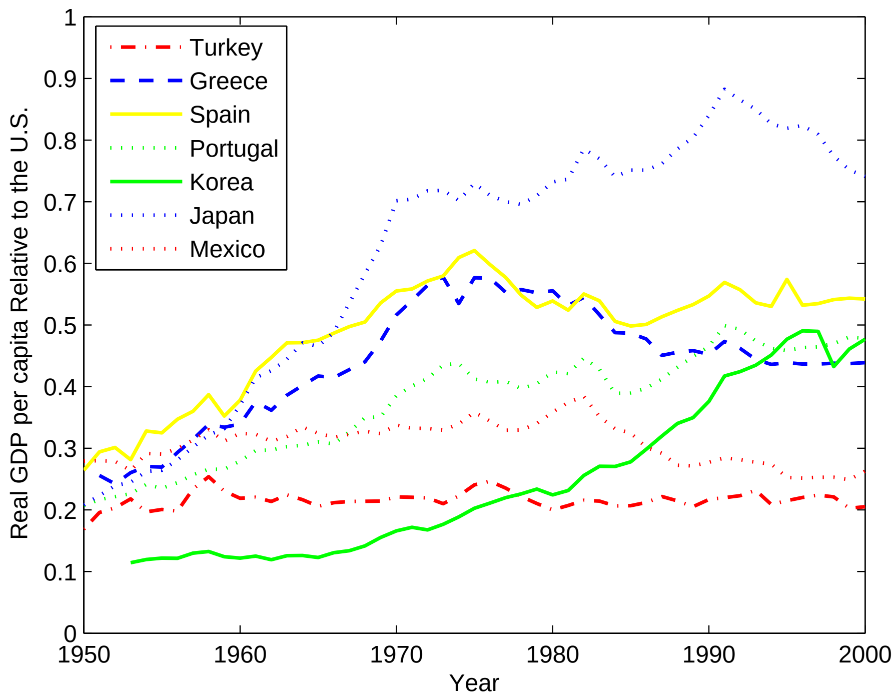

Figure 3: Relative Real GDP per capita: Turkey and OECD Countries

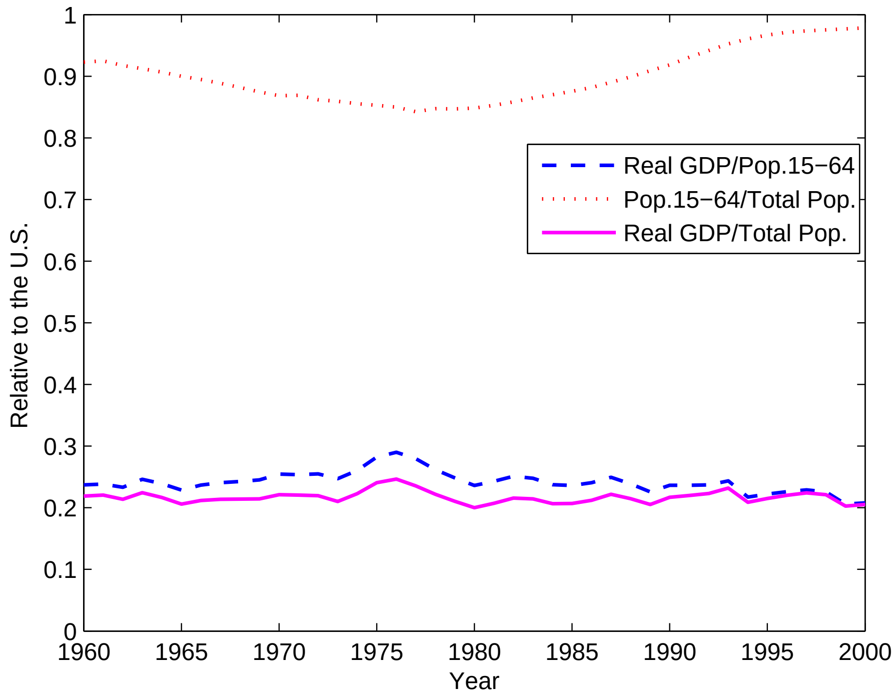

Figure 4: Decomposition of Turkish Real GDP per Capita