Agricultural Productivity and Growth in Turkey*

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Abstract

This paper investigates the growth experience of one country in detail in order to enhance our understanding of important factors that affect economic growth. Using a two sector model, we identify the low productivity growth in the agricultural sector as the main reason for the divergence of income per capita between Turkey and its peer countries. An extended model that incorporates distortions in the use of intermediate goods in producing the agricultural output indicates that policies that have different effects across sectors and across time may be important in explaining the growth experience of countries.

JEL Classification: O11, O40, O57.
Key Words: Sectoral productivity differences; International comparisons; Turkey; Agriculture; Two-sector model

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1 Introduction

Between 1960 and 1977 Turkish GDP per capita fell from 73% of Greece, Portugal, and Spain to around 50% and remained at this level until very recently. In this paper we investigate the reasons behind this relative stagnation. We inquire whether we can isolate particular policies or features that may have been responsible for this experience. Many authors have focused on the role of institutions, human capital, and macroeconomic policies that may have hindered growth in developing countries. For example, Hall and Jones (1999) attributed most of the differences in output per worker to differences in institutions and government policies across countries. Acemoğlu, Johnson, and Robinson (2001) estimated large effects of institutions on income per capita. Recently, models of sectoral transformation have been emphasized in providing further insight into these differences. For example, Gollin, Parente, and Rogerson (2002) and Restuccia, Yang, and Zhu (2008) discussed the importance of the agricultural sector in accounting for the differences in income per capita while Duarte and Restuccia (2010) concluded that low productivity in services explains the lack of convergence across a large set of countries.[1]

In this paper, we examine the growth experience of Turkey through the lens of a multi-sectoral model and find that the main reason behind its stagnation relative to Greece, Portugal, and Spain was its low agricultural productivity growth. While this result may not be surprising given the large differences in agricultural productivity levels across these countries, it transforms the focus of the investigation, for Turkey, into policies that have different effects across sectors and across time. We provide some evidence that policies that discriminated against agriculture deserve special attention for understanding the low productivity growth in the Turkish agricultural sector.

The growth rate of GDP per capita in Turkey between 1923 and 2008 was 3.0%, but that rate fluctuated considerably over time. For example, from 1960 to 1977, GDP per capita grew at 3.8% while during 1977-2001 it grew at 1.6%.[2] Despite the fact that the 1977-2001 period could almost be classified as a "great depression" based on the Kehoe and Prescott (2007) definition, it is the earlier period when the gap between Turkey and some of its peers widened. Indeed, in the 1960s and 1970s, Turkish per capita GDP significantly fell behind its peers, whom we define for the purposes of this paper as Greece, Portugal, and Spain.[3] In 1960, Turkish GDP per capita was 73% of its peers. By 1977, this ratio had

[1]For the role of human capital, see Glaeser, La Porta, Lopez-de-Silanes, and Schleifer (2004) and Barro (1999).

[2]The data after the 1950 period are from the Conference Board, Total Economy Database. For data before 1950, we use Maddison (2003).

[3]We use these three countries as a comparison group that were similar to Turkey in terms of their income gap with the U.S. after WWII in addition to geographical proximity and similar institutional setups such as

declined to 50% and continued to be around 47% in the 1980s and 1990s.

The divergence of income per capita between Turkey and its peers took place in a period when neither one of the peer countries was a member of the European Union and some of the fiscal and monetary policy indicators such as the share of government consumption in GDP and the inflation rate were not significantly different across countries. A striking difference, however, was present in their sectoral employment shares and sectoral productivities. In 1960, the share of employment in agriculture was 76% in Turkey, 57% in Greece, 44% in Portugal, and 42% in Spain. All countries experienced a decline in the share of agriculture over time. However, the decline was much slower in Turkey compared to its peers. By 2008, the share of employment in agriculture had fallen to 24% in Turkey, 11% in Greece, 12% in Portugal, and 4% in Spain.[4] This indicates a dramatically slow de-agriculturalization of the Turkish economy relative to its peers. In addition, Turkish labor productivity, especially in the agricultural sector, was significantly lower than that of its peers. For example, average productivity growth in Turkish agriculture between 1968 and 1978 was 1.76%, while it was 6.80% in Spain. Turkey provides an interesting case to study as these differences help us isolate some of the key factors in generating differences in income per capita.

In this paper, we use a two-sector model to examine the reasons behind the low sectoral productivities, slow de-agriculturalization, and increased divergence of income per capita in Turkey relative to its peers.[5] In our framework, labor allocation between sectors is driven by the differences in sectoral productivities as well as the income effect of non-homothetic preferences. We calibrate the model to the structural transformation of Spain, the peer country with the fastest growth, between 1968-2005 and use it to understand the sectoral allocations in Turkey. We investigate if it is low productivity in agriculture or industry (or both) that is responsible for the slow de-agriculturalization and the low overall productivity in Turkey.[6] We conduct a counterfactual experiment in which we equip

the civil and penal codes. In the 1960s, GDP per capita in Turkey, Greece, Portugal, and Spain was about 20% of the U.S. GDP per capita. GDP per capita in Italy, for example, was about 40% of U.S. GDP per capita at that time.

[4]The data are from the OECD Employment and Labor Market Statistics.

[5]Our framework is similar to Adamopoulos and Akyol (2009) and our results fit well with the recent literature on models of sectoral transformation that highlights the importance of agriculture, such as Gollin, Parente, and Rogerson (2002, 2004, 2007); Restuccia, Yang, and Zhu (2008); and Lagakos and Waugh (2011).

[6]Gollin (2009) provides a detailed survey of theories related to the role of agriculture in economic growth. He summarizes some of the debate in economic history such as whether or not agricultural productivity improvements preceded the industrial revolution and whether government assistance should prioritize agricultural development or industrial development. There is still a debate on whether the structural transformation is achieved by increases in productivity in the industrial sector, which pulls employment out of the agricultural sector, or increases in productivity in the agricultural sector, which pushes employment out of agriculture to the industry (see Alvarez-Cuadrado and Poschke (2011) and the references therein).

Turkey with either the agricultural or the industrial productivity growth from Spain starting in 1968.

Our results indicate that if Turkey had inherited Spanish agricultural productivity growth from 1968 to 2005, de-agriculturalization would have been much faster and the growth rate of aggregate GDP per capita would have been much higher in Turkey. Inheriting Spanish industrial productivities, on the other hand, would not have contributed to the growth experience. Moreover, our results reveal that Turkey would not have fallen behind its peers had Turkey inherited the Spanish productivity growth in agriculture during the 1960s and 1970s. Similar results are obtained where sectoral productivity data from several other European countries are used in the counterfactual experiment.

This result is due to the fact that many of Turkey's peer countries enjoyed much higher productivity growth in agriculture as opposed to the industry in this period. While Turkish productivity growth was lagging behind its peers in both sectors, it was particularly worse in agriculture. Our results provide support for the general finding in this literature where agricultural productivity growth plays a key role in the lack of catch up in relative incomes across countries. For the case of Turkey, however, most of the recent attention has been on the role of institutions, low human capital, and flawed macroeconomic policies in hampering growth.[7] Our results may help refocus the attention to policies that have different effects across sectors and across time. We show some preliminary evidence that indirect policies such as import substitution and overvalued exchange rates that discriminated against agriculture in Turkey may have hampered the efficient use of intermediate inputs, resulting in lower agricultural productivity. A more systematic study of how agricultural policies, like those discussed in Krueger (1974), Olgun (1991) or Olgun and Kasnakoğlu (1989), among others, affect economic growth is left for future research.

The rest of the paper is organized as follows. In Section 2, we examine the growth experience of the Turkish economy. Section 3 introduces the two sector model and Section 4 provides the results. Section 5 concludes.

2 The Growth Experience of Turkey

Figure 1 shows the GDP per capita in Turkey and in a set of European countries, relative to the GDP per capita in the U.S. between 1950 and 2008. We divide the European countries into two sub groups: "Europe 1" (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom) and "Europe

[7] See, for example, Altuğ, Filiztekin, and Pamuk (2008).

2” (Greece, Portugal, and Spain).

Relative income in “Europe 1” starts at 45% of the U.S. level in 1950, reaches 66% in 1982, and then fluctuates around 60% after that. Relative income in “Europe 2” is 22% of the U.S. level in 1950 and ends at 54% in 2008. Turkish GDP per capita starts at 17% of the U.S. level in 1950 and ends at only 28% in 2008. Since per capita GDP relative to the U.S. in the second set of European countries is quite similar to that in Turkey in the 1950s, we define them as a relevant peer group for Turkey. This set of European countries catch up significantly with the U.S. after WWII compared to Turkey. In fact, the gap in GDP per capita between these countries and Turkey widens between 1960 and 1977 and then stays relatively flat. In particular, Turkish GDP per capita starts at 77% of the GDP per capita of the set of Europe 2 countries in 1950. However, it gradually declines to 50% by 1976. In 2008, the relative GDP per capita is at 52%.

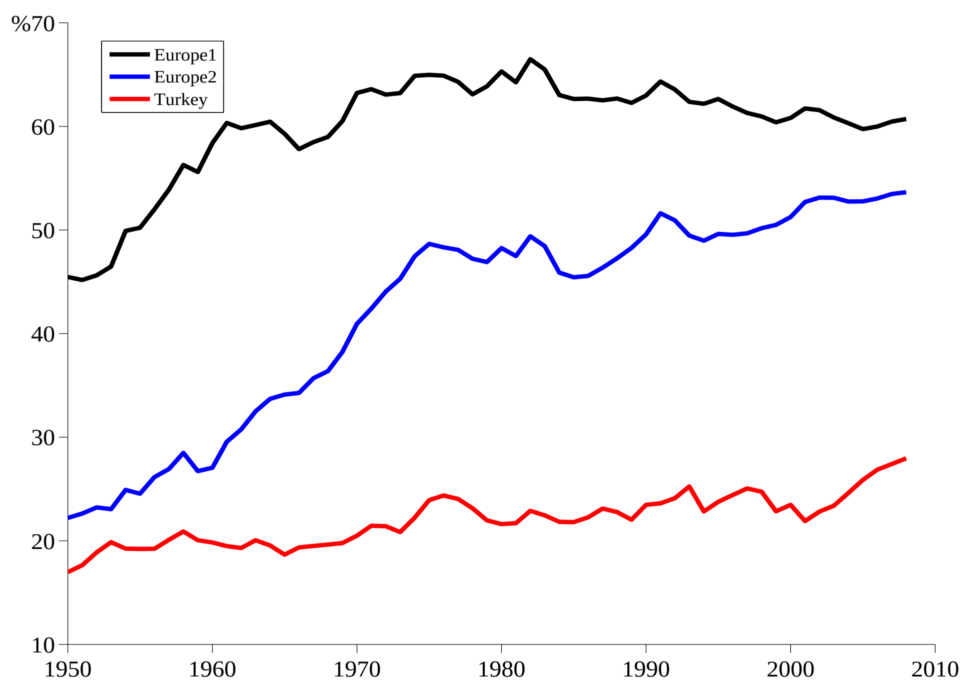

Figure 1: GDP per Capita Relative to the U.S.

Another way to examine the data is to study the performance of detrended output per working age person as in Kehoe and Prescott (2007) who argue that the 2% average trend growth experienced in the U.S. during this time period should be used in judging the relative performance of other countries.[8] We define the detrended output per working

[8]Others have argued that it may not be appropriate to use the growth rate of the U.S. as a reference

age as $y_t^d = y_t * (1.02)^{t_0 - t}$ where y_t is output per working age person at time t, t_0 is the base year, and the trend is 2%.[9] Figure 2 shows y_t^d in Greece, Portugal, Spain, and Turkey between 1960 and 2007, where the value in 1960 is normalized to 100.

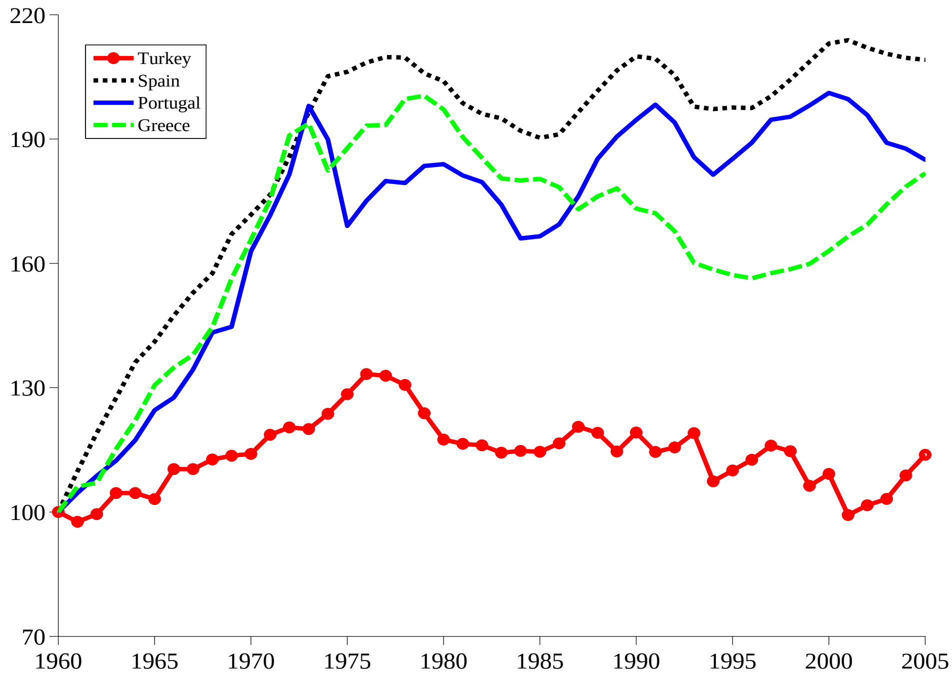

Figure 2: GDP per Working Age Person Relative to 2% Trend

Several observations stand out. First, there is a significant change in trend in Turkey as well as in Greece, Portugal, and Spain in mid-1970s. Second, both Turkey and Greece experience what can be classified as a great depression after the mid-1970s.[10] GDP per working age person declines by 26% between 1976 and 2001 in Turkey and 22% in Greece between 1979 and 1996. Both countries experience large declines in output in the first

point. For example, Ahearne, Kydland, and Wyne (2006) argue that the use of a 2% trend growth rate is probably reasonable for countries that were relatively rich at the beginning of their great depressions but not for all countries. During the period under investigation, the average growth rate of GDP per working age population in all four countries was above 2%. Consequently, we use the 2% growth as the benchmark to judge their growth experiences.

[9] Working age population data come from the OECD Employment and Labor Market Statistics. Consistent data is available starting in 1960.

[10] Kehoe and Prescott (2007) propose three criteria for classifying a cyclical episode as a great depression: a) the downturn must be sufficiently severe, b) the decline must be rapid, and c) the reversal must be slow. Kehoe and Prescott (2007) adopt a working definition of severity as a decline of at least 20% below trend and of rapidity as a decline of at least 15% below trend within the first decade of the episode. While this episode is not consistent with the third criteria used by Kehoe and Prescott (2007), it clearly presents a severe slowdown of the Turkish economy. See also Çiçek and Elgin (2011).

decade of the episode. Turkey loses 14% of its output between 1976 and 1985; Greece loses 16% of its output between 1979 and 1992. Their experiences satisfy two of the three criteria proposed by Kehoe and Prescott (2007) for classifying a cyclical episode as a great depression. Spain and Portugal also experience significant declines in their growth rates. However, they recover much faster compared to Greece and Turkey. Finally, until the 1970s, growth in Greece, Portugal, and Spain is much stronger than that in Turkey, resulting in a widening income gap between Turkey and its peers.

We point to two observations based on these comparisons. First, examining the growth in Turkish GDP per working age person in isolation reveals the 1976-2001 period as a period of significant stagnation. While this observation is correct, its peers experienced significant declines in their growth rates in the same period as well. Second, if one is interested in examining the lack of catch-up in the Turkish economy, the 1960-1976 period deserves special attention. This is a period, known as the 'Golden Age' of growth when income per capita in some Western European countries more than tripled.[11] Turkey, although not being directly affected by the devastation of World War II, showed high growth rates until the late 1970s. Indeed, some stated that, until the debt crisis in the late 1970s, Turkey enjoyed high growth rates by following a state-led import-substitution strategy in the 1960s and 70s (see, for example, Çeçen, Doğruel, and Doğruel (1994), and Günçavdı, Bleaney, and McKay (1999)). Our analysis, however, identifies this period as the period where Turkey falls behind its peers. In order to understand the factors that are responsible for these observations, we proceed with a two-sector model in the next section.

3 A Two-Sector Model

There has been a recent growing interest in multi-sector general equilibrium models to understand the sources of the structural transformation of production and to quantify the impact of the shift in resources across the sectors on aggregate growth and productivity. These studies utilize two (agriculture and non-agriculture) or three (agriculture, industry, and services) sector models and rely on two types of forces to generate the structural transformation observed in the data. The first type of models, such as Baumol (1967) and Ngai and Pissarides (2007) view the structural transformation as a supply-side phenomenon based on the sectoral differences in productivity growth. The second type of models views the structural transformation as a demand-side phenomenon based on the sectoral differences in income elasticities of demand (see, for example, Kongsamut, Re-

[11]See, for example, Temin (2002), and Alvarez-Cuadrado and Pintea (2009).

belo, and Xie 2001). There are also some models, known as hybrid models, that combine two types of channels (see, for example, Duarte and Restuccia 2010 and Rogerson 2008).[12]

We study a two-sector closed economy model to understand the role of domestic sectoral productivity changes on the structural transformation of Turkey combined with the Engel's law of demand.[13]

3.1 Technology

At each date t, there are two sectors, agriculture (A) and industry (I). The industrial sector, in this section, is more properly thought of as the non-agricultural sector. It incorporates both services and manufacturing.[14] The production function for sector *j*=*A*,*I* is given by:

$$Y_{j,t} = \theta_{j,t} N_{j,t}, \tag{1}$$

where $Y_{j,t}$ is the output of sector *j*, $N_{j,t}$ is labor allocated to production, and $\theta_{j,t}$ is sector *j*'s labor productivity at date t. We assume that labor is fully mobile across sectors and the wage rate in the economy is given by:

$$\omega_t = \theta_{j,t} p_{j,t}, \tag{2}$$

where $p_{j,t}$ is the price of good-*j* and ω_t is the wage-rate in the economy at date t. Given the absence of any distortions, relative prices reflect relative productivities in this economy, i.e., $p_{I,t}/p_{A,t} = \theta_{A,t}/\theta_{I,t}$. Since we abstract from capital and fixed factors in production, differences in labor productivity implicitly incorporate differences due to capital as well as due to technology adoption, regulation, etc. across sectors.

3.2 Household's Problem

The economy is populated by an infinitely-lived representative household. Population is constant and normalized to one. Preferences are described by a period utility function

[12] See also Acemoğlu and Guerrieri (2008), Alvarez-Cuadrado and Poschke (2011), Buera and Kaboski (2009), Echevarria (1995, 1997), and Gollin, Parente, and Rogerson (2002, 2004, 2007) and the references therein for recent studies of structural transformation.

[13] Closed economy abstraction is quite reasonable especially until the 1980s where Turkey followed an import substitution policy. The average ratio of imports to GNP between 1960 and 1977 is 7%. After the 1980s, there is a significant and consistent increase in the share of imports in GNP, with an average of 19.5% between 1977 and 2006.

[14] Our findings extend to a three-sector model for Turkey that separately examines agriculture, manufacturing, and services.

given by:

$$U(C_t) = \log(C_t). \tag{3}$$

C_t is a composite consumption good derived from the agricultural, A_t, and non-agricultural consumption, I_t, via a CES aggregator.

$$C_t = (\gamma_A^{1/\eta}(A_t - \bar{A})^{(\eta-1)/\eta} + \gamma_I^{1/\eta} I_t^{(\eta-1)/\eta})^{\eta/(\eta-1)}.$$

The parameter $\bar{A}$ represents the subsistence level of agricultural good consumption and satisfies at each date t

$$\theta_{A,t} > \bar{A} > 0. \tag{4}$$

The first inequality states that the economy's agricultural sector is productive enough to provide the subsistence level of food to all households (see Matsuyama 1992). The second inequality implies that preferences are non-homothetic and the income elasticity of demand for the agricultural good is less than unity. It is also assumed that the representative household has enough income to purchase more than $\bar{A}$ units of agricultural good. The weight γ_j influences how consumption expenditure is allocated between the two sectors, with $\gamma_A, \gamma_I > 0$, and $\gamma_A + \gamma_I = 1$.

The parameter $\eta > 0$ is the (constant) elasticity of substitution between agricultural and industrial goods and it underlies the magnitudes of price responses to quantity adjustments. A lower substitution elasticity implies that sharper price changes are needed to accommodate a given change in quantities consumed. If η approaches 1, preferences over the two goods approach a Cobb-Douglas so that the substitution effect vanishes regardless of the magnitude of the differences between sectoral productivities.

We assume that the household is endowed with one unit of productive time in each period that it supplies inelastically to the market. At each date, the household chooses consumption of each good to maximize its lifetime utility subject to the budget constraint:

$$p_{A,t}A_t + p_{I,t}I_t = 1, \tag{5}$$

taking prices as given. The demand for labor must equal the exogenous labor supply at every date:

$$N_{A,t} + N_{I,t} = 1. \tag{6}$$

Since there is no international trade or capital accumulation, the following conditions hold at each date, implying that the market must clear for each good produced:

$$A_t = Y_{A,t}, \quad I_t = Y_{I,t}. \tag{7}$$

3.3 Equilibrium

A competitive equilibrium consists of consumption decisions $\{A_t, I_t\}$ of the households, factor allocations $\{N_{A,t}, N_{I,t}\}$, sectoral output decisions $\{Y_{A,t}, Y_{I,t}\}$ of the firm, and prices $\{p_{A,t}, p_{I,t}\}$ such that given prices, the firm's allocations solve its profit maximization problem, the household's allocations solve the household's utility maximization problem, and all product and factor markets clear.

The equilibrium employment share in agriculture is given by:

$$N_{A,t} = \left(\frac{\gamma_A \theta_{A,t}^{\eta-1}}{\gamma_A \theta_{A,t}^{\eta-1} + \gamma_I \theta_{I,t}^{\eta-1}} \right) + \left(\frac{\gamma_I \theta_{I,t}^{\eta-1}}{\gamma_A \theta_{A,t}^{\eta-1} + \gamma_I \theta_{I,t}^{\eta-1}} \right) \frac{\bar{A}}{\theta_{A,t}}. \tag{8}$$

The equilibrium employment share in the industrial sector is given by:

$$N_{I,t} = 1 - N_{A,t}. \tag{9}$$

3.4 Calibration

We calibrate the model economy to Spain between 1968 and 2005. We use sectoral value added (measured in constant prices in Euros) and employment data for Spain for agriculture and non-agriculture.[15] All time series are de-trended using the Hodrick-Prescott filter with a smoothing parameter of 6.25 for annual data before any ratios are computed.[16] We normalize productivity levels across sectors to one for the initial year. We use data on sectoral labor productivity growth rates to obtain the time paths of sectoral productivities for the sample period.

Next, we set γ_A and η to match the long run share of employment in agriculture in Spain and examine two cases: $\gamma_A = 0.04$ and $\eta = 0.5$ so that the goods are complements, and $\gamma_A = 0.01$ and $\eta = 1.5$ so that the goods are substitutes. Since η determines the amount of substitution among different goods, this parameter determines how much labor will be

[15]The source for Spanish sectoral data we use in this section is the Groningen Growth and Development Centre (GGDC) 10-sector database, which is available at http://www.ggdc.net/dseries/10-sector.html. Timmer and de Vries (2007) provide a detailed discussion of the construction of the employment and value added series on a country-by-country basis.

[16]We follow Ravn and Uhlig (2002) for choosing 6.25 as a smoothing parameter.

reallocated to the non-agricultural sectors in response to uneven changes in productivity growth.

The subsistence level in agriculture $\bar{A}$ is calibrated so that the equilibrium of the model matches the share of employment in agriculture for the initial year in Spain:

$$\bar{A} = (N_{A,1968} - \gamma_A)/(1 - \gamma_A). \tag{10}$$

After calibrating the model economy for Spain, we produce sectoral labor productivity series for Turkey between 1968 and 2005. We follow the Duarte and Restuccia (2010) method and calibrate the initial year productivity series for both sectors in Turkey using the calibrated model economy for Spain as follows. We choose the two labor productivity levels $\theta_{A,1968}$ and $\theta_{I,1968}$ to match two targets in the first year in Turkey: (1) the share of employment in agriculture (the model also matches the share of non-agriculture by the labor market clearing condition) and (2) aggregate labor productivity relative to that of Spain.[17]

As argued in Duarte and Restuccia (2010), the lack of PPP-adjusted sectoral output data across countries is one of the reasons for this approach. This strategy results in productivities in agriculture and non-agriculture in Turkey to be around 45 and 65%, respectively, of Spanish productivities in 1968. The levels of sectoral labor productivity implied by the model for the first year together with data on growth rates of sectoral value added per worker in local currency (Turkish lira) units imply time paths for sectoral labor productivity in Turkey between 1968 and 2005.[18]

4 Results

We start this section by discussing our key findings. Next, we examine the properties of our model economy in more detail and conduct several sensitivity analyses.

[17] We use the Conference Board, Total Economy Database to get the aggregate labor productivity relative to Turkey and Spain in 1968. We use the series of *labor productivity per person engaged in 1990 US$ (converted at Geary Khamis PPPs)*. The implied aggregate productivity ratio between Turkey and Spain in 1968 was 0.5261.

[18] We use GDP by kind of economic activity in 1987 prices and employment by kind of economic activity to derive labor productivity (value added per worker) series for the Turkish economy between 1968 and 2005. Turkish data are from the Turkish Statistical Institute, http://www.tuik.gov.tr, and the OECD Employment and Labor Market Statistics.

4.1 Key Findings

In Figure 3, we display the agricultural and non-agricultural employment shares that are generated by the model economy against their data counterparts in Turkey. Two observations stand out. First, the model captures the secular decline in the share of employment in agriculture reasonably well. Second, η plays a quantitatively insignificant role on the share of employment in each sector. The results with $\eta = 0.5$ and $\eta = 1.5$ are very similar. This finding indicates that labor allocation is mainly determined by increases in productivity in the agricultural sector during this time period in Turkey.

We use this framework to investigate the role of productivity growth in agriculture versus non-agriculture in impacting the speed of de-agriculturalization in Turkey. We ask what would have happened to the share of employment in the two sectors and the overall GDP per worker if Turkey had inherited Spanish productivities starting in 1968. More importantly, we are interested in finding out if inheriting sectoral productivities in both sectors or in one of them in particular would have put the Turkish economy in a significantly different growth path. In the following counterfactual experiment, we allow Turkey to inherit productivity levels from Spain starting in 1968 in each sector one at a time.

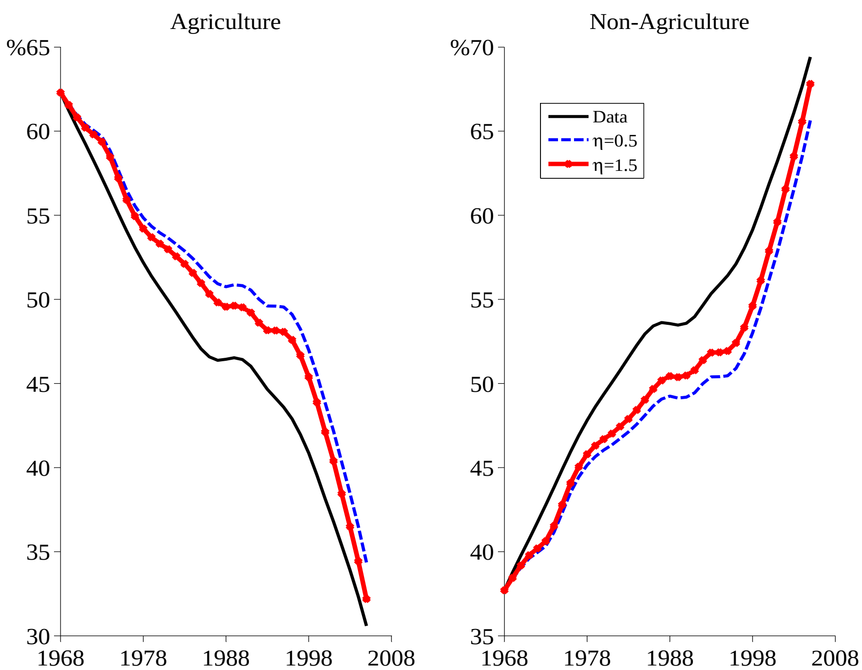

Figure 3: Benchmark

Figure 4 shows the share of employment in agriculture and the GDP per worker that is obtained under the first counterfactual experiment where we only use the agricultural productivity growth from Spain and keep the non-agricultural productivity growth as it is in the benchmark. Compared to the benchmark results, this counterfactual experiment generates a much faster de-agriculturalization and a higher growth in overall productivity. By 2005, the share of employment in agriculture falls to around 10% and aggregate labor productivity is about three times its 1968 level.

A more interesting point emerges, however, when we compare the results from this counterfactual experiment with those from using sectoral productivities for both sectors from Spain. Comparing the series labeled "Counterfactual A only" to the series "Counterfactual A&I" where both productivities are taken from the Spanish data in Figure 5 reveals the importance of the agricultural sector in driving the results. In particular, the fast decline in the share of employment in agriculture and the high growth in aggregate labor productivity are accomplished by feeding in the agricultural productivities alone.

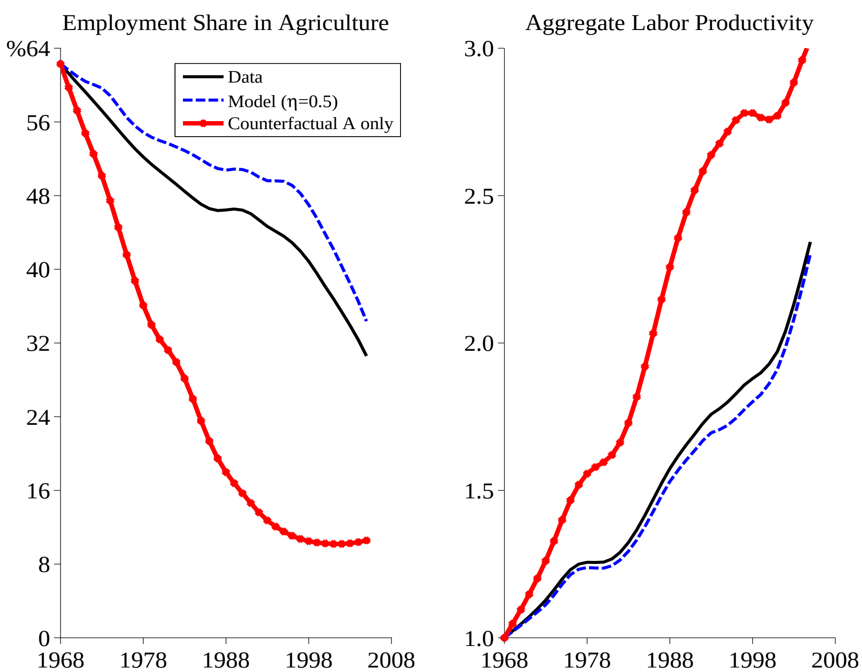

Figure 4: Role of Agriculture

In the first panel of Figure 5, the employment share in agriculture implied by both counterfactual experiments coincide. This is due to the fact that, first, differences in growth rates in the industrial sector between Turkey and Spain are not very large, and second, their impact in equation (8) is small. The period from 1968 to the late 1970s, when

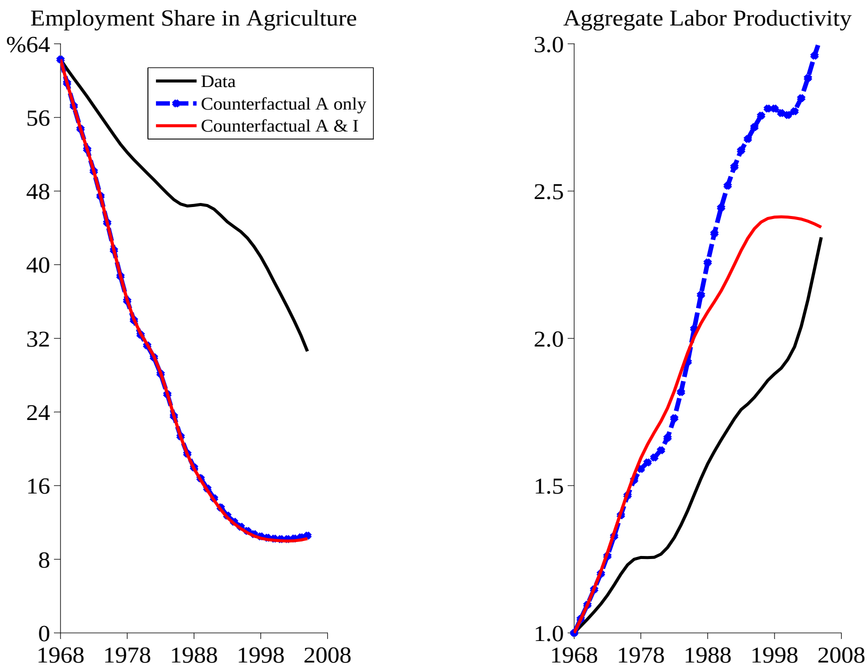

Figure 5: Role of Agriculture versus Non-agriculture

Turkey was falling behind its peers, displays significantly higher growth in labor productivity that comes entirely from productivity growth in the agricultural sector. These results are nearly identical for the $\eta = 1.5$ case.

4.2 An Extension

In this extension, we investigate one channel through which productivity in general and agricultural productivity in particular might have been adversely affected in Turkey. Between 1960 and 1980, import substitution was the official development strategy in Turkey. Under this regime, most agricultural products could only be imported by state economic enterprises. Moreover, only these enterprises could import agricultural inputs such as fertilizer and pesticides, often at an overvalued exchange rate. Krueger (1974) studies the growth effects of this regime in Turkey in the 1960s. Focusing on the income gap between Turkey and its European neighbors, Krueger (1974) conducts several counterfactual experiments to investigate the growth rate that could have been achieved under alternative policies instead of the quantitative-restriction and the import-substitution regime that was present in Turkey. Her econometric analysis suggests that "alternative strategies could have resulted in significant increases in the rate of growth of manufacturing output and value-added at both Turkish and international prices, reduced import requirements for both new investment and for intermediate goods, a reduced incremental capital-output ratio, and greatly increased employment opportunities for the same level of investment." (Krueger 1974, Chapter 9).

Krueger, Schiff, and Valdes (1988) utilize a measure called the relative rate of assistance (RRA) to quantify the impact of sector-specific and economy wide policies on agricultural incentives. Anderson and Valenzuela (2008) provide data on estimates of (RRA) for 75 countries from 1955 to 2008.[19] These estimates attempt to capture the entire array of governmental policies that affect agricultural incomes relative to what they would be in the presence of a free market system. Policies considered include direct interventions to agricultural prices (price setting by the government, subsidies to inputs, policies affecting the costs of transportation and marketing). Indirect interventions are the ones that affect the prices of agricultural tradables relative to non-tradables through their impact on the real exchange rate or to other tradables as a result of industrial protection or import substitution policies. These policies affect production incentives by making agriculture more or less attractive than other sectors of the economy. Using this data set, Dennis and İşcan (2011) find that the rate of structural change and productivity growth in agriculture have been very slow in countries that discriminated against their agricultural sector.

Krueger, Schiff, and Valdes (1988) show that government policies regarding agriculture have adversely affected agricultural incentives in developing countries where the bulk of the discrimination was due to indirect price interventions. Among the eighteen developing countries examined, indirect taxation and tax due to industrial protection were highest in Turkey. The average reduction in farm prices relative to nonfarm prices because of the indirect interventions was 37% in Turkey while direct policies were subsidizing agriculture at a rate of 5.3% between 1961 and 1983.[20]

Figure 6 provides data on the relative rate of assistance to agriculture for Spain, Portugal, and Turkey obtained from Anderson and Valenzuela (2008). Turkey exhibits high but declining levels of discrimination against agriculture until the 1990s while the rest of the countries exhibit varying degrees of protection to agriculture.

One way to incorporate the measure of RRA into the two sector growth model of the previous section is to assume that low output prices discourage the application of intermediate inputs that are needed for the production of the agricultural good. This is a simplification of the impact of RRA where inefficiencies created by subsidizing one

[19] RRA is defined as $\frac{1+NR_{ag}}{1+NR_{non-ag}} - 1$ where NR_{ag} is the nominal rate of assistance to agriculture and NR_{non-ag} is the nominal rate of assistance to non-agriculture. There is no data for Greece.

[20] Krueger (1992) argues that in Turkey, agricultural producers associations were influential in affecting direct interventions but were virtually voiceless in affecting trade and exchange rate policies.

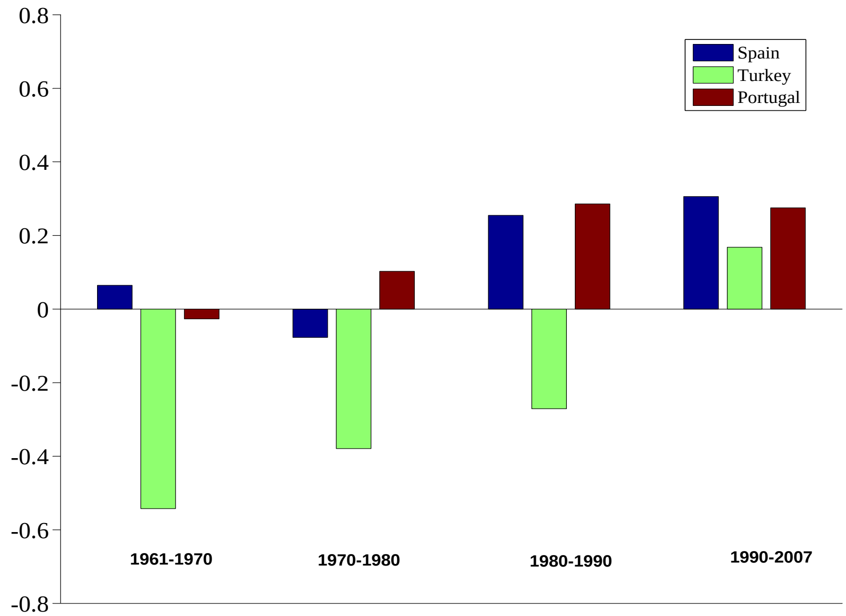

Figure 6: Relative Distortion

good versus the other are much more complicated. Nevertheless, we proceed with this interpretation to see the potential quantitative impact of this measure on agricultural productivity in Turkey. We use a version of the model in Restuccia, Yang, and Zhu (2008) that incorporates the impact of distortions to intermediate goods on agricultural productivity.

In particular, we make one change in the previous model and assume a different production function in the agricultural sector given by:

$$Y_{A,t} = X_t^{\alpha}(\theta_{A,t}N_{A,t})^{1-\alpha}, \tag{11}$$

where X_t is the intermediate input used in the production of the agricultural good $Y_{A,t}$ and α is the intermediate-input elasticity of output in agriculture. This intermediate input may consist of chemical fertilizers, pesticides, hybrid seeds, fuel, energy, and other purchased factors. Restuccia, Yang, and Zhu (2008) introduce a distortion that requires one unit of non-agricultural output to produce $1/\pi_t$ units of X_t. Therefore, a low value of π_t implies high efficiency of producing the input. With this formulation in competitive factor and output markets, π_t is the price of intermediate inputs relative to non-agricultural goods.

In this setup, the representative farmer maximizes profits by choosing labor inputs and the use of the intermediate input:

$$max \quad p_{A,t}X_t^{\alpha}(\theta_{A,t}N_{A,t})^{1-\alpha} - \pi_t X_t - \omega_t N_{A,t}, \tag{12}$$

where $p_{A,t}$ is the price of agricultural goods relative to non-agricultural goods; thus, the price of non-agricultural goods is treated as the numeraire. The solution to this problem yields the following first-order conditions:

$$\frac{X_t}{Y_{A,t}} = \frac{\alpha p_{A,t}}{\pi_t}, \tag{13}$$

and

$$p_{A,t}(1-\alpha)\frac{Y_{A,t}}{N_{A,t}} = \omega_t = \theta_{I,t}. \tag{14}$$

The intensity of using intermediate inputs is determined by the elasticity of output to intermediate inputs, α, and by the price of the agricultural good relative to the cost of intermediate inputs. We only consider direct barriers in the market for intermediate inputs X_t that increase π_t, the resource cost of converting non-agricultural output into X_t. A high value of π_t represents a high level of direct barriers confronting farmers in using the technical input.[21] The production function in the non-agricultural sector and the utility function are the same as in the previous section.

To examine changes in productivity over time in Turkey, we focus on four key variables of the competitive equilibrium: the intermediate input ratio $X_t/Y_{A,t}$, the share of employment in agriculture $N_{A,t}$, labor productivity in agriculture $Y_{A,t}/N_{A,t}$, and aggregate labor productivity Y_t. The agricultural production function yields the following decomposition of agricultural final output per worker:

$$\frac{Y_{A,t}}{N_{A,t}} = \theta_{A,t}\left(\frac{X_t}{Y_{A,t}}\right)^{\alpha/(1-\alpha)}. \tag{15}$$

Labor productivity in agriculture depends positively on the intensity of technical input use $X_t/Y_{A,t}$. We can get the following expressions performing simple algebraic manipulations:

$$\frac{X_t}{Y_{A,t}} = \left[\frac{\alpha}{\pi_t(1-\alpha)}\frac{\theta_{I,t}}{\theta_{A,t}}\right]^{1-\alpha}, \tag{16}$$

[21] Restuccia, Yang, and Zhu (2008) also consider labor market distortions that increase the cost of reallocating labor from agriculture to non-agriculture.

and

$$\frac{Y_{A,t}}{N_{A,t}} = \theta_{I,t}^{\alpha}\theta_{A,t}^{1-\alpha}\left[\frac{\alpha}{\pi_t(1-\alpha)}\right]^{\alpha}. \tag{17}$$

The consumption allocation equations of the representative household imply:

$$A_t = \bar{A} + \frac{\gamma_A}{\gamma_I}p_{A,t}^{-\eta}I_t. \tag{18}$$

Substituting the market-clearing conditions for A_t and I_t into the above equation, we obtain:

$$Y_{A,t} = \bar{A} + \frac{\gamma_A}{\gamma_I}p_{A,t}^{-\eta}(Y_{I,t} - \pi_t X_t). \tag{19}$$

Notice that $\pi_t X_t = (\alpha/(1-\alpha))\theta_{I,t}N_{A,t}$. Now, we can derive the following equation for the share of employment in agriculture.

$$N_{A,t} = \frac{\bar{A} + \frac{\gamma_A}{\gamma_I}\left(\frac{Y_{A,t}}{N_{A,t}}\right)^{\eta}\left(\frac{1-\alpha}{\theta_{I,t}}\right)^{\eta}\theta_{I,t}}{\left(\frac{\alpha\theta_{I,t}}{\pi_t(1-\alpha)}\right)^{\alpha}(\theta_{A,t})^{1-\alpha} + \frac{\gamma_A}{\gamma_I}\left(\frac{Y_{A,t}}{N_{A,t}}\right)^{\eta}\left(\frac{1-\alpha}{\theta_{I,t}}\right)^{\eta-1}}. \tag{20}$$

If the benchmark economy for Turkey incorporates distortions, then it must be the case that the observed labor productivity, $Y_{A,t}/N_{A,t}$, is a result of an unobserved $\theta_{A,t}$ and exogenously taken π_t. We solve equation (17) for $\theta_{A,t}$ that, together with π_t, results in the observed $Y_{A,t}/N_{A,t}$. Other than this modification, we follow the procedure outlined in the previous calibration exercise to conduct this counterfactual experiment where $\eta = 0.5$, $\gamma_A = 0.04$, and $\alpha = 0.5$. We solve equation (20) for the employment share in agriculture.

4.2.1 Results

In this section, we assume that Spain has no distortions in the use of intermediate inputs ($\pi_t = 1$), while π_t in Turkey is set to 1.36 between 1968 and 1980, 1.25 until 1990, and 1.0 afterwards. These numbers reflect the period averages of relative distortions capturing the existence of significant but declining distortions on the use of intermediate inputs in the Turkish economy as shown in Figure 6. While the π_t used to capture the distortions, the purpose of this section is to examine the quantitative implication of a distortion on the economy that mainly affects the use of intermediate inputs. We interpret the size of RRA to reflect the potential distortions faced in the agricultural sector.

In this experiment, we are interested in measuring the quantitative impact of the distortions in the use of intermediate inputs on the share of labor in agriculture and productivity in agriculture in Turkey. The first panel in Figure 7 presents the share of employment in agriculture with and without distortions.

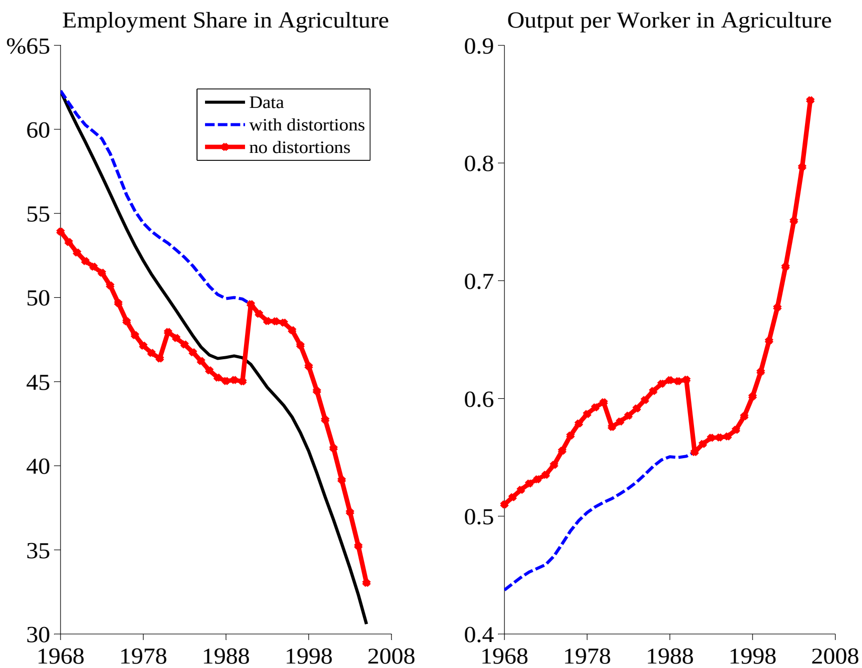

Figure 7: Role of Distortions

The economy is calibrated to start from an employment share of 62% with the distortions since now the benchmark economy has distortions. Setting $\pi = 1$ as a counterfactual experiment where distortions are eliminated results in a starting employment share of 54% instead. In other words, the existence of a 36% distortion on the use of intermediate inputs results in a 16% higher share of employment and 14% lower productivity in agriculture.[22]

This is a stylized experiment that does not model all the complicated features of the agricultural policies that were followed in Turkey. However, it demonstrates that policies that discriminated against agriculture indirectly can have important quantitative effects. A more detailed study of these polices is left for future research.

[22]This framework generates the same results for the counterfactual experiment conducted earlier where the lack of productivity in the agricultural sector is shown to be the major determinant of the divergence in income per capita between Turkey and its peers.

5 Conclusions

This paper examines the growth experience of Turkey through the lens of a multi-sectoral model. We devote special attention to comparing the Turkish experience to that in countries we identify as its peers: Greece, Portugal, and Spain. We abstract from many historical, institutional, and economic differences between these countries. For example, there are at least three military coups in Turkey (1960, 1971, and 1980), several financial crises (1973-1974, 1994, 1999, and 2001), and periods of very high inflation rates (1978-2003). Meanwhile, Greece has a military junta between 1967 and 1974, Portugal a military coup in 1974 and its first free elections in 1975, while Spain ends the Franco regime in 1975. Greece joins the European Union in 1981, while Spain and Portugal in 1986. While these facts as well as many others may have a bearing on the growth experience of countries, we rely on growth accounting to guide us in a certain direction.

We conclude that the period during 1960s and early 1970s where Turkey falls behind its peers deserves special attention if we are interested in understanding the lack of convergence of the Turkish economy. This is a period where Turkish GDP per working age person grows in excess of 3%. However, the growth rate of its peers is significantly higher, 5% to 6%. Using a two-sector model, we show that low agricultural productivity in Turkey accounts for the increased income gap between Turkey and Spain in the 1960s and 1970s. Our results indicate that if Turkey could have experienced the Spanish productivity growth in agriculture, the share of employment in agriculture would have declined much more rapidly and the overall per capita GDP would have increased more dramatically. We argue that policies that discriminated against agriculture deserve special attention for understanding the lack of convergence in the Turkish economy.

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