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Abstract

When examined in isolation, the 2002-2007 period in Turkey stands out as a high growth period. However, the relative performance of Turkey in this period is weaker compared to China. The service sector in Turkey had the lowest labor productivity growth rate. Counterfactual experiments based on a three-sector model point out that the service sector represented a drag on aggregate productivity in Turkey. Using a newly constructed detailed sectoral database for China, I argue that if the service sector in Turkey had had the same annual productivity growth rates as observed in China, then the average annual growth rate of the aggregate labor productivity would have been 7.8% instead of 5.7% during 2002-2007.

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The key implication of the structural transformation imperative from a policy perspective is that while the composition of output may be of second-order importance in a rich country, it is of first-order importance for economic performance and economic growth in a developing country. It is crucial for developing countries to achieve the right mix of economic activities.

— Dani Rodrik (2012, p. 160)

1 Introduction

The rising importance of emerging market economies in global economic affairs is one of the central topics of the current research in international macroeconomics (see, for example, Kose and Prasad, 2010). Over the past two-three decades, the global economy has been reshaped by the rise of the emerging markets, most notably China. Economic reforms, which started in 1978, have driven a rapid transition of the economy from a central planning system toward a market-oriented system integrating with the world economy. The Chinese economy, today the second largest in the world, has maintained high and steady growth rates for over two decades (see, for example, Brandt and Rawski, 2008). Lately, Turkey has grabbed the attention of international economics as the country has shown very high growth rates in recent years. Turkey is an upper middle income country with a population of around 75 million and a GDP of around US$0.8 trillion, making it the 18th largest economy in the world as of 2011. In addition, Turkey's economy was the fastest growing in Europe in 2011, growing 8.5% (the second fastest after China among major emerging market economies).[1] It is the Government's stated intention that Turkey becomes one of the world's ten largest economies by 2023, the 100th anniversary of the founding of the Turkish Republic.

Panel (a) in Figure 1 shows GDP per capita and labor productivity (measured as GDP per person employed) in Turkey relative to the United States during 1960-2010.[2] GDP per capita in Turkey increases from about 19% of the U.S. level in 1960 to about 23% in 1976. Turkey experiences a relative deterioration starting with 1977 on as the GDP per capita shrinks to 19.8% of the U.S. level in 2001. Then, there is an upward trend since 2002 and GDP per capita in Turkey relative to the United States increases from 20.5% in 2002 to 24.3% in 2007. Moreover, labor productivity in Turkey increases from about 31% of the U.S. level in 2002 to about 42% in 2007. This makes Turkey ranked second (after China) in average annual growth rate of labor productivity during 2002-2007 among the BRICs and the MISTs economies.[3]

Panel (b) in Figure 1 depicts labor productivity (based on constant local currency) in Turkey between 1988 and 2010.[4] During the period 1988-2001, real GDP per person em-

[1] `http://www.cnbc.com/id/100390252/Can_Turkey_Become_039the_China_of_Europe039`

[2] Data are from the Conference Board Total Economy Database (January 2013). The level estimates are converted at purchasing power parity to adjust for differences in relative price levels between countries.

[3] Data are from the Conference Board Total Economy Database (January 2013). The acronym BRIC stands for Brazil, Russia, India and China, the four emerging markets some believed would become a dominant part of the world economy in the years ahead. The term MIST has been coined to describe the next tier of large emerging economies - Mexico, Indonesia, South Korea and Turkey. See, for example, reports of Goldman Sachs: `http://www2.goldmansachs.com/ideas/brics/index.html`.

[4] Data are from Saygılı and Cihan (2011).

ployed grew at 1.5% per year. The Turkish economy used to experience boom-and-bust cycles throughout the 1990s. The economic crisis in 2001 was the low point of this period, when the economy contracted more than 5%. Since 2001, Turkey has put in place a structural reform agenda, coupled with sound monetary and fiscal policies, to establish macroeconomic and financial stability and to improve the business environment (OECD, 2006). During the period 2002-2007, real GDP per person employed grew more than 5% per year.

Observed high growth rates in aggregate labor productivity are linked to the structural transformation of the economies, broadly described as changes in the allocation of factors of production across sectors. Table 1 reports the sectoral allocation of output and employment in China and in Turkey. Panel (a) in Table 1 shows the distributions of output in both China and Turkey measured in value-added terms (all measured in current local currency) in 2002, 2005, and 2007.[5] The share of output in agriculture (which also includes forestry, hunting and fishing) appear quite similar for China and Turkey. The share of value-added in industry (manufacturing, mining, construction, and utilities) is higher in China than it is in Turkey and the share of value-added in services is higher in Turkey than it is in China during 2002-2007.

Panel (b) in Table 1 shows the distributions of employment by sector.[6] From 2002 to 2007, the share of employment in agriculture in China fell from 50.1% to 41.7%, the share of employment in industry increased from 21.8% to 26.0%, and the share of employment in services increased from 28.1% to 32.3%. The share of employment in industry in Turkey and in China are very close in 2007. The share of employment in agriculture is higher in China than it is in Turkey and the share of employment in services is higher in Turkey than it is in China during 2002-2007. In Turkey, the share of services in employment has been increasing at a rapid rate, much greater than the corresponding growth rate witnessed by the service sector in the employment of China. The service sector accounts for about about 50% of total employment in Turkey in 2007.

Figure 2 shows the time paths of labor productivity (measured as output per worker) (2002=1) in Turkey and in China during 2002-2007.[7] Sectoral data (employment and output in constant prices) for Turkey are from Üngör (2011a) and sectoral data for China are from de Vries et al. (2012).[8] The annualized growth rates in labor productivity between 2002 and 2007 are 4.84%, 5.38%, and 3.65% for agriculture, industry and services, respectively in Turkey. When examined in isolation, the 2002-2007 period in Turkey stands out as a high growth period. However, the relative performance of Turkey in this period is weaker compared to China. Panel (b) in Figure 2 shows that all of the three sectors had expe-

[5]Data for Turkey are from Üngör (2011a). I use the China Statistical Yearbook (2012, Table 2-1) for China. I also compare these Chinese data with those from the World Development Indicators (2013) and observe that they coincide.

[6]Data for Turkey are from Üngör (2011a). I use de Vries et al. (2012) for China and compare these data with those from the China Statistical Yearbook (2012, Table 4-3). The calculated sectoral employment shares for China are very similar in these two sources.

[7]I use constant prices in local currency to derive the growth rates of labor productivity in each country since the focus of the paper is on the sectoral productivity growth rates. Therefore, the levels are not directly comparable since they do not reflect the purchasing power parity adjustments.

[8]Based on a critical assessment of the reliability and consistency of various primary data sources, de Vries et al. (2012) bring together a new database that provides value added and employment at a detailed 35-sector level for the BRIC countries.

rienced rapid labor productivity growth rates in China and the corresponding figures are 7.47%, 9.50%, and 7.75% for agriculture, industry and services, respectively. One striking observation from Figure 2 is that the service sector in Turkey had the lowest labor productivity growth rate during 2002-2007. This is important since, whether measured in terms of employment or value added, the service sector by far dominates the structure of the Turkish economy (Table 1). These observations raise the following questions: Did the rising importance of the service sector decelerate overall productivity improvement of Turkey during 2002-2007? What would have happened to the overall productivity if Turkey had shown the Chinese sectoral labor productivity growth rates?

This paper tries to answer such questions with a quantitative analysis of a three-sector general equilibrium model in the spirit of Rogerson (2008), Duarte and Restuccia (2007, 2010), Üngör (2011b), and İmrohoroğlu et al. (2012). At the center of this analysis is the view that along the development process there are heterogeneity among different sectors and I contend that the process of structural change is endogenous to sectoral productivity performance and formulate, accordingly, a three-sector general equilibrium model that accommodates this. I discuss how accurately the model predicts the process of structural transformation in Turkey during 2002-2007. A series of counterfactuals are then performed to quantify the role of sectoral labor productivity growth in the process of structural transformation and their combined effects on the aggregate productivity performance of Turkey. In linking the process of sectoral changes with the evolution of aggregate productivity, this paper is closely related to Duarte and Restuccia (2007, 2010), Gollin et al. (2007) and the references therein.[9]

The model is a static closed economy model with no asset accumulation. The idea is to assess the relevance of sectoral labor productivity growth rates in driving labor reallocation across sectors and aggregate productivity. The model generated employment shares seem to capture the movements in the Turkish data very well. Then, I use the model to assess the quantitative role of sectoral labor productivity growth rates in the behavior of aggregate labor productivity in Turkey. To do so, I perform a series of counterfactual experiments whereby I replace observed sectoral labor productivity growth rates in a sector with the ones observed in China. These experiments show the importance of the service sector on the possibility of higher overall output per worker during the high-growth period in Turkey. I find that if the service sector in Turkey had had the same annual productivity growth rates as observed in China, then the average annual growth rate of the aggregate labor productivity would have been 7.8% instead of 5.7% during 2002-2007. On the other hand, the experiment where the growth rates of labor productivity in agriculture and industry are set to the growth rates in these sectors in China, leaving the service sector growth rates as in the Turkish data, suggests that the average annual growth rate of the aggregate labor productivity would have been 7.6% during 2002-2007.

I also study the sectoral sources of aggregate output per worker attributing the changes in labor productivity to two processes: productivity growth within individual sectors and the reallocation of labor across sectors. I conduct a shift-share analysis and find that productivity growth within the nine sectors of the total economy explains 68.0% of the aggregate labor productivity growth in Turkey during 2002-2007. Structural change explains the remaining

[9]For a recent survey of this literature, see Herrendorf et al. (2013).

32%. This finding is consistent with the observations of Timmer and de Vries (2009) that growth accelerations are mostly explained by productivity increases within sectors. Among the individual sectors, manufacturing contributes most (30.6% in total) to the labor productivity growth during 2002-2007. Market services (as a whole) contribute 56.5% to the aggregate labor productivity, while the contribution of non-market services to growth in labor productivity is very small (1.4% in total). Finance, insurance, real estate and business services and non-market services suffer from low productivity growth, increasing output prices and growing shares in employment.

The findings of this paper point out that the service sector represented a drag on aggregate productivity in Turkey between 2002 and 2007. The services employment share continues to increase in Turkey implying that the aggregate labor productivity is determined by the productivity of the service sector in the long run. As services make up an increasing share of the Turkish economy, a decline in aggregate productivity growth would be inevitable. This finding is important considering the recent discussion of growth-enhancing or growth-reducing structural change experiences of different countries. For example, McMillan and Rodrik (2011) show that since 1990 structural change has been growth-reducing in both Africa and Latin America, with the most striking changes taking place in Latin America.[10]

The results of this paper may help focus the attention to policies that have different effects across sectors and across time. For example, Duarte and Restuccia (2010) state that because services are less traded than manufacturing goods, the service sectors are less subject to competitive pressure, which may create obstacles to productivity growth.[11] This statement seems to be an important avenue for further research on Turkey considering the data from the OECD Indicators of Product Market Regulation.[12] The OECD has developed a range of indicators of product market regulation at both the economy-wide and sectoral levels. All of these indicators measure the extent to which policy settings promote or inhibit competition in areas of the product market where competition is viable. Among the OECD countries, Turkey (with Luxembourg, the Czech Republic, Mexico, and Poland) is characterized by restrictions on competition that are significantly higher than average: the importance of state control seems to be one of the highest in Turkey than elsewhere in the OECD, and barriers to entrepreneurship and investment appear to play important roles in limiting overall competitive pressures in Turkey, though there are some improvements throughout the time (Wölfl et al., 2009).

[10] de Vries et al. (2012) argue that this result is overturned when a distinction is made between formal and informal activities within sectors. Increasing formalization of the Brazilian economy since 2000 appears to be growth-enhancing, while in India the increase in informality after the reforms is growth-reducing. Another dimension of Turkey's labor market problems, which I do not deal in this paper, is the large share of employment in the informal sector. For example, the World Bank (2009) reports that, in 2005, one-half of the employed labor force is not registered with a social security institute; this figure is about one-third even when agriculture is excluded.

[11] Alesina et al. (2005) use data on regulation in several sectors of many OECD countries to provide evidence that regulatory reform of product markets is associated with an increase in investment. Barone and Cingano (2011) study the effects of anti-competitive service regulation by examining whether OECD countries with less anti-competitive regulation show better economic performance in manufacturing industries that use less-regulated services more intensively; and find that that service regulation has a significant negative impact on the growth rate of value added, productivity and exports of service dependent industries in some of the OECD countries.

[12] www.oecd.org/economy/pmr

This paper is related to a number of literatures. First, there are some recent studies investigating the evolution of aggregate growth and productivity in Turkey from a historical perspective. For example, Altuğ et al. (2008) consider the sources of long-term economic growth for Turkey, conducting a growth accounting exercise across broad historical periods and policy regimes, over the period 1880-2005. Similarly, Ismihan and Metin-Ozcan (2009) explore sources of growth in the Turkish economy by performing growth accounting exercises over the 1960-2004 period and relevant subperiods. Çiçek and Elgin (2011) use growth accounting and dynamic general equilibrium models to study growth performance of Turkey from 1968 to 2004. In addition to these studies, Adamopoulos and Akyol (2009) and İmrohoroğlu et al. (2012) focus on the role of sectoral productivity in explaining the process of structural transformation in Turkey using calibrated multi-sector general equilibrium models. Adamopoulos and Akyol (2009) find that the evolution of exogenous differences in sectoral productivity and taxes, between Turkey and the United States, as well as Southern Europe, can account quantitatively for most of Turkey's relative underperformance to these regions between 1960 and 2003. İmrohoroğlu et al. (2012) highlight the key importance of raising productivity in agriculture, which still has a high share in total employment in Turkey, and find that if Turkey had inherited Spanish agricultural productivity growth from 1968 to 2005, the growth rate of aggregate GDP per capita would have been much higher in Turkey. This paper complements these studies addressing the aggregate economic performance of Turkey in a sectoral comparison with the Chinese economy during the high growth period of Turkey between 2002 and 2007.

Second, this paper is part of a literature that focuses on structural transformation in countries. The reallocation of resources across the broad economic sectors agriculture, industry, and services is a prominent feature of economic development since the pioneering works of Clark (1941), Kuznets (1966), Maddison (1987) and the references therein. The decline of the agricultural labor force and agriculture's share in national income in the course of economic development is well-established (Johnston, 1970; Barrett et al., 2010). In addition, many studies provide comparative studies of industrialization experiences of the developing countries around the world (Chenery et al., 1986; Amsden, 2001). The dominance and increasing share of service activities in the sectoral structure, in addition to the earlier studies by Stigler (1956) and Fuchs (1968), have been one of the main topics in recent macroeconomic research (İşcan, 2010; Jorgenson and Timmer, 2011; Buera and Kaboski, 2012; Eichengreen and Gupta, 2013).

Third, this paper complements the research on convergence at the sectoral level, which focuses on the importance of the service sector. For example, Bernard and Jones (1996) find that within sectors across countries there is evidence for convergence for some industries, but not for others. These differences across sectors account for convergence at the national level. Wong (2006) quantifies sectoral contributions to OECD convergence and finds that poorer OECD countries grew faster than richer OECD countries because they experienced significantly faster productivity growth in the service sector and the agricultural sector. Duarte and Restuccia (2010) find that productivity catch-up in industry explains about 50% of the gains in aggregate productivity across countries, whereas low productivity in services and the lack of catch-up explain all the experiences of slowdown, stagnation, and decline observed across countries. Investigating the relationship between the growing importance of the service sector and its implications for aggregate productivity growth, this paper is

related to Baumol (1967), Nordhaus (2008), and van Ark et al. (2008).

The rest of the paper is organized as follows. In Section 2, a model adopted is developed and discussed. Section 3 conducts a quantitative analysis using the theoretical framework with an emphasis on the counterfactual outcomes of inheriting the Chinese sectoral productivity growth rates. Section 4 complements the quantitative analysis with some sectoral details and Section 5 concludes.

2 Model

Households. The economy is populated by an infinitely-lived representative household of constant size over time. The population size is normalized to one, without loss of generality. I assume that the household is endowed with one unit of productive time that it supplies inelastically to the market and consumption is the only determinant of the instantaneous utility function, which is given by:

$$U(\bar{A}, I, S) = \bar{A} + \log\left(\gamma I^{(\eta-1)/\eta} + (1-\gamma)S^{(\eta-1)/\eta}\right)^{\eta/(\eta-1)}. \tag{1}$$

The instantaneous utility is defined over the agricultural good ($\bar{A}$) and the composite consumption good, where I is the consumption of the industrial good, and S is the consumption of the services. $\bar{A}$ represents the subsistence level of agricultural good consumption and it also is a satiation point.[13] The elasticity of substitution between industrial goods and services is given by η. The weight γ influences how non-agricultural consumption expenditure is allocated between industry and services and $\gamma \in (0, 1)$.

At each date, and given prices, the household chooses consumption of each good to maximize his lifetime utility subject to the budget constraint:

$$p_A\bar{A} + p_I I + p_S S = \omega, \tag{2}$$

where p_j is the price of good-j output and ω is the wage-rate in the economy.

Production. There are three goods produced. The production function for sector j is given by:

$$Y_j = \theta_j L_j, \tag{3}$$

where Y_j is output of sector j, L_j is labor allocated to production, and θ_j is sector j's labor productivity. Firm j problem is given by:

$$max \quad p_j Y_j - \omega L_j \qquad s.t. \qquad Y_j = \theta_j L_j, \qquad L_j > 0. \tag{4}$$

[13]The utility function belongs to the following general type of utility function:

$$U(A, C) = \begin{cases} \bar{A}, & \text{if } A < \bar{A}, \\ \log(C) + \bar{A}, & \text{if } A \geq \bar{A}. \end{cases}$$

This specification of preferences implies that the economy specializes in agriculture until the subsistence level $\bar{A}$ is reached. Moreover, the economy will never produce more agricultural goods than $\bar{A}$ (Stokey, 2001; Gollin et al., 2007).

Equilibrium. Given a set of prices $\{p_A, p_I, p_S, \omega\}$, a competitive equilibrium consists of consumption decisions that are the household's allocations $\{\bar{A}, I, S\}$, and factor allocations for the firms $\{L_A, L_I, L_S\}$ 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 factor and product markets clear:

1. The demand of labor from firms must equal exogenous supply at every date:

$$L_A + L_I + L_S = 1. \tag{5}$$

2. Since there is no international trade or capital accumulation the following conditions hold at each date implying that the market must clear for each goods and services produced:

$$\bar{A} = Y_A, \quad I = Y_I, \quad S = Y_S. \tag{6}$$

One can combine the first-order conditions for the household maximization problem with the market-clearing conditions to obtain the following equations that explicitly characterize the equilibrium employment shares in each sector:

$$L_A = \bar{A}/\theta_A, \qquad L_I = \frac{\Delta(1 - L_A)}{1 + \Delta}, \qquad L_S = 1 - L_A - L_I, \tag{7}$$

where $\Delta \equiv (\gamma/(1-\gamma))^{\eta}(\theta_I/\theta_S)^{(\eta-1)}$.

Employment share in agriculture is determined solely by the subsistence constraint and labor productivity in agriculture. Employment share in agriculture is negatively correlated with productivity in this sector (and it is independent of productivity in other sectors). Hence, increases in the level of agricultural productivity push labor out of the agricultural sector, since the same amount of agricultural goods can be produced with lower levels of employment (see Üngör (2013) for a detailed discussion).

A productivity increase in a non-agricultural sector j, ceteris paribus, leads to flows of labor out of this sector, i.e., $\partial L_j/\partial\theta_j < 0$ as long as industry and services are complementary. This result is consistent with Baumol (1967) in which if one sector (say, industry) realizes higher productivity growth than its complement (say, services), the less productive sector eventually dominates the economy in terms of employment.

Note that labor is perfectly free to move between the sectors. Then, the nominal wages in sectors are equalized.[14] From the profit-maximizing and zero-profit conditions, the producer price of good i relative to good j is given by the ratio of labor productivity in these sectors:

$$\frac{p_i}{p_j} = \frac{\theta_j}{\theta_i}, \qquad i \neq j. \tag{8}$$

[14]Like many models in this literature, the model presented in this paper assumes that average wages per worker are equated across sectors. This is not the case in many developing countries, as pointed out by Gollin et al. (2012). To discuss other channels further than productivity differences would diverge the focus of the paper since the idea of this paper is to focus solely on the sectoral productivity growth rate differences across sectors. Therefore, I keep the simple structure of the model. More importantly, this very simple model remarkably matches the sectoral allocation of labor; and therefore it is suitable for counterfactual experiments (see Figure 3). İmrohoroğlu et al. (2012) provide a discussion on this issue for Turkey.

3 Quantitative Analysis

3.1 Data and Calibration

I use data for Turkey between 2002 and 2007. Sectoral employment and output (measured in constant local currency) are from Üngör (2011a).[15] I calculate productivity levels (output per worker), θ_j, from the data between 2002 and 2007. The model has three parameters to assign values to: $\bar{A}$, η, and γ. First, using Equation (7), I calibrate the subsistence term in agriculture, $\bar{A}$, to match the share of employment in agriculture in 2002. This suggests that $\bar{A} = 0.4583$.

Although I do not have independent information on the elasticity of substitution between industry and services, I calibrate η to match the time path of the aggregate labor productivity closely. This suggests that η to be around 0.7.[16] Finally, I calibrate γ to match the share of employment in industry in 2002. This suggests that $\gamma = 0.3101$. Below I study the performance of the model economy fitting data for sectoral employment shares (and relative prices).

3.2 Benchmark Results

Figure 3 shows the predicted sectoral employment shares in each sector and compares with the actual data in Turkey during 2002-2007. The data are plotted as a solid line and the model results are plotted as a dashed line.

Panel (a) in Figure 3 shows that the model reproduces the shift of employment from the agricultural to the non-agricultural sector. During the 2002-2007 period, the model predicts a decline in the agricultural employment share of 6.6 percentage points, which is 82.6% of the actual decline in the data.[17] This result suggests that the simple characterization of preferences for agricultural goods in the model represents a good abstraction of the forces for employment in agriculture relative to the data.[18] Panel (b) in Figure 3 shows that the model predicts an increase in the industrial employment share of 1.9 percentage points, which is 83.4% of the actual increase in the data between 2002 and 2007. The model slightly under predicts the industrial employment share in 2007: the model prediction is 26.4%, while the actual employment share of industry is 26.8% in 2007. Panel (c) in Figure 3 shows that the

[15] Üngör (2011a) collects the data as follows: Sectoral GDP data (at basic prices in 1998) are from the Turkish Statistical Institute and sectoral employment data are from the Household Labor Force Survey of the Turkish Statistical Institute. The Turkish Statistical Institute has revised the Labor Force Survey results for 2004 and later by the new population projections. Revisions for the earlier period are not completed yet. Thus pre-2004 employment data is adjusted to account for the changes in population projections.

[16] Rogerson (2008), Bah (2009), and Duarte and Restuccia (2010) study similar multi-sector models and pick η as 0.44, 0.45, and 0.40, respectively, for the United States. I do sensitivity analysis for this parameter studying three values of η: 0.3, 0.5, and 0.7. The corresponding results are similar (see Figure 4).

[17] The model predicts that agricultural employment share decreases by 4.72% (from 31.3% in 2002 to 24.7% in 2007, a 100*ln(31.3/24.7)/5=4.72% annual decrease) while in the data the decrease is 5.72% (from 31.3% to 23.5%, a 100*ln(31.3/23.5)/5=5.72% annual decrease). Thus, the model accounts for 100*4.72/5.72=82.6% of the decline in agricultural employment share during 2002-2007.

[18] See Sengul and Üngör (2011), Gürsel and İmamoğlu (2012), and İmrohoroğlu et al. (2012) for detailed studies focusing on the secular changes in the agricultural employment share in Turkey throughout the time.

model predicts an increase in the service sector employment share of 4.7 percentage points, which is 86.0% of the actual increase in the data during 2002-2007.

In the model, sectoral output is given by labor productivity times labor input. Because the model matches the time path of sectoral labor allocation very closely, the output implications of the model over time are also quite close to the data. Therefore, I focus on the implications for relative prices. Observe that in the model labor is perfectly mobile across sectors. Hence there is one wage across sectors in the model. Since the wage is the marginal productivity of a worker in a sector, relative prices are a function of relative labor productivity (see Equation 8). I calculate the price of a sector by dividing its value added in current prices by the value added in constant prices. The model implies that the producer price of services relative to industry increases by 1.67% per year during 2002-2007, close to the increase in the data for the relative price of services from the implicit price deflators (1.13%).[19] An increase in the price of services relative to that of industrial goods (such as manufactured goods) is a well documented feature of economic development (see, for example, Obstfeld and Rogoff, 2002). Since labor productivity growth lags behind in the service sector, unit labor cost rises in the service sector, and the price of services go up for their provision to remain profitable.[20]

A three-sector model of general equilibrium is successful to reproduce most of the secular changes of labor in Turkey during 2002-2007. Below I do several experiments. Specifically, I am interested in whether mimicking labor productivity growth by sector in China would have significant consequences for aggregate labor productivity in Turkey during 2002-2007.

3.3 Counterfactuals

Using the calibrated model, I now run a series of counterfactuals meant to quantify the outlook of structural transformation and aggregate productivity growth had Turkey experienced a different path of sectoral productivity performance. Specifically, I conduct different counterfactual experiments, in the spirit of Duarte and Restuccia (2010), to see the sectoral employment shares and aggregate labor productivity if Turkey could have had sectoral productivity growth rates observed in China. Aggregate labor productivity is given by a weighted average of the productivity growth of the sectors with the weights being the corresponding employment shares. I compute counterfactuals where I set the growth rate of labor productivity in one sector to the growth rate in that sector in China, leaving the other sectoral growth rates as in the Turkish data.

Experiment 1 asks how this economy would change if year-by-year labor productivity

[19]This finding is consistent with the literature on the relative prices of services. For example, Canzoneri et al. (1999) study a panel of OECD countries and argue that relative prices generally reflect relative labor productivity in the long run. Metin-Özcan and Kalafatcılar (2009), using econometric techniques, study Turkish economy during 1995-2007 and find that differences in productivity have significant share (along with the real exchange rate) in accounting for relative price movements between industry and services.

[20]The results can also be thought in the context of the Balassa-Samuelson effect regarding the open economy issues. Since manufactured goods are tradable across borders while services are largely not, one may observe a secular increase in the price of nontradables relative to that of tradables in an open economy. In other words, differential productivity rates between these two sectors along with the hypothesis of perfect labor mobility leads to inflation rates in the tradable sector (say, industry) that are different from those held in the nontradable sector (say, services).

growth rate in agriculture followed the path observed in China during 2002-2007. *Experiment 2* asks how this economy would change if year-by-year labor productivity growth rate in industry followed the path observed in China. *Experiment 3* asks how this economy would change if year-by-year labor productivity growth rate in services followed the path observed in China. For completeness, I also compute a counterfactual where all sectoral growth rates are set to the corresponding rates in China. Specifically, *Experiment 4* asks how this economy would change if year-by-year labor productivity growth rates in all sectors followed the paths observed in China.

Table 2 provides an understanding of how aggregate output per worker would have changed under alternative scenarios.[21] Counterfactual experiments do have important implications for the behavior of aggregate labor productivity compared to the benchmark results. Experiment 1 (2) suggests that if agriculture (industry) in Turkey had had the same annual productivity growth rates as observed in China, then the average annual growth rate of the aggregate labor productivity would have been 6.2% (6.9%) instead of 5.7% in Turkey between 2002 and 2007. Experiment 3 shows that if the service sector in Turkey had had the same annual productivity growth rates as observed in China, then the average annual growth rate of the aggregate labor productivity would have been 7.8% instead of 5.7% during 2002-2007.

A comparison of these three experiments reveals that a significantly higher growth in aggregate labor productivity would have been accomplished by feeding the service sector productivity growth rates observed in China. Experiment 4 points out that if all three sectors in Turkey had mimicked the productivity growth paths of the Chinese sectors, then the average annual growth rate of the aggregate labor productivity would have been 10.0% during 2002-2007. I also conduct another experiment to emphasize the role of the labor productivity growth in the service sector: the growth rates of labor productivity in agriculture and industry are set to the growth rates in these sectors in China, leaving the service sector growth rates as in the Turkish data. The average annual growth rate of the aggregate labor productivity would have been 7.6% in this experiment.

4 Details by Sector

The counterfactuals suggest a detailed analysis of the service sector (in addition to the other individual sectors of the aggregate economy) in Turkey. Table 3 provides some details for different sectors. Labor productivity increased in all sectors except in non-market services during 2002-2007. Average annual growth in labor productivity is highest in electricity, gas and water (7.8%), second in manufacturing (5.9%), third in transportation, communication and storage (5.1%), and fourth in agriculture (4.8%) during 2002-2007. Table 1 shows the lack of productivity growth in services compared to the manufacturing sector. Productivity growth in the service sector is attributable to the two market services: (i) wholesale and retail trade, restaurants and hotels; and (ii) transportation, communication and storage. On the other hand, average annual growth in labor productivity of finance, insurance, real estate and business services is less than 1% during 2002-2007. More importantly, negative

[21] Table A.1 reports the allocation of employment across sectors, compared to the benchmark results, under alternative scenarios.

productivity growth is observed for non-market services (community, social and personal services). This sub-sector's employment share in total employment was 17.3% in 2007. One explanation for the observed low productivity in this sub-sector is that non-market service sector is typically labor-intensive with a possible low level of competition-both factors that slow productivity. These findings can also be interpreted in line with Jorgenson and Timmer (2011) that there is a need for improved measurement of non-market services and finance.

Whilst the analysis of sectoral growth is informative, the relative sizes of the sectors are of significant importance when evaluating how significant an impact each sector makes to overall labor productivity growth. I conduct a shift-share analysis expressing the labor productivity for the economy as a whole as the productivity level by sector weighted by the sectoral employment shares:

$$\frac{Y_T}{L_T} - \frac{Y_0}{L_0} = \underbrace{\sum_{j=1}^{J} \alpha_{j0}\Big(\frac{Y_{jT}}{L_{jT}} - \frac{Y_{j0}}{L_{j0}}\Big)}_{\text{Intra-Sectoral Effect}} + \underbrace{\underbrace{\sum_{j=1}^{J}(\alpha_{jT} - \alpha_{j0})\frac{Y_{j0}}{L_{j0}}}_{\text{Static Sectoral Effect}} + \underbrace{\sum_{j=1}^{J}(\alpha_{jT} - \alpha_{j0})\Big(\frac{Y_{jT}}{L_{jT}} - \frac{Y_{j0}}{L_{j0}}\Big)}_{\text{Dynamic Sectoral Effect}}}_{\text{Structural Change Effect}}. \quad (9)$$

Here $\frac{Y_T}{L_T} - \frac{Y_0}{L_0}$ is the labor productivity growth between years 0 and T, j is the sector, and α_{jT} is the share of employment in sector j in year T (van Ark, 1996; Maudos et al., 2008). The intra-sectoral effect shows the part of the overall productivity change caused by productivity growth within the sectors. That is, it is due to the aggregate productivity gains obtained because of the improvements of productivity in each sector. The structural change effect captures the effect of the reallocation of factors towards sectors with higher initial level of labor productivity (static effect), or higher rate of labor productivity growth (dynamic effect). The dynamic sectoral effect (or the interaction effect) represents the joint effect of changes in employment shares and sectoral productivity.

Table 4 shows the percentage contributions of these three effects to the overall labor productivity growth for different sectors during 2002-2007. The columns report the separate effects: intra, static- and dynamic-shift effects and the total effect looking at the total contribution of all nine sectors during 2002-2007. The intra-sectoral effect dominates the outcome and productivity growth within the nine sectors explains 68.0% of the aggregate labor productivity growth in Turkey. Structural change explains the remaining 32%: 29.1% is due to the static sectoral effect and 2.9% is due to the dynamic sectoral effect. There are considerable variations in the importance played by different sectors. However, market services and manufacturing are major contributors during 2002-2007. Market services contribute 56.5% to the aggregate labor productivity.[22] This productivity growth contribution of market services comes from transportation, communication and storage (19.8% in total); finance, insurance, real estate and business services (18.4% in total); and wholesale and retail trade, restaurants and hotels (18.3% in total). Among the individual sectors, manufacturing contributes most (30.6% in total) to the labor productivity growth during 2002-2007. This

[22]Market services include wholesale and retail trade, restaurants and hotels; transportation, communication and storage; finance, insurance, real estate and business services; and non-market services include community, social and personal services (see Timmer and de Vries, 2009).

is mostly due to the intra-sectoral growth in this sector (25.2%).

The most striking observation is that the total contribution of non-market services to growth in labor productivity is very small (1.4% in total). Table 3 and Table 4 indicate that non-market services have the symptoms of Baumol's (1967) cost disease: non-market services suffer from low productivity growth, increasing output prices and growing shares in employment and nominal output. Moreover, this technologically stagnant sector showed slower growth in real output than have the technologically dynamic ones. Market services increased shares in nominal output and employment as well.[23]

5 Concluding Remarks

This paper centers around an important component of economic growth that has not received the required attention of the policy making debate in Turkey during the high-growth era of 2002-2007. I investigate quantitatively how much and in what ways the Turkish service sector absorbs labor and contributes to the overall economic growth, and whether there are discernible signs of cost disease. The findings of this paper call for paying greater attention to the individual service sectors to understand the process of economic growth in emerging markets (see, for example, Eichengreen and Gupta (2011) for a detailed study of the service sector in India). It is well-known that the problem of measuring output (and therefore productivity) is in general much more challenging in services than in goods-producing industries (Griliches, 1994; Inklaar et al., 2008). One direction for further research is to enrich the sectoral production functions to gain further insight into the sources of productivity growth in each sector considering sectoral differences in capital accumulation, hours worked, capacity utilization, technology adoption, regulation, informal and home production, etc., which are omitted in this study. These factors may provide a more complete picture for the sectoral productivity differences in Turkey answering the possible questions of whether measurement issues can account for the individual sectors' productivity growth rates (McKinsey, 2003; Saygılı et al., 2005).

Since I abstract from capital and fixed factors in production, differences in labor productivity implicitly incorporates differences due to capital as well as due to the institutional differences across sectors. For example, an explicit introduction of land, private, and public capital would help the measurement of total factor productivity in addition to the labor productivity (see, for example, Verma (2012) for a study of the factors, which generate the services led growth witnessed in India during 1980-2005). There are also data limitations, such as data problems on hours per worker outside manufacturing sector in Turkey as in many developing countries.

This paper provides some insights for policy makers and one policy message is that there is a need to determine the key drivers of competitiveness in each sector to be able to understand

[23] One aspect of the rise in the service sector for recent years is the increases in the number of the foreign-controlled firms, which were very few in Turkey until 2001. These firms are mainly concentrated in domestic market-oriented service sector activities such as banking, telecommunications and retail trade. Sayek (2007) provides some observations regarding foreign direct investment (FDI) flows to Turkey and notes the regulatory changes implemented with the FDI Act (Law No. 4875) that entered into force as of June 2003. With this legislative change, investment climate has been made more favorable for the entries of foreign firms.

differences in growth rates across sectors in the Turkish economy. This requires attempts to supplement aggregate calculations with micro-level information about individual firms or narrowly defined industries (see also Taymaz and Suiçmez (2005) for some policy suggestions to increase productivity both at the sector and firm level). A more refined treatment of the service sector (especially non-market services) in a model economy featuring household production could be another direction for further research (see, for example, Rogerson, 2008).

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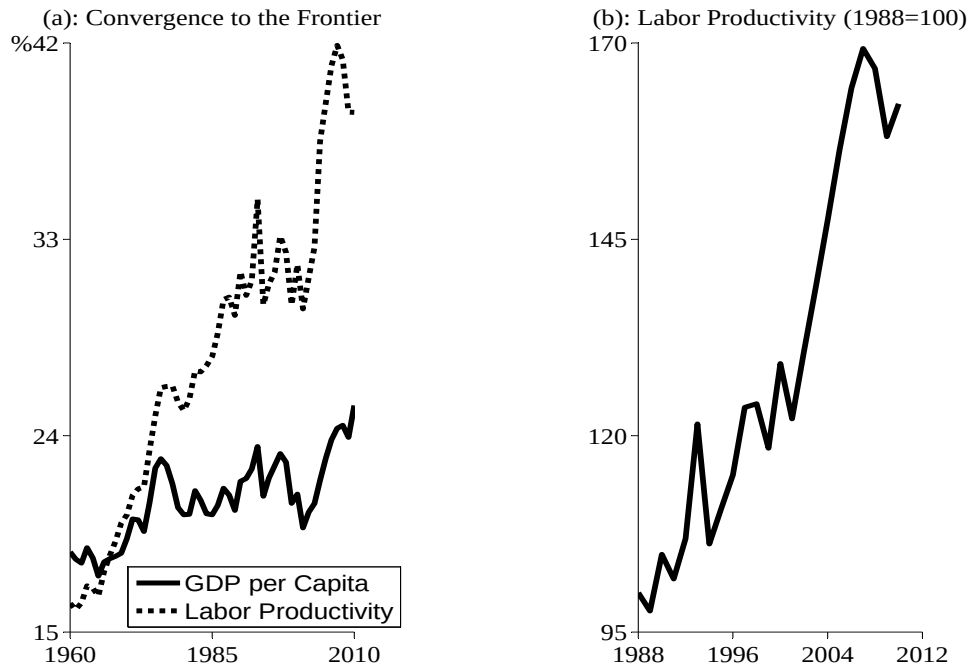

Figure 1: Historical Growth Performance of Turkey

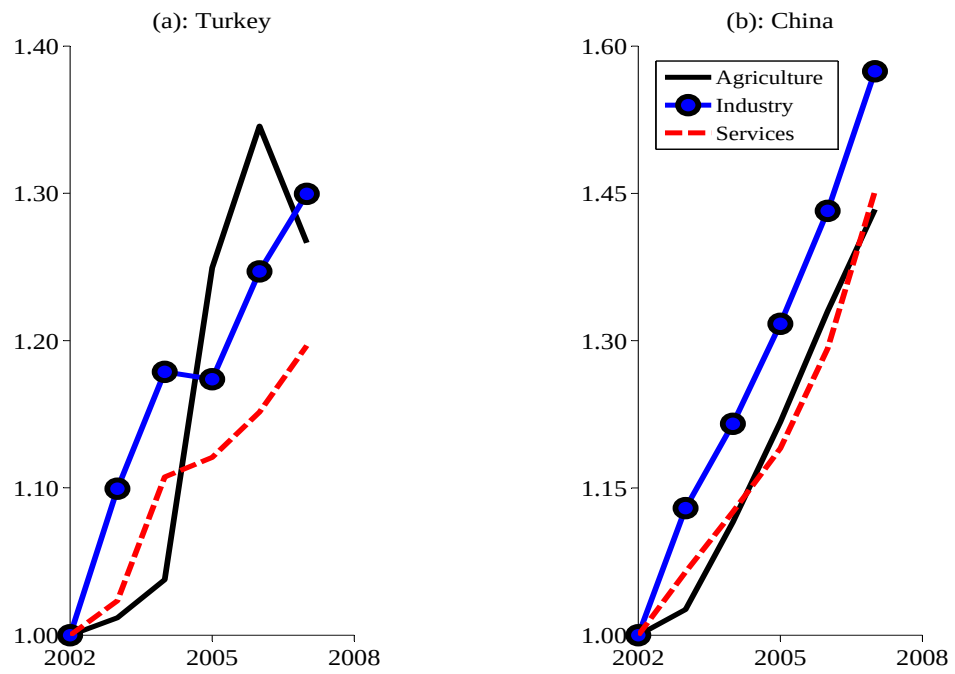

Figure 2: Output per Worker by Sector

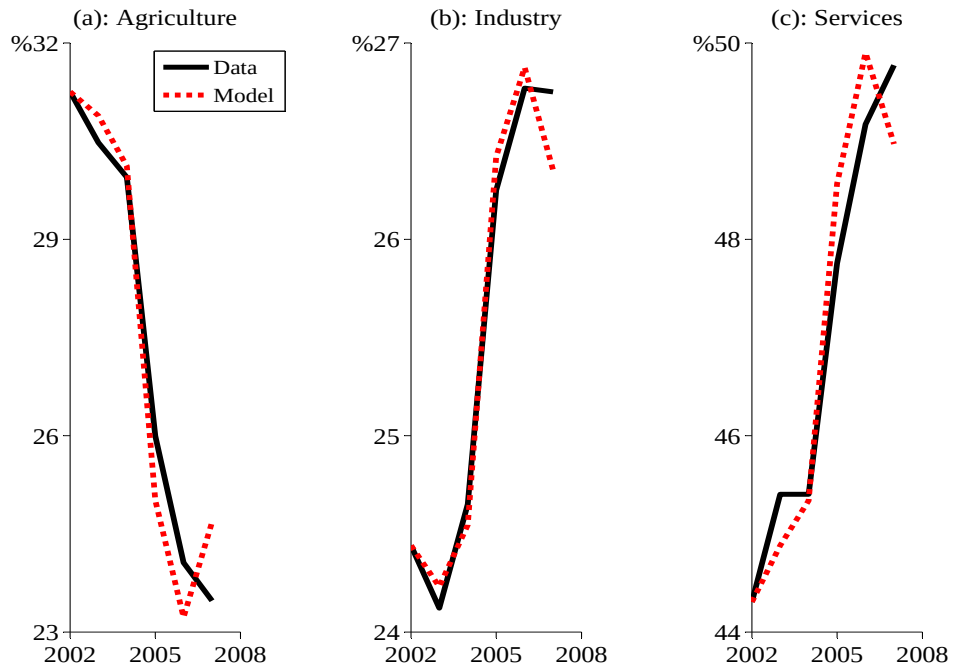

Figure 3: Sectoral Employment Shares in Turkey, Model versus Data

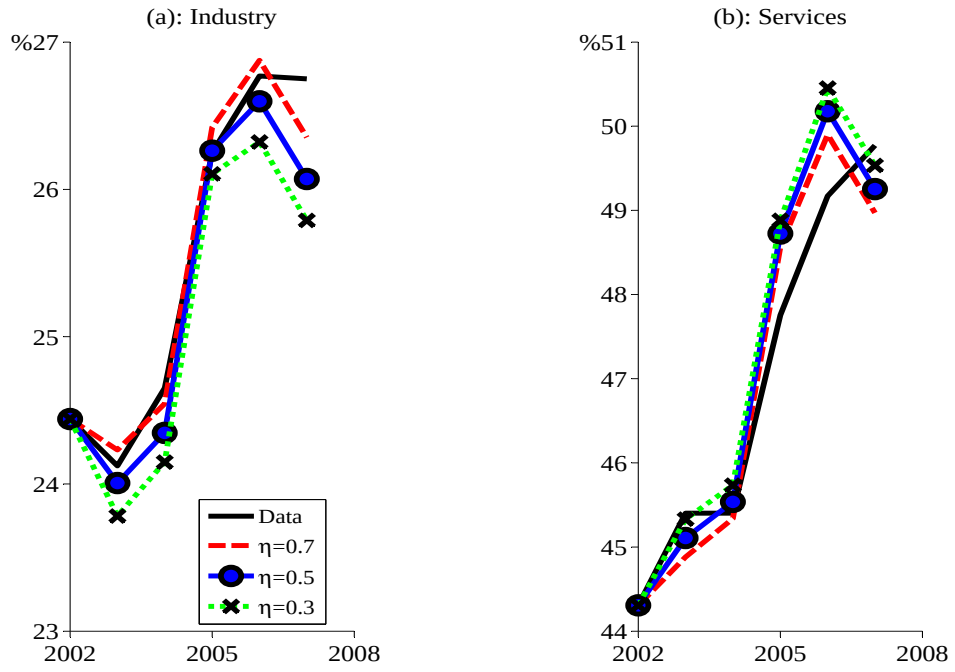

Figure 4: Sensitivity, Sectoral Employment Shares in Non-Agriculture

Table 1: Value-Added and Employment by Sector as a Share of Total (%)

	(a): Value Added			(b): Employment		
	Agriculture	Industry	Services	Agriculture	Industry	Services
2002						
China	13.7	44.8	41.5	50.1	21.8	28.1
Turkey	**12.5**	**30.6**	**56.9**	**31.3**	**24.4**	**44.3**
2005						
China	12.1	47.4	40.5	45.8	23.2	31.0
Turkey	**11.9**	**31.3**	**56.8**	**26.0**	**26.2**	**47.8**
2007						
China	10.8	47.3	41.9	41.7	26.0	32.3
Turkey	**9.7**	**31.6**	**58.7**	**23.5**	**26.8**	**49.8**

Source: China Statistical Yearbook (2012); de Vries et al. (2012); Üngör (2011a); WDI (2013).
Note: GDP shares are based on current prices (local currencies).

Table 2: Counterfactuals

	Average Annual Growth in Aggregate Output per Worker (%)				
	Data	Experiment 1	Experiment 2	Experiment 3	Experiment 4
2002-2007	5.7	6.2	6.9	7.8	10.0

Table 3: Sectoral Shares and Productivity in Turkey, 2002-2007

	Employment Shares (%)		GDP Shares (%)		GDP per Worker (TL per person)		Average Annual Growth of Labor Productivity (%)
Sector	2002	2007	2002	2007	2002	2007	2002-2007
Agriculture, forestry, hunting and fishing	31.3	23.5	12.5	9.7	1,466	1,857	4.8
Mining and quarrying	0.6	0.6	1.1	1.6	5,735	5,996	0.9
Manufacturing	18.7	19.7	21.6	21.4	4,477	5,949	5.9
Electricity, gas and water	0.5	0.5	2.8	2.4	14,233	20,732	7.8
Construction	4.7	5.9	5.1	6.2	4,313	5,325	4.3
Wholesale and retail trade, restaurants and hotels	19.5	22.0	17.6	18.4	2,768	3,370	4.0
Transportation, communication and storage	4.9	5.5	17.0	17.7	10,181	13,041	5.1
Finance, insurance, real estate and business services	3.6	5.1	9.4	9.3	12,147	12,482	0.5
Community, social and personal services	16.4	17.3	13.0	13.2	2,262	2,235	-0.2

Source: Üngör (2011a). Note: GDP shares are based on current prices. I do not include the series "Ownership and dwelling" since this imputed production does not have an employment equivalent and should preferably not be included in output for the purposes of labor productivity calculations.

Table 4: Sectoral Contributions, 2002-2007 (%)

	Intra	Static	Dynamic	Total
Agriculture, forestry, hunting and fishing	11.2	-10.4	-2.8	-2.0
Mining and quarrying	0.1	0.3	0.02	0.5
Manufacturing	25.2	4.1	1.3	30.6
Electricity, gas and water	3.0	-0.3	-0.1	2.5
Construction	4.3	5.0	1.2	10.5
Wholesale and retail trade, restaurants and hotels	10.7	6.2	1.4	18.3
Transportation, communication and storage	12.8	5.5	1.5	19.8
Finance, insurance, real estate and business services	1.1	16.8	0.5	18.4
Community, social and personal services	-0.4	1.9	-0.02	1.4
Total	**68.0**	**29.1**	**2.9**	**100.0**

Appendix A

Table A.1: Counterfactuals

	(a): Employment Share of Agriculture (%)					
	Data	Benchmark	Experiment 1	Experiment 2	Experiment 3	Experiment 4
2002	31.3	31.3	31.3	31.3	31.3	31.3
2003	30.5	30.9	30.5	30.9	30.9	30.5
2004	29.9	30.1	28.0	30.1	30.1	28.0
2005	26.0	25.0	25.7	25.0	25.0	25.7
2006	24.1	23.2	23.5	23.2	23.2	23.5
2007	23.5	24.7	21.8	24.7	24.7	21.8
	(b): Employment Share of Industry (%)					
	Data	Benchmark	Experiment 1	Experiment 2	Experiment 3	Experiment 4
2002	24.4	24.4	24.4	24.4	24.4	24.4
2003	24.1	24.2	24.4	24.1	24.4	24.4
2004	24.7	24.5	25.3	24.4	24.6	25.2
2005	26.2	26.4	26.2	25.8	26.7	25.9
2006	26.8	26.9	26.8	26.2	27.5	26.7
2007	26.8	26.4	27.4	25.4	27.4	27.4
	(c): Employment Share of Services (%)					
	Data	Benchmark	Experiment 1	Experiment 2	Experiment 3	Experiment 4
2002	44.3	44.3	44.3	44.3	44.3	44.3
2003	45.4	44.9	45.2	45.0	44.7	45.1
2004	45.4	45.3	46.7	45.5	45.3	46.8
2005	47.8	48.6	48.1	49.2	48.3	48.4
2006	49.2	49.9	49.7	50.6	49.3	49.8
2007	49.8	49.0	50.8	49.9	48.0	50.8

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