Productivity, structural change, and skills dynamics: Evidence from a half-century analysis

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Abstract

This article explores the contribution of structural change and the skill upgrading of the labor force to productivity. Our growth decomposition based on an original database we built for Tunisia and Turkey shows that productivity is mainly explained by intra-industry changes during the import substitution period. Secondly, we show that this productivity increase has been driven by the reallocation of higher educated labor between sectors rather than the absorption of highly educated workers within sectors. Based on an instrumental variable regression setting, we also find evidence that the change in the share of high-educated workers had a causal impact on productivity levels. Moreover, when we exclude the government sector, the overall skills upgrading is negatively associated with productivity growth, suggesting a downward sloping return to educated labor demand over time.

Keywords: Productivity, Skills, Structural change, Tunisia, Turkey, MENA
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1 Introduction

This paper examines the respective contributions of labor reallocation and skill upgrading to productivity variation. In most developing countries, educational attainment has increased spectacularly in recent decades. In the past, education had often been reserved for foreigners and the elite, especially in countries with a colonial heritage. Its spread became widely considered as a vector for modernization during the first half of the twentieth century. Nevertheless, Pritchett (2001) showed that education did not always foster growth. Among the explanations, the low quality of education and skill mismatch have been widely cited. For the latter, low levels of structural change, particularly from basic manufacturing to high value-added industries and services, contributed to the lack of demand for high skilled workers. However, education as a social mobility vector and anti-poverty mechanism continues to be encouraged even when the demand for skilled workers is not high. A stagnation of skilled labor demand can also result from the absence of within-sector skill upgrading. According to Hendricks (2010), within-industry gaps play a much higher role than a structural change in explaining differences in education across countries. In contrast, much of the development literature highlights the role of structural change in income differences between countries (Restuccia et al., 2008).

In the past half-century, the most significant trend in structural change has been the reallocation out of the agricultural sector into more productive sectors (Caselli and Coleman II, 2001). On a cross-country level, the catch-up between the US and other countries is higher in manufacturing than in other sectors (Herrendorf and Valentinyi, 2012). While there are substantial differences between countries in services' productivity (Duarte and Restuccia, 2010), cross-country aggregate productivity gaps are in a larger part, due to the agricultural sector (Gollin et al., 2013). Since 2000, structural change contributed positively to growth in Africa, primarily due to increasing agricultural productivity and rising food and commodity prices (McMillan et al., 2014). Our paper is related to this strand of the literature, which tries to understand the contribution of structural change, among other factors in productivity growth. Previous authors have argued that competitive exchange rates and labor market flexibility are among the most important determinants of growth-enhancing structural change (McMillan and Rodrik, 2011). There is also literature arguing that productivity growth increases after the implementation of pro-competitive trade reforms in particular when sectors were previously import-competing or that faced onerous domestic regulations (Topalova and Khandelwal, 2011).

Our paper is also related to the literature on the growing impact of skills on productivity with structural change. In a cross-country analysis, human capital and product specialization are essential determinants of economic growth. As countries move into more specialized goods and more knowledge-intensive industries, the role of human capital becomes more prevalent.[1] However, the interaction between human capital and structural change depends on the level of development of the country. Furthermore, there is a correlation between demand for high-skilled labor and a compositional shift of value-added to sectors that are intensive in high-skilled labor (Buera et al., 2015).

It is difficult to untangle the direction of causality between productivity and growth within

[1] Hanushek and Woessmann (2008) considers that cognitive skills are even more relevant in determining growth than just human capital as measured by years of education, but limitations in the historical availability of this data make the investigation through this angle more difficult.

and between sectors because of the endogeneity of key variables. Different rates of productivity can explain structural change (Ngai and Pissarides, 2007), and increases to productivity have a positive impact on the skill premia (Dix-Carneiro and Kovak, 2015). But skilled workers contribute to productivity, with the observed polarization in skills and wages resulting mainly from structural change from manufacturing to services (Bárány and Siegel, 2018).

Our article first explores the contribution of structural change and skill upgrading of the labor force to productivity by taking a comparative historical approach to the post-World War II trends and data in Tunisia and Turkey.[2] We develop an original database since the 1960s on the two countries and use it to decompose the overall productivity change into within and between components. This decomposition allows us to assess whether labor productivity resulted from workers moving out of lower productivity sectors, like agriculture, into higher productivity sectors, like manufacturing, or if productivity increased mainly because of changes within each sector (McMillan and Rodrik, 2011). Using a similar method from Berman et al. (1998), we decompose the overall contributions to total skills upgrading to the movement of high skilled workers between sectors and increased concentration of high-skilled employment within sectors. The next step consists of regressing labor productivity on the various indices computed. Because of the endogenous nature of the relationship between skills and productivity growth, our most convincing methodology relies on instrumental variables.

We find that the total skill upgrading has a causal impact on productivity and its primary driver is the reallocation of skilled workers between sectors, and not skills upgrading within sectors. We show that a one-point increase in total skill upgrading increases sectoral productivity by 0.12 percentage point. More specifically, a one-point increase in the reallocation of the share of the highest skill between sectors increases productivity by order of .26 percentage points. The instrument used did not allow us to identify the causal relationship for Tunisia.

2 Historical setting

This section sets out to identify the differences and similarities between Turkey and Tunisia in terms of industrial development and structural change, the relative role of the public sector in transitional periods, and the evolution of education and skills from the 1960s to the 2010s. The short historical narrative seeks to demonstrate that while in the 1960s, Turkey had a sizable private sector, particularly in manufacturing, Tunisia came right out of the decolonization processes where the state and public sector played a more pivotal role. Therefore, it is likely that this environment created a path dependency where the state continued to play a significant role in economic institutions in Tunisia. Turkey's dynamic business classes outperformed the role of the Turkish public sector in the economy. Structural change played a less significant role in the allocation of labor resources to the public sector in Turkey, and productivity gains were more strongly realized in the private sector. Even though both countries showed significant improvements in educational attainment, the utilization of the more skilled labor force remains more limited in Tunisia, in particular, due to the vast size of the public sector.

[2]The reason we choose these two countries is that both countries are labor-rich developing countries, where the weak absorption of college graduate job seekers is identified as a particularly acute problem. In more recent years, the research shows that the 2011 Tunisian uprising was motivated by the frustration of thousands of unemployed educated youth (Gatti et al. 2013, Rijkers et al. 2014, Angel-Urdinola et al. 2015). Furthermore, some aspect of the Tunisian economic post-colonial institutions were modeled after the post-war Turkish state's model.

Overall, Turkey and Tunisia present a suitable point of comparison as two non-oil economies with sizable domestic markets in the European periphery. Furthermore, the Tunisian economic model took several examples from the post-war Turkish model. The macro policy framework in both countries went through a similar shift from the import substitution industrialization (ISI) period with a heavily planned economy roughly between 1960-1980 to the liberalization hereafter. The ISI period also involved reallocating labor away from traditional sectors, primarily agriculture in both countries. Finally, the human capital composition improved significantly between and within sectors throughout policy shifts since the 1960s.[3]

However, there were significant differences, as well. Even though nation-state building and industrialization overlapped in both countries, the process started much later in Tunisia. In Turkey, most of institution-building occurred in the 1920s, and by the early 1930s, the nationalization of the economy, effectively meaning the removal of non-Muslim elements, was almost complete. ISI with substantial state entrepreneurship proceeded after the Great Depression, and by 1960, the country had reached the end of the first stage of import substitution, producing most of the non-durable consumer goods domestically. However, the pre-1960 period did not see structural change. Turkey was still a "frontier country." Hansen (1991) and the open land frontier prevented a large scale migration from rural areas and agriculture until the 1950s.

Between 1960-80, Turkey started to produce consumer durables and intermediate goods. Even though there was a sizable public sector activity in manufacturing, more than half of the value-added was created by the private sector. The sharp policy reversal towards market liberalization, reduction of state intervention, and export promotion took place in 1980 at the height of the political turmoil and the crisis of the ISI period. Real wages dwindled; the prices significantly moved in favor of manufacturing, and agricultural subsidies were reduced. The combined result was the reinforcement of rural-urban migration.[4]

The large sectoral shifts in employment coincided with significant improvement in skills acquisition. In 1960, the average literacy rate was 38 percent. It steadily increased up to 95 percent in 2013 (TIUK, 2014). As for the quality of education, while the student-teacher ratio in primary schools was 46 in 1960, it came down to 20 in 2013.[5] The gross enrollment ratio in primary and secondary education increased from about 60 percent to 90 percent between 1960-2013, and even more remarkably, the rise in tertiary education gross enrollment rate increased from 5 to 95 percent over the same period. The most critical reform affecting enrollment was the reform in 1997, which increased compulsory education from 5 to 8 years.

In Tunisia, we observe the implementation of a mix of ISI and nationalization policies, starting from after independence. Before independence, Tunisia had a predominantly agricultural economy, where the urban centers, trade, and small scale manufacturing were controlled by the Europeans, who had settled in the country in the late nineteenth century.[6] The national census

[3]See Karakoç et al. (2017) for a brief evaluation of industrialization over the whole 20th century. Chapters 11 and 12 of Hansen (1991) also provide a detailed evaluation of import substitution and liberalization after 1980.

[4]The symbiotic relationship between the large scale public enterprises and the private sector also changed structurally. Small and medium scale manufacturing enterprises revived in the Anatolian cities, which had not been industrial centers previously, thus changing notably the spatial distribution of industry.Filiztekin and Tunalı (1999) shows that the so-called "Anatolian tigers" heavily depended on low wages to be able to compete domestically and globally.

[5]However, the student/teacher ratio did not change much in high schools. Also, the doubling of the ratio for college-level indicates the massive increase in college enrollment particularly after the 1990s.

[6]Indeed, the first industrialization experience was launched by the French in the 1930s to promote local manufac-

conducted in 1951 shows that Tunisians owned less than 10% of the largest manufacturing firms, as the local bourgeoisie preferred investing in land and commerce instead of manufacturing. After independence in 1956, the government was preoccupied with transferring the administration to Tunisians and the creation of sovereign institutions. The post-colonial period initially started with a liberal economic model (1956-1961) failing in private investment (Bellin, 2002), but, switched to a socialist agenda after 1962 with the expropriation of 450,000 hectares of land from French settlers and collectivized the land of small-holders. The land seizure and collectivization policy ended in 1969 due to its failure to deliver significant improvements, opposition from large landowners, and the international donors. Subsequently, liberalization coupled with a large-scale export promotion program "*Loi 1972*" at the beginning of the 1970s and marked the beginning of the development of the manufacturing sector. [7]

A severe economic crisis and balance of payments problems in the 1980s jointly led to the adoption of a structural adjustment plan (Naccache, 2009), which was followed by the liberalization of foreign trade.[8] Shortly after that, Tunisia undertook labor reforms intending to increase labor market flexibility while maintaining some form of protection to workers, but these had a limited impact on labor flexibility and reallocation (Angel-Urdinola et al., 2015). Lastly, competition law and a new investment code were established respectively in 1991 and 1993. All these reforms aimed to accelerate the growth in jobs and productivity, but cronyism, corruption, and rent extraction continued to foster to unequal access to business opportunities and limited competition (Rijkers et al., 2017).

Historically, educational attainment is relatively high in Tunisia as compared to Turkey, as well as in most other MENA countries (Figure 3). However, in the 2010s, the profile of the workforce in Turkey matched that of Tunisia, suggesting a rapid catch up in the employed skills base. Interestingly, there is a time lag between Tunisia and Turkey in the diffusion of education (Turkey's education attainment leaped forward in the 1980s). In Tunisia, we observe a trend that supports the implementation of a statist post-transitional model, with a relatively high level of public sector employment and a relatively high level of medium and highly educated workers in public employment (Figures 4 and 5). In 1991, mandatory schooling was extended from 6 to 9 years in 1991, increasing average schooling years for most students. In addition, there is some evidence to suggest that the quality of schooling improved. According to UNESCO data, student-teacher ratios for pre-primary schools dropped by half after the 1980s. Contrary to countries that were able to quickly absorb a massive increase of educated workers (Marouani and Mouelhi, 2015), in Tunisia, the increase in education was accompanied by massive unemployment of young graduates (30 percent on average and 40 percent for women). [9]

Therefore, by the time both economies embarked on structural change in the 1950s, Turkey had a solid manufacturing base, a large private sector, and an ISI policy that was still more pro-business than Tunisia's nascent socialist institutions. Reflecting on the trends described so

turing (tax exemptions, guaranteed credit, among others) during World War II. However, this industrialization period did not last long. Trade with Europe stopped abruptly. It only resumed after the end of the war, quickly dismantling the burgeoning manufacturing sector (Bellin, 2002)

[7]Not coincidentally, this development was often spearheaded by former civil servants who became entrepreneurs benefiting from government incentives.

[8]This included GATT (1989), the WTO (1994) and the free-trade agreement with the European Union (1995). Nevertheless, trade liberalization was not rampant in the mid to late 1990s, primarily because of preoccupations with social stability and protecting Tunisian firms from international competitors.

[9]Data extracted from INS website, available here: http://www.ins.tn/fr

far, Figure 1 shows the sectoral composition of GDP since the 1960s. Turkey witnessed a more clear-cut increase in the share of productivity originating from the services industry. The share of agriculture steadily decreased from 33 to 10 percent, while manufacturing and services share increased structurally and significantly. Meanwhile, the share of the public sector remained small, and in fact, declined after the 1980s. In Tunisia, the composition of GDP shows two periods: one between before 1980 (mostly socialist period) where agriculture expanded, and manufacturing grew perhaps marginally, and one after 1980 where markets more rapidly liberalized. Overall, services interestingly remained stagnant.

3 Decomposing productivity and skills demand: Data and methodology

Our paper now takes a macroeconomic approach that decomposes the components of changes in productivity and skills from the 1960s to 2010. The decomposition analysis requires data on value-added by country and sector. Critically, to understand skills contributions, we also need to gather data on employment both by country, sector, and education level. There are several international databases with information on value-added per sector. Many contemporaries use data from the Groningen database for internationally comparable value-added data. Studies focusing on employment by sector can use sources such as the UNIDO data on employment by sector. However, matching between the two sources for employment by sector and education for both our countries was not possible. Instead, in a laborious effort, we returned to original data sources to extract data, reclassify, and harmonize between the two countries. The result is a 5-sector database that includes information on value-added by sector, and employment by education and sector.

For Turkey, the data on the educational status of employees for each sector is obtained from the Turkish population censuses.[10] GDP per sector was used to proxy for value-added data and were gathered from official statistical yearbooks provided by the Turkish Statistical Agency (Turkstat). The national sources for the Tunisia data have been gathered through two main national surveys. The value-added per sector data was obtained through annual statistical books from the Development Plans and Institute of Statistics. Data on employment by education level, and the sector was gathered from periodic censuses and labor force surveys. Both value-added and employment by education statistics were cross-checked with the data from the Tunisian Institute for Competitiveness and Quantitative Studies (*Institut Tunisien de la Competitivité et des Études Quantitatives (ITCEQ)*.[11] Data on trade flows were gathered from CEPII-CHELEM database that includes several world trade statistics and calculated indicators (CEPII and de Saint Vaulry, 2008).[12] Further data used for macroeconomic controls were gathered from the World Penn Tables database (Feenstra et al., 2015) and the World Bank's Climate Change Knowledge Portal.

[10] Data is reported in census results for every five years from 1960 to 1990 and 2000. The years 2010 and 2015 can be found in the employment statistics in the database Turkish Statistical Agency.

[11] We are indebted to Monji Ben Chaabene for having shared his work with us.

[12] CEPII-CHELEM uses data from UN COMTRADE. The advantage of using CEPII-CHELEM over UN COMTRADE is that CEPII applies a harmonization strategy to improve the quality and representativeness of the data and creates useful indicators.

3.1 Decomposition analysis

In our paper, we followed the decomposition methodology employed by McMillan and Rodrik (2011) and Berman et al. (1998) to understand the respective contributions of within sector and structural change components to the overall productivity and skills upgrading in each sector and on the aggregate level. The two decompositions follow the same logic and are as follows:

- Productivity Decomposition, McMillan and Rodrik (2011)

$$\Delta P_t = \sum_{i=1}^{n} \Theta_{i,t-k} \Delta P_{i,t} + \sum_{i=1}^{n} P_{i,t} \Delta \Theta_{i,t} \tag{1}$$

- Skill Upgrading Decomposition, Berman et al. (1998)

$$\Delta Sk_t = \sum_{i=1}^{n} \Delta sk_{i,t} \Theta_{i,t} + \sum_{i=1}^{n} \Delta \Theta_{i,t} sk_{i,t} \tag{2}$$

where P_t is aggregate productivity, $P_{i,t}$ is sectoral productivity, $\Theta_{i,t}$ is the share of sector i in total employment, Sk_t is the share of highly educated labor in total labor and $sk_{i,t}$ is the share of highly educated labor by sector.

Productivity Decomposition The trends in the evolution of productivity for Tunisia and Turkey demonstrated differences over the past half a decade (see Figure 12 and 13). For Tunisia, overall productivity after independence was relatively large but fluctuated in the following years. While the within component explained much of the change from the 1960s to 1975, reallocation of resources explained the lion's share of productivity from 1975 to 2000. The first period saw the end of restrictive regulations on ownership and investment and the beginning of windfall tax incentives for foreign investors in the investment law of 1972 (*la Loi 1972*), bringing the Tunisian industry towards more export-oriented activities in the decades to follow. The next few decades correspond to the structural adjustment period, which cut agricultural subsidies and led to a switch from import-substitution to export-orientation. The relationship changed again in the 2000s onwards, where we observe the resurgence of productivity within sectors as the primary (and almost the sole) driver of productivity, similar to Marouani and Mouelhi (2015).

In Turkey, the story is a bit more marked (Figure 13, Panel Turkey). Like Tunisia, the productivity in Turkey in the 1960s was dominated by the within component of productivity decomposition. In the 1980s, the reallocation of resources had a dominant role in productivity. From the 1980s to 2000s, reallocation between sectors was still an important component of productivity but gradually lost ground to the within component. This observation occurred at the same time as the periods of ISI policies and the initial phase of opening up to global markets. From the 1990s onward, productivity within sectors gained ground. The timing of this change coincides with a reversal of political openness to global markets, a reduction of state interventionism, and export promotion. It also coincides with the changes in educational reforms.

Both in Tunisia and Turkey, the between and within trends in productivity vary by sector (Figures 14 and 15). In Tunisia's agriculture sector, and to some extent in the manufacturing sector, most of the productivity is driven by within changes, while in services, productivity is equally about reallocation of labor. Productivity in Tunisia's agricultural sector is dominated by within changes for most of the periods in the last 50 years, while the other sectors do not demonstrate any unusual patterns except for in government where changes within sectors explain productivity more in later years. In Turkey, the agricultural sector plays less of an important role, but manufacturing and services are rather important sectors, and both structural change and within sector upgrading are important determinants of overall productivity. Like in Tunisia, the Turkish service sector is growing in productivity. It is also mostly dominated by the between component of the productivity decomposition in earlier years, but it is overpowered by the within component in later years. Overall, there is no clear correlation between the components of between and within sector productivity over time for either country (see Figures 7 and 8).[13]

Skills Decomposition The evolution for skills decomposition for Tunisia is more or less continuously positive over the entire period (Figure 18). There was only a marginally negative contribution that came from changes within sectors in 1989 and in 2015, and a negative contribution of structural change to productivity in our first period from 1967 to 1975. In Tunisia, skill upgrading (or the change in the overall share of high skilled employment) from the 1960s to 2015 was primarily due to the reallocation of skills to different sectors. Once we approach the 90's to 2010, total skills-upgrading starts becoming due, to a larger part, to each sector containing a larger share of high skilled workers. The swell of high-skills within sectors that does not coincide with an economy shifting towards more productive activities (c.f. Figure 20 and 13), set the background for the 2011 Jasmine revolution, and provides fuel for frustration among unemployed, high-skilled youth. At the same time, jobs for high-skilled workers in the government services and public sector (Figure 16), with low to no tangible productivity, still accounted for a relatively high share of employment at that time.

In Turkey, the skills composition of employment was more volatile than in Tunisia. In the period after ISI and a more command-led economy, substantial growth of educated labor force working within sectors was an important component of overall skills-upgrading. In the later period (1970-1975), moving high-skilled workers between sectors actually negatively contributed to overall skills-upgrading. In the following periods until 1990, skills-upgrading within sectors had an overall negative contribution to overall skills upgrading. Like Tunisia, the between component of skills upgrading, capturing the increase of employment in sectors requiring high skilled workers had an important rol in most of the periods from the 1970s. The remarkable negative contribution of the within component of skills upgrading from 1980 to 1985, suggests

[13]On sectoral level, we observe that both countries have grown in the share of employment in the agricultural sector and services. In Tunisia, we observe mostly stable and low levels of productivity per sector but steady changes in the share of employment across most sectors (Figure 16). As expected, the employment share in agriculture dropped substantially, while the share of employment in services increased. While we observe some increase in the share of employment in government, the share of employment in construction remained minimal, and the share of employment in manufacturing stayed more or less constant over time. In Turkey, the trends were similar, with a sharp drop in the share of employment in agriculture over the 50 years, and a large increase in the share of employment in the services sector (Figure 17). Like Tunisia, the share of employment in the services sector rose. However, unlike in Tunisia, the share of employment in the Turkish manufacturing sector also steadily rose. This trend suggests that while in Tunisia, the low productivity government sector employment may have expanded and obstructed the contribution of skills to sectoral productivity, in Turkey this is was not the case.

a loss of relative education levels of workers within sectors. This may have been a temporary result of the gradual opening of the economy to global economy, at the same time as the sharp improvement of the mandatory years of education keeping some workers temporarily out of the labor market.

Finally, while there is little correlation of the between and within (see Figures 7 and 8), there is a positive correlation between the between component of productivity and the between component of skills in particular in Turkey (see Figure 10). This suggests that there is a potential link between productivity and skills reallocation that may be occurring due to the reallocation of resources between sectors rather than within sector upgrading. If we look at the sectoral components of this correlation, for both Turkey and Tunisia, there is a positive association between skills reallocation and resource reallocation and its contributions are productivity enhancing in the services sector, while it is productivity declining in the agricultural sector (see Figure 9).[14] This is even more evident in the correlation between the structural change (between) component of the productivity decomposition and the reallocation of skilled workers component of skills decomposition in Turkey (see Figure 11.)

4 Modeling productivity and skill upgrading

Average years of schooling increased significantly in both countries, and yet the contribution of skills upgrading to productivity is largely overlooked in the literature. This section aims to explore whether there is support for the causal inference of the impact of skill-biased structural change on sectoral productivity in Turkey and Tunisia. Our main aim in this section is to estimate the contribution of each of the following measures of skill upgrading to productivity growth:

- **Total skill upgrading:** increase in the share of the highest skilled category of labor in total employment,
- **Skill upgrading within sectors:** increase in the share of the highest skilled category of labor in total employment due to the within sector component,
- **Skill upgrading between sectors:** increase in the share of the highest skilled category of labor in total employment due to the between sector component. This type of increase is also known as Skill Biased Structural Change (SBSC).

Estimating the causal impact of skill upgrading on productivity is admittedly a difficult task given limited data availability and the endogenous nature of the relationship between productivity and skills. In our attempt to establish a sound empirical link between the two, we face the following challenges. First, data on sectoral employment by education starts only from 1965 for Turkey and 1967 for Tunisia with 5 to 10-year gaps, limiting a more long-term and more data-rich approach. Secondly, sectors are not consistent across time or between the two countries. The sectors that are commonly available in the official statistics of both countries are agriculture, manufacturing, construction, services, and public administration. This collection of data leaves us a total of 50 observations by five sectors on skill upgrading for Turkey for the years: 1965, 1970, 1975, 1980, 1985, 1990, 2000, 2006, 2010 and 2015. For the upskilling decomposition variables, each year refers to the span between that year and the previous year.

[14] A positive between component value suggests that the reallocation is productivity enhancing, while a negative component value suggests that the reallocation is resulting in a net decrease in productivity.

The first year of data in Turkey is 1960, and therefore the upskilling variables for the data point 1965 refer to the span from 1960 to 1965. The first year of available data in Tunisia is 1967, and the first data point refers to the span of years from 1967 to 1975. [15] We acknowledge, however, that the small sample size is a significant problem which may cast doubt on our estimations. Hence our results should be interpreted with caution.

The second challenge is that skills and productivity are highly endogenous, and it is notoriously difficult to isolate the independent effects of the two. Our main variables of interest are the total skill upgrading, skill upgrading within sectors, and skill upgrading between sectors, and we use each of them independently (one at a time) because the sum of the within and between components is equal to total skill upgrading. Given the nature of the endogenous relationship between skills and productivity growth, it is ideal to use the Arellano-Bond type system GMM estimators. However, there are reasons why this is not possible. We have only 50 observations for a total of 5 sectors in Turkey, which can lead to problems of over-fitting and instrument proliferation, taking into account the fact that the time dimension is larger than the cross-section, i.e., $T = 10$ versus $N = 5$. Pooling the Turkish and Tunisian data does not solve the problem, as in that case, we would need to drop the sectors and use the overall decomposition results for the two countries.[16] Doing that would reduce the sample size even further without providing any added benefit for a sounder estimation strategy. Instead, our empirical strategy relies on first documenting the correlations based on OLS estimations, and then with the available data at hand, trying to investigate whether skill upgrading has a causal impact on productivity growth using three different sets of instrumental variables for Turkey. For Tunisia, we follow the same procedure.

Our first set of instruments is the lagged values of skill upgrading for each of the three measures that we defined above, plus the lagged values of the share of university graduates in each sector as a percent of the total economy-wide employment. Since the data is available for every five years for Turkey, the instruments that we use are the fifth lags. For Tunisia, since the data is irregular, we use the first lagged value available between two observations (such as using skill upgrading between 1967-1975 for predicting skill upgrading between 1975-1984) and lag $n - 5$ when observations allow (such as using skill upgrading from 2005 to 2010 to predict upgrading from 2010-2015). Our identifying assumption is that the lagged values of skill upgrading and the sectoral share of university graduates in economy-wide employment affect productivity only through their impact on current skill upgrading, and there is no direct association between current productivity and the lagged values of our instruments. Although our instruments pass commonly used identification tests in most specifications, these are admittedly strong assumptions which may, in fact, not hold. Hence we relax these assumptions one by one and try other instruments as explained below.

Using OLS and 2SLS, we estimate the following equation for each country:

[15] The data for Tunisia is more abundant than Turkey and yet more irregular spanning the years: 1967, 1975, 1984, 1989, 1994, 1997, annually between 2000 and 2007, and again for all years between 2010 and 2015, all of which provide 95 potential observations. Using annualized data, we choose to keep similar period gaps between the years in Turkey as in Tunisia to avoid too much noise in regressions. The years used in Tunisia are 1975, 1984, 1989, 1994, 2000, 2006, 2010, and 2015. Since years in which data is available for both countries do not entirely overlap (especially for the period before 2000), we prefer to run separate regressions for both countries to maximize the observations per country. More specifically, pooling the data results in a total of 70 observations of country-year pairs, 35 for each.

[16] More specifically, pooling the data means year-sector pairs would not be unique anymore as there are two pairs for each year and sector when Turkey and Tunisia are combined.

$$y_{i,t} = \beta_0 + \beta_1 Skill_{i,t} + \beta_2 X_{i,t} + \beta_3 \rho_t + \Delta W_t' \gamma + \lambda_i + \tau_t + \epsilon_{i,t} \quad (3)$$

where $y_{i,t}$ is the log of productivity in sector i between $t-1$ and t; $Skill_{i,t}$ is either i.) total skill upgrading, or, ii.) between skill upgrading, or iii.) within skill upgrading in sector i between $t-1$ and t. Following the work of McMillan and Rodrik (2011); McMillan et al. (2014) and Topalova and Khandelwal (2011), that identify commodity prices and trading trends as important factors impacting productivity, we control for the relative comparative advantage (RCA) of Turkish or Tunisian exported commodities on global markets, with $X_{i,t}$, which we extract from CEPII and de Saint Vaulry (2008) database.[17] In OLS specifications, we also control for the comparative advantage of EU commodities on global markets. Consistent with the literature on agricultural development (Gollin et al., 2013), we use average rainfall, ρ_t, as a control for agricultural output trends. These values are provided by the World Bank's Climate Change Knowledge Portal.[18] We include controls for real capital stock growth (at constant 2011 national prices) to control for capital flows. Lastly, following the literature on human capital and productivity (Teixeira and Queirós, 2016; Bárány and Siegel, 2018), we include a variable to control for the change in human capital index between $t-1$ and t, ΔW_t. Both the financial and human capital values are taken from the Penn dataset.[19] And finally, to follow standard cross-sectional analysis protocols, we control for λ_i sector and τ_t year fixed effects.

We start with baseline OLS estimations for Turkey and Tunisia in Tables 1 and 2. Columns (1), (4) and (7) shows the raw correlations between productivity and i) total skill upgrading, ii) skill upgrading between sectors, and iii) skill upgrading within sectors when only the year effects, sector effects, and sector-specific linear trends are controlled. The basic estimations show that there is a negative and but not statistically significant association between total skill upgrading and productivity growth for Turkey and a negative and significant association for Tunisia. When we look at the association between productivity and skill upgrading between sectors and within sectors separately, we see that skill upgrading between sectors, i.e., skilled biased structural change in column (4) is positively but not statistically significantly associated with productivity growth with a coefficient of 0.09 percentage points for Turkey. In Tunisia, it is again, negatively and significantly associated with productivity with a magnitude of 26 percentage points. [20] Likewise, in Turkey, upgrading skills within sectors is positively associated with productivity (and to a higher magnitude than upgrading of skills in sectors through reallocation), while it is negatively, but not significantly significantly associated with productivity in Tunisia.

[17] We are able to match CHELEM's relative comparative advantage data with agriculture, manufacturing, and services properly. However, since there is no comparable RCA for construction and public administration sectors, we assign zero for the two sectors. This variable is used as a proxy for country export activity and competitiveness. More details on this variable are in the annex.

[18] Since Turkish data is available for every five years, we take five years average of the rainfall data for Turkey, however since the data is irregular, we use the annual rainfall data for Tunisia.

[19] The Penn dataset from **?** uses a measure of human capital from **?** that captures the average years of schooling in 5-year intervals by age group for the working-age population. Their variables provide a yearly stock of the overall years of schooling as an aggregate. We acknowledge that there may be some multi-collinearity between our main skills upgrading variables and human capital stocks (supply of skills), but our skills variables include the number of employed individuals in each education category by sector. The employment values are, therefore, based on the demand for skilled workers per sector rather than a supply of educated individuals in the entire country. Furthermore, the primary goal of our paper is to estimate the causal effect of skill upgrading on productivity using employed skills (demand of skills) rather than the causal impact of skills itself. Lastly, we do not directly use human capital stock but the change in the human capital index.

[20] The differences in magnitude of estimates in Turkey and Tunisia is also reflective of the different total levels of productivity within each country.

In columns (2), (5) and (8), we include rainfall, real capital and human capital stock growth and in columns (3), (6) and (9) we also include the change in the relative comparative advantage of national exports and EU exports as two additional controls. Our estimations show that with additional controls, skill upgrading between sectors is still positive and not significantly associated with productivity for Turkey and that total skills, within sector and between sector skill upgrading is negative but either weakly or not significantly associated with productivity in Tunisia. In terms of magnitude, both columns (8) and (9) show that a percentage point increase in skill upgrading between sectors is, on average, associated with a 0.07 point increase in productivity for Turkey. The change in real exchange rates was negatively associated with productivity in Turkey, but not in Tunisia. This outcome may be due to the fact that in Turkey, exchange rates were fixed over most of the period of analysis, and used as a tool to improve competitiveness. While this was also the case in the earlier periods in Tunisia, exchange rates were floated at an earlier period. Interestingly, average rainfall negatively affects productivity in Turkey, whereas it has a positive impact on Tunisia. This correlation could be due to the fact that agriculture is still a prominent sector in Tunisia for which there could be a boost in productivity after more substantial rainfall, lifting the overall productivity, whereas it is the opposite in Turkey. Our results also show that capital accumulation is positively and significantly associated with productivity for Turkey but negatively associated with Tunisia. The percentage change in human capital stock is negatively and significantly associated with productivity in Turkey and negatively but not significantly associated with productivity in Tunisia. In Turkey, this may be explained in particular by education supply reforms that sharply lifted the supply of educated workers in the economy but did not react to the economy's demand for skills. In our baseline OLS estimations, the comparative advantage for EU exports and the comparative advantage of Tunisian and Turkish export measures are not significantly correlated with productivity.

If we now look at how good our estimations were at predicting actual productivity levels for Tunisia and Turkey in Tables 19 and 20, we see that in both cases fitted values of productivity are quite close to the estimated values for both Tunisia and Turkey. In both cases, the fitted regressions marginally overestimated productivity in the agricultural, manufacturing and services sector – all trade-able sectors. On the other hand, they very precisely estimated outcomes in the construction sector. Lastly, in Turkey, the fitted regression estimates also underestimated productivity in the government sector. However, in Tunisia, the fitted regression estimates overestimated productivity in the government sector.

So far, our estimations aimed to document the basic correlations between measures of skill upgrading and productivity without attributing any causal interpretation. In the macroeconomic literature, finding instruments to push towards causal inference for aggregate values is notoriously difficult. When possible, most authors use GMM methods or lagged values of key variables as instruments. We have discussed why a panel GMM is not possible due to over-fitting, but we can still attempt to follow others in the literature by using lagged values of variables that are closely related to and directly impact key right-hand side values. Following the review on aggregate productivity and education trends by Sianesi and Reenen (2003), one potential instrument for a macroeconomic study is the lagged values of skill upgrading and the share of university graduates in economy-wide employment as instruments. In what follows below, we rely on 2SLS estimations, which we hope will allow us to document the causal effect of skill upgrading on productivity. Tables 3 and 4 show the results of the OLS estimations

compared to our set of 2SLS estimations. For Turkey, estimates in the last three columns show that there is a positive and significant impact of total skills upgrading and reallocation of skills between sectors on productivity. More specifically, our results confirm that total skill upgrading and productivity are positively related and statistically significant for Turkey (Table 3), but there is no meaningful association captured in the last three columns for Tunisia (Table 4). Moreover, as in the decomposition analysis, our results suggest that the impact, on average, comes from the movement of skilled labor between sectors, rather than the upgrading of skills within sectors for Turkey.

The first stage results indicate that our instruments perform reasonably well for Turkey but weakly for Tunisia. In all specifications in Tables 3 and 4, Hansen's J Statistics show that the instruments are uncorrelated with the error term and satisfy the over-identification requirements. F statistics for the first stage for Turkey are above 10, except for skill upgrading within sectors. Moreover, the first stage coefficients of instruments for Turkey are highly significant, with the exception of the fifth lag of skill upgrading within sectors in columns (3) and (6). The negative coefficients for the two instruments reflect base effects, as larger changes in the past period, on average, led to lower increases in the current period. Overall, based on the instrument validity tests in the first stage, we can at least confidently argue that for the period between 1970-2015, the effect of skill reallocation between sectors on productivity was, on average, positive for Turkey. While this first set of instruments had a measurable impact on productivity, it had no impact on productivity growth. As for Tunisia, although the instruments perform relatively poorly and it is harder to argue based on poor instruments, there is no convincing evidence, using this method and these instruments with the available data, of the impact of skill upgrading on productivity growth whatsoever.

Overall, both the OLS and the 2SLS estimations point to the same empirical finding, that for the period between 1970-2015 *i*) total skill upgrading has been a positive determinant of productivity for Turkey, *ii*) Skill reallocation between sectors was the main driver of productivity increases in Turkey, however, *iii*) there were no robust findings for Tunisia.

5 Conclusion

This article aimed at understanding the links between skill demand and productivity using a structural change perspective. We relied on decomposition techniques and regressions using Tunisian and Turkish postwar sectoral data.

The productivity decomposition results showed that structural change played a significant role during the last 40 years, but that productivity upgrading within sectors plays a more critical role in explaining overall productivity decomposition only in the more recent years. The skills decomposition results show us that concurrently, overall skills upgrading is characterized by the reallocation of skills across sectors. Furthermore, historically, there were more high, and medium-skilled workers occupied more jobs in the government sector in Tunisia than in Turkey, which may have been explained by post-colonial path dependency in the 1960s.

Our regression results show that skill upgrading has a causal impact on productivity. The main driver of productivity is the reallocation of skilled labor between sectors and not the

increase of the share of highly educated workers within sectors.

The policy implications of the outcomes are essential. In Tunisia, weak instruments may be limiting further causal inferences, however, descriptively, the reallocation of skilled labor and reallocation of resources (structural change) do not seem to have a strong positive impact on productivity, while it is evident that from the productivity decomposition analysis there seems to be a swelling of resources contributing to productivity within sectors. The relatively higher allocation of educated skilled labor into the public sector may be impeding a more productive contribution of such skills to the economy. In Turkey, the measurable positive impact of skill reallocation, and the concurrent higher levels of productivity are being explained by the growth of sectors (the increases in the within component of the productivity decomposition) in more recent years. This finding suggests that productivity increased by the reallocation of high skills into sectors that are more productive and on the verge of expansion.

The historical context and institutions of both countries are essential in how skills can contribute to productivity in the economy. Historically in Turkey, the private sector was more dynamic at an earlier stage. It experienced growth-enhancing reforms, concurrently with education reforms creating an institutional environment where skills contributed to productivity. On the other hand, a strong statist tradition, in a post-colonial institutional setting, that absorbed high skills into the government sector to build the modern state. Access to education in Tunisia may have been historically higher, but its economy was not moving fast enough to absorb them appropriately. To respond to Lant Pritchett, education went more to productive activities in Turkey, while in Tunisia, high skilled education continued to be channeled to the public sector in the absence of sufficient opportunities in the formal private sector. This final result means that the contribution of education to productivity growth depends on the historical institutional setting of the country.

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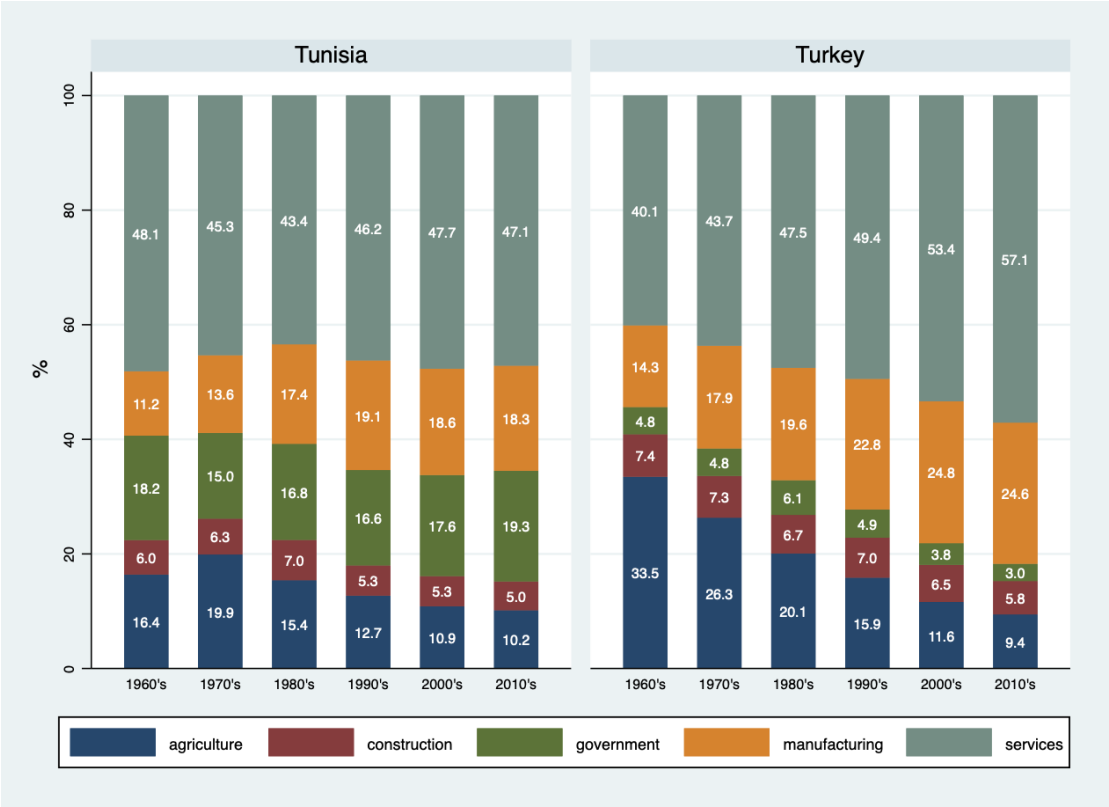
Figure 1: Sectoral Composition of Value Added



Further explanation of variables.

Revealed Comparative Advantage (Tunisia and Turkey to the rest of the world, in 2010 USD.)

$$RCA_{i,k} = 1000 * \frac{W_k}{YPPA_i}\left[\frac{X_{i,k} - M_{i,k}}{W_k} - \frac{X_i - M_i}{W}\right] \tag{4}$$

where W represents world exports; $YPPA$ is GDP measured in thousands; X represents exports; and M represents imports for each good k and country i.

In using this measure, we rely on the assumptions that *i*) both Turkey and Tunisia are small, price-taker countries whose supply of goods do not significantly impact world demand, or significantly pose any dumping or anti-competitive risks, and *ii*) that world trends are exogenously determined outside of Turkish and Tunisian internal industrial and educational trends.

Table 1: OLS Estimations for Sectoral Productivity (Value-Added per worker), Turkey

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS
Skill Upgrading	-0.011	0.077	0.074						
	[0.096]	[0.093]	[0.095]						
Skill Upgrading Between				-0.095	0.008	0.007			
				[0.172]	[0.167]	[0.173]			
Skill Upgrading Within							0.022	0.162	0.162
							[0.132]	[0.131]	[0.134]
Real exchange rate (% change)		-0.235**	-0.236**		-0.250**	-0.247**		-0.245***	-0.251**
		[0.092]	[0.109]		[0.091]	[0.108]		[0.088]	[0.102]
Average rainfall (mm)		-2.133**	-2.133**		-2.265**	-2.235**		-2.226***	-2.277**
		[0.839]	[0.994]		[0.829]	[0.994]		[0.801]	[0.936]
Capital stock growth (2011 national prices, in logs)		8.354**	8.324**		8.867***	8.731**		8.677***	8.821**
		[3.035]	[3.534]		[3.003]	[3.533]		[2.931]	[3.353]
Human capital stock (% change)		-18.083***	-18.004**		-19.059***	-18.770**		-18.596***	-18.860**
		[6.161]	[7.143]		[6.033]	[7.061]		[5.996]	[6.825]
Comparative advantage of EU exports (% change)			-0.010			-0.012			-0.007
			[0.022]			[0.023]			[0.021]
Comparative advantage of TR exports (% change)			-0.004			-0.004			-0.004
			[0.005]			[0.005]			[0.005]
Constant	-84.776***	18.307	18.272	-85.066***	26.223	24.590	-85.148***	20.439	22.994
	[9.868]	[39.906]	[48.459]	[9.492]	[38.886]	[47.874]	[10.393]	[37.356]	[44.731]
Observations	50	45	45	50	45	45	50	45	45
R-squared	0.970	0.977	0.977	0.970	0.976	0.976	0.970	0.977	0.978
Sector specific Time Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Productivity growth refers to annualized growth of value-added per worker.

Table 2: OLS Estimations for Sectoral Productivity (Value-Added per worker), Tunisia

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS
Skill Upgrading	-0.212**	-0.212**	-0.187*						
	[0.084]	[0.084]	[0.092]						
Skill Upgrading Between				-0.262**	-0.262**	-0.237*			
				[0.109]	[0.109]	[0.124]			
Skill Upgrading Within							-0.561*	-0.561*	-0.498
							[0.327]	[0.327]	[0.410]
Real x-rate growth		0.007	0.007		0.007	0.006		0.008	0.008
		[0.005]	[0.005]		[0.005]	[0.005]		[0.005]	[0.006]
Rainfall (mm)		0.025**	0.024*		0.024**	0.022		0.028**	0.026*
		[0.011]	[0.013]		[0.011]	[0.013]		[0.012]	[0.015]
Capital stock growth (2011 national prices, in logs)		-1.476***	-1.464**		-1.492***	-1.481***		-1.372**	-1.375**
		[0.504]	[0.523]		[0.498]	[0.510]		[0.539]	[0.558]
Human capital stock (% change)		-0.206	-0.252		-0.170	-0.204		-0.327	-0.400
		[0.857]	[0.861]		[0.845]	[0.834]		[0.908]	[0.965]
Comparative advantage of EU exports (% change)			0.008			0.010			0.006
			[0.015]			[0.014]			[0.018]
Comparative advantage of TN exports (% change)			0.001			0.001			0.001
			[0.001]			[0.001]			[0.001]
Constant	-17.034*	-16.844*	-16.484*	-17.478*	-17.268*	-16.770*	-17.147*	-17.040*	-16.594*
	[8.591]	[8.669]	[8.841]	[8.511]	[8.596]	[8.643]	[8.852]	[8.920]	[9.211]
Observations	40	40	40	40	40	40	40	40	40
R-squared	0.981	0.981	0.982	0.981	0.981	0.982	0.980	0.980	0.981
Sector specific Time Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Productivity growth refers to annualized growth of value-added per worker.

Table 3: OLS and 2SLS Estimations of Sectoral Productivity, Turkey

	(A) OLS : Log of value added per worker			(B) 2SLS : Log of value added per worker		
	Total Skill Upgrading	Between Upgrading	Within Upgrading	Total Skill Upgrading	Between Upgrading	Within Upgrading
Skill Upgrading	0.074			0.122*		
	[0.095]			[0.074]		
Skill Upgrading Between		0.007			0.259*	
		[0.173]			[0.144]	
Skill Upgrading Within			0.162			0.163
			[0.134]			[0.169]
Real x-rate growth	-0.236**	-0.247**	-0.251**	-0.237***	-0.214**	-0.259***
	[0.109]	[0.108]	[0.102]	[0.077]	[0.086]	[0.070]
Average rainfall (mm)	-2.133**	-2.235**	-2.277**	-2.150***	-1.939**	-2.348***
	[0.994]	[0.994]	[0.936]	[0.699]	[0.782]	[0.637]
Capital stock growth (2011 national prices, in logs)	8.324**	8.731**	8.821**	8.354***	7.617***	9.073***
	[3.534]	[3.533]	[3.353]	[2.505]	[2.787]	[2.297]
Human capital stock (% change)	-18.004**	-18.770**	-18.860**	-18.099***	-16.858***	-19.363***
	[7.143]	[7.061]	[6.825]	[5.082]	[5.597]	[4.694]
Comp. advantage of TR exports (% change)	-0.004	-0.004	-0.004	-0.003	-0.002	-0.004
	[0.005]	[0.005]	[0.005]	[0.004]	[0.005]	[0.004]
Constant	18.272	24.590	22.994	18.5	11.696	26.634
	[48.459]	[47.874]	[44.731]	[33.352]	[36.837]	[30.326]
Observations	45	45	45	45	45	45
R-squared	0.977	0.976	0.978	0.976	0.974	0.977
Controls	YES	YES	YES	YES	YES	YES
FIRST STAGE AND IDENTIFICATION for 2SLS Estimations						
Coefficients of Instruments						
L5. Share of College Grad. in Tot. Emp.				-38.420***	-24.410***	-14.145**
				[7.606]	[3.760]	[6.370]
L5. Total Skill Upgrading				-0.372		
				[0.138]		
L5. Between Skill Upgrading					-0.390***	
					[0.130]	
L5. Within Skill Upgrading						-0.342
						[0.212]
Sanderson-Windmeijer F Statistic				13.04	22.92	2.74
				pval(0.000)	pval(0.000)	pval(0.0837)
Hansen J Statistic				0.003	0.708	0.913
				pval(0.955)	pval(0.400)	pval(0.339)

(1) Newey West standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

(2) Null hypothesis for S.-Windmeijer weak identification test is that *the particular endogenous regressor in question is unidentified*.

(3) Null for Hansen's J statistic is that the *instruments are uncorrelated with the error term*.

Table 4: OLS 2SLS Estimations of Sectoral Productivity, Tunisia

	(A) OLS : Log of value added per worker			(B) 2SLS : Log of value added per worker		
	Total Skill Upgrading	Between Upgrading	Within Upgrading	Total Skill Upgrading	Between Upgrading	Within Upgrading
Skill Upgrading	-0.187*			-0.037		
	[0.092]			[0.239]		
Skill Upgrading Between		-0.237*			-0.238	
		[0.124]			[0.551]	
Skill Upgrading Within			-0.498			0.590
			[0.410]			[0.517]
Real x-rate growth	0.007	0.006	0.008	0.019***	0.017***	0.019***
	[0.005]	[0.005]	[0.006]	[0.005]	[0.006]	[0.005]
Average rainfall (mm)	0.024*	0.022	0.026*	0.051***	0.045**	0.054***
	[0.013]	[0.013]	[0.015]	[0.014]	[0.018]	[0.013]
Capital stock growth (2011 national prices, in logs)	-1.464**	-1.481***	-1.375**	0.221	0.254	0.184
	[0.523]	[0.510]	[0.558]	[0.329]	[0.331]	[0.312]
Human capital stock (% change)	-0.252	-0.204	-0.400	-0.900	-0.670	-0.990
	[0.861]	[0.834]	[0.965]	[0.906]	[1.056]	[0.820]
Comp. advantage of TN exports (% change)	0.001	0.001	0.001	-0.003***	-0.004**	-0.004**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Observations	40	40	40	35	35	35
R-squared	0.982	0.982	0.981	0.983	0.984	0.979
Controls	YES	YES	YES	YES	YES	YES
FIRST STAGE AND IDENTIFICATION for 2SLS Estimations						
Coefficients of Instruments						
Lagged Share of College Graduates in Tot. Emp.				-12.2**	-5.89	–8.051***
				[4.71]	[4.39]	[2.690]
Lagged Total Skill Upgrading				0.009		
				[0.123]		
Lagged Between Skill Upgrading					0.019	
					[0.150]	
Lagged Within Skill Upgrading						-0.115
						[0.110]
Sanderson-Windmeijer F Statistic				3.42	1.05	6.34
				pval(0.056)	pval(0.373)	pval(0.009)
Hansen J Statistic				7.08	6.84	2.65
				pval(0.008)	pval(0.009)	pval(0.104)

(1) Newey West standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

(2) Null hypothesis for S.-Windmeijer weak identification test is that *the particular endogenous regressor in question is unidentified*.

(3) Null for Hansen's J statistic is that the *instruments are uncorrelated with the error term*.

Figure 2: Sectoral Composition of Employment

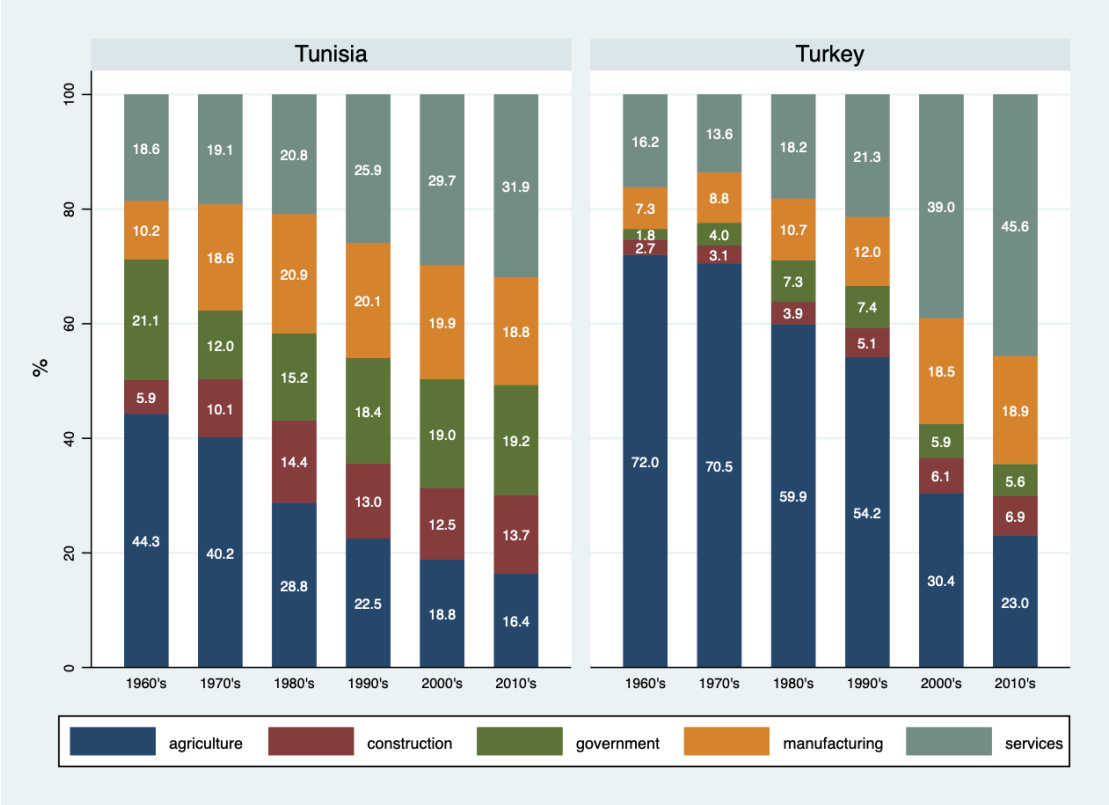
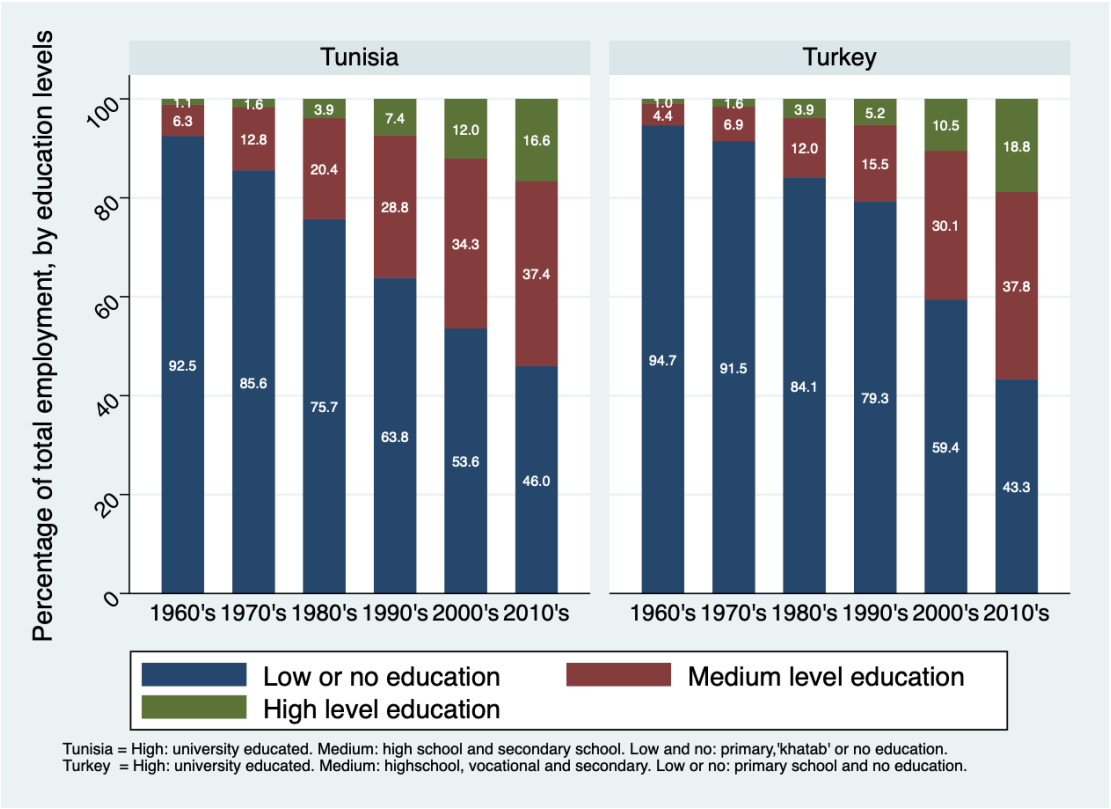
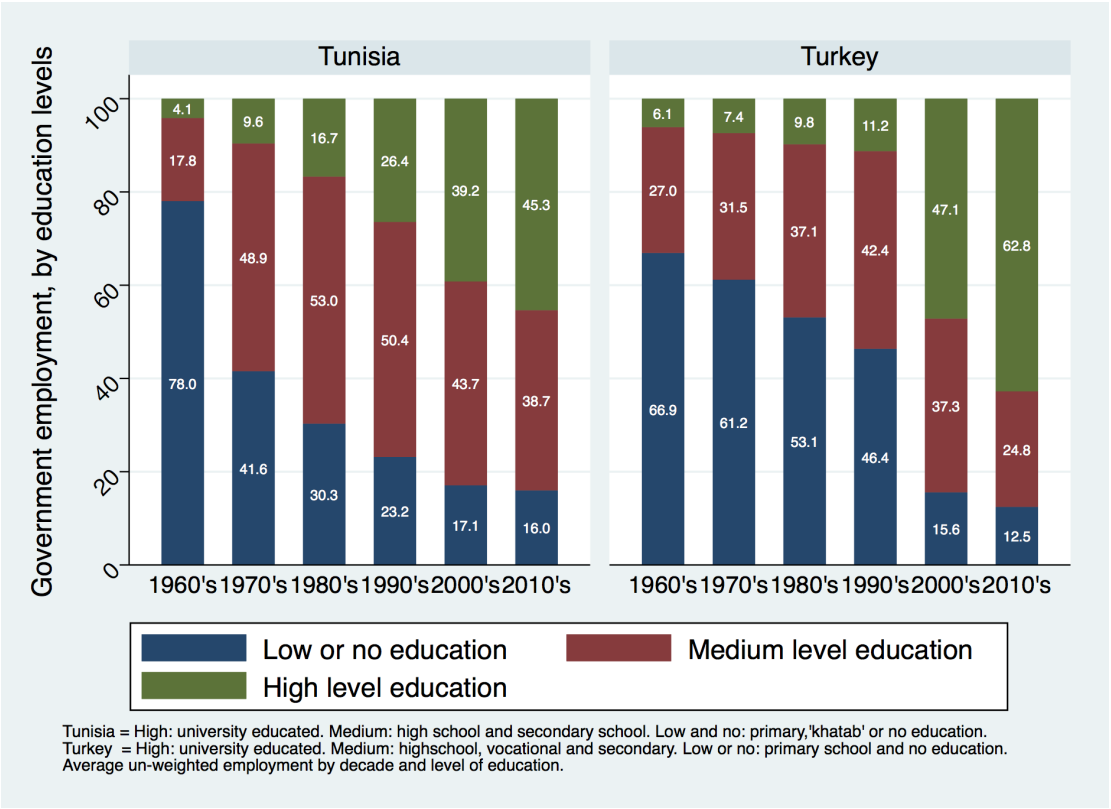


Figure 3: Composition of Education



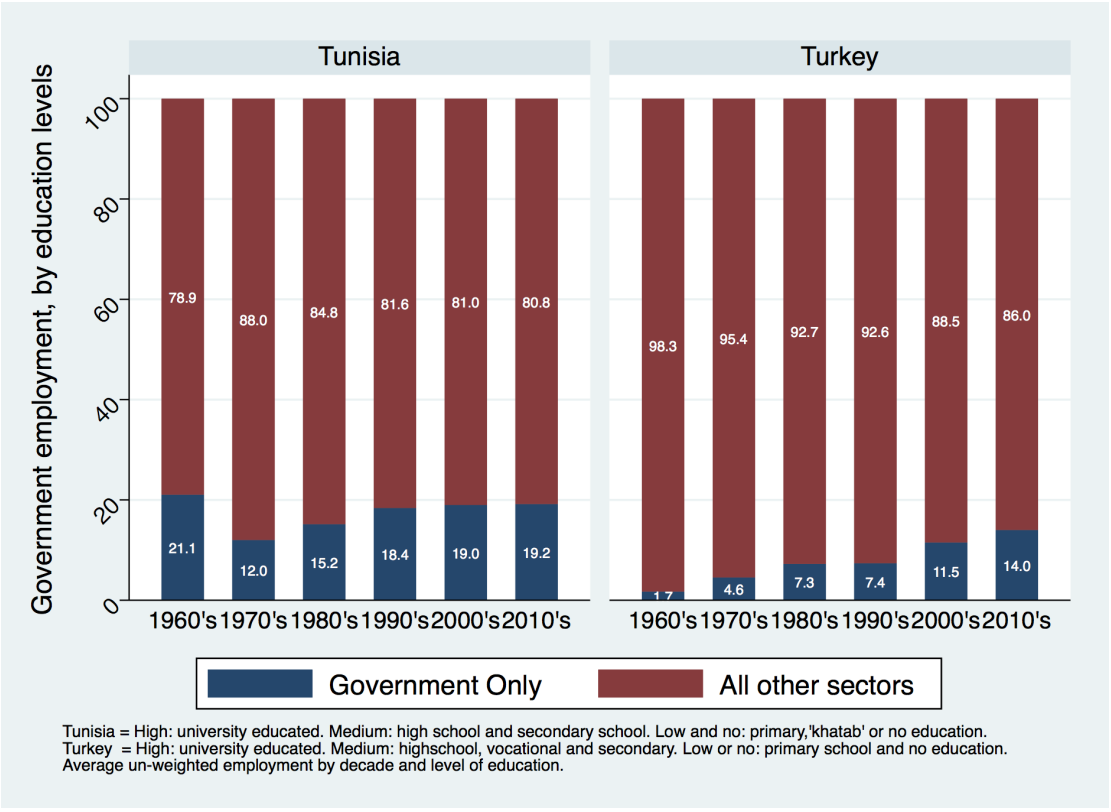
Tunisia = High: university educated. Medium: high school and secondary school. Low and no: primary,'khatab' or no education.
Turkey = High: university educated. Medium: highschool, vocational and secondary. Low or no: primary school and no education.

Figure 4: Government Employment



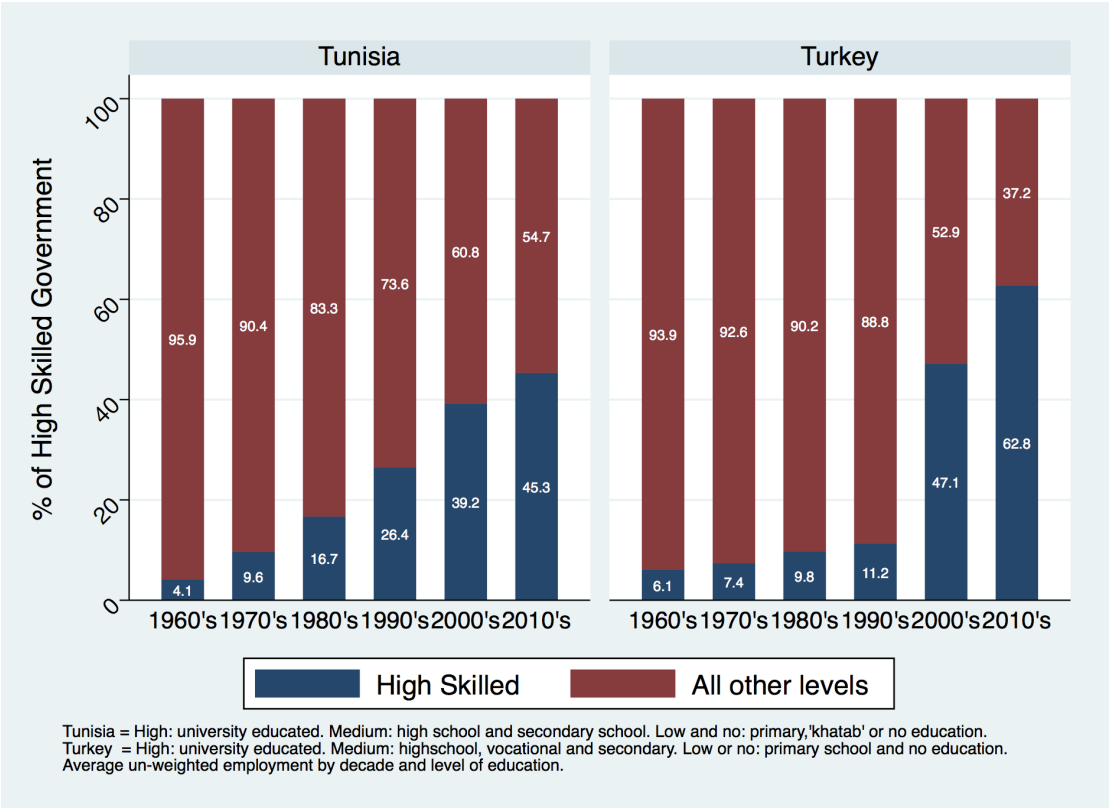
Tunisia = High: university educated. Medium: high school and secondary school. Low and no: primary,'khatab' or no education.
Turkey = High: university educated. Medium: highschool, vocational and secondary. Low or no: primary school and no education.
Average un-weighted employment by decade and level of education.

Figure 5: Total Government Employment



Tunisia = High: university educated. Medium: high school and secondary school. Low and no: primary,'khatab' or no education.
Turkey = High: university educated. Medium: highschool, vocational and secondary. Low or no: primary school and no education.
Average un-weighted employment by decade and level of education.

Figure 6: Total High Skilled Government Employment



Tunisia = High: university educated. Medium: high school and secondary school. Low and no: primary,'khatab' or no education.
Turkey = High: university educated. Medium: highschool, vocational and secondary. Low or no: primary school and no education.
Average un-weighted employment by decade and level of education.

Figure 7: Cross-correlations for Productivity and Skills Decomposition

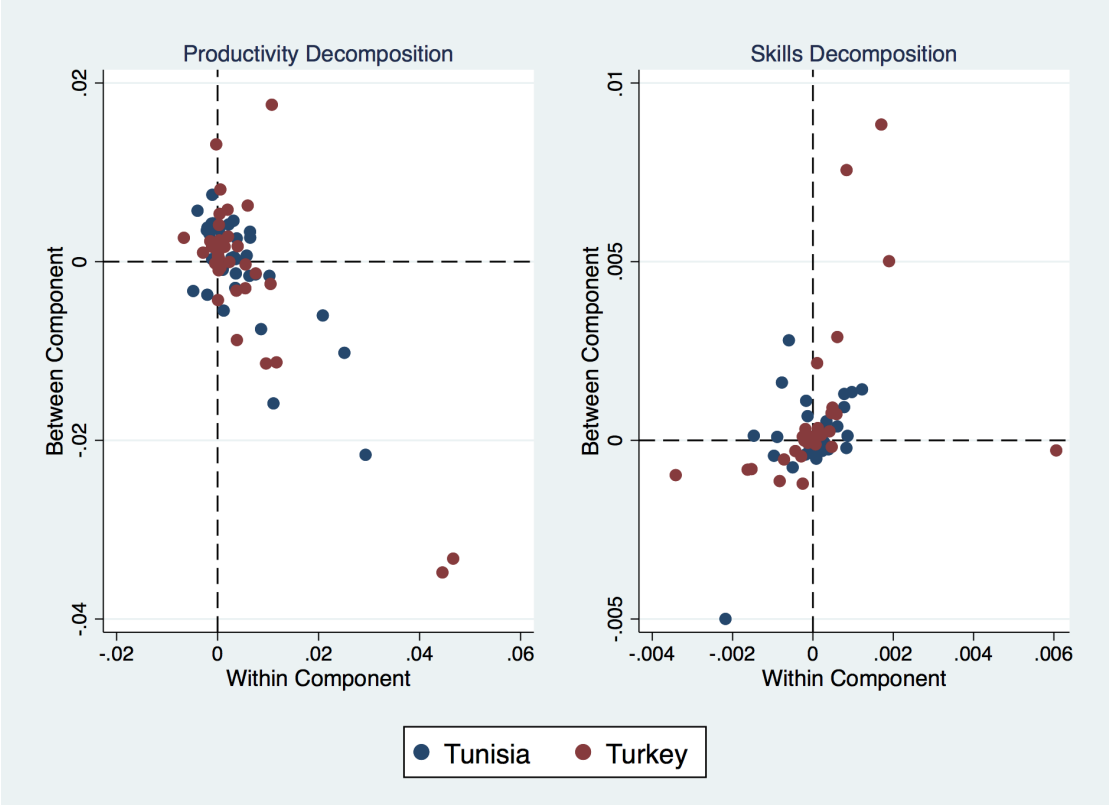


Figure 8: Cross-correlations for Productivity and Skills Decomposition

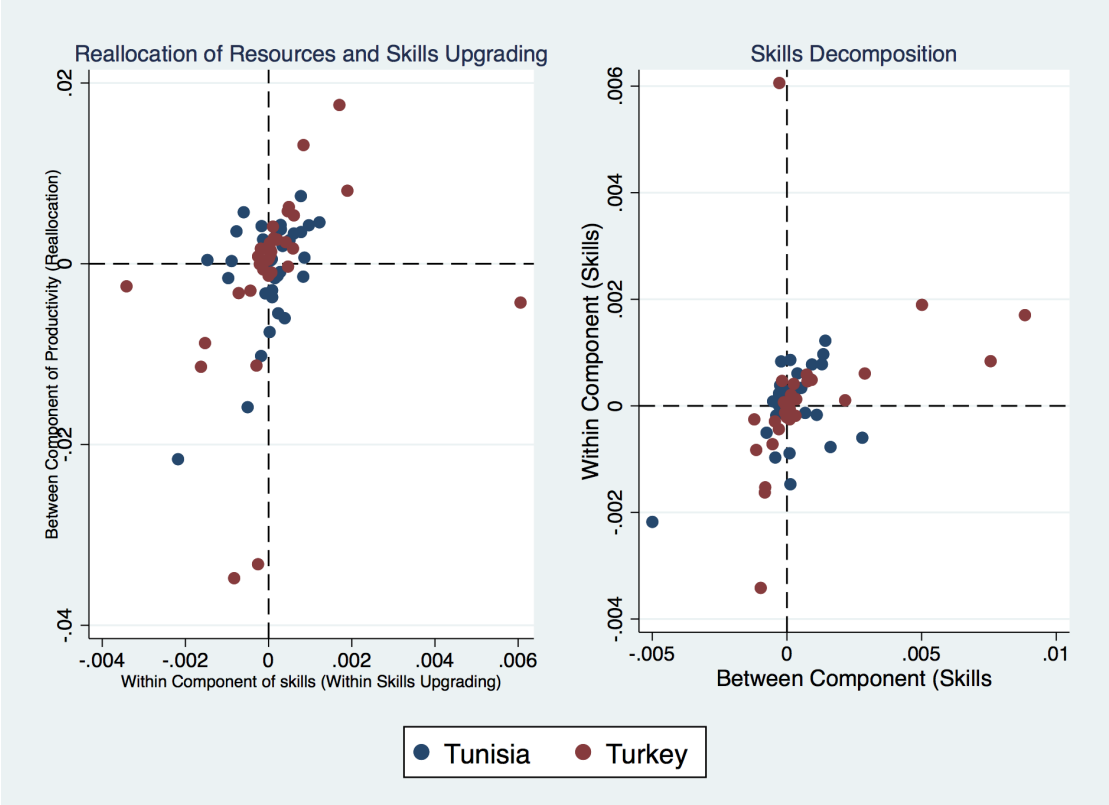


Figure 9: Correlations for Productivity and Skills Decomposition

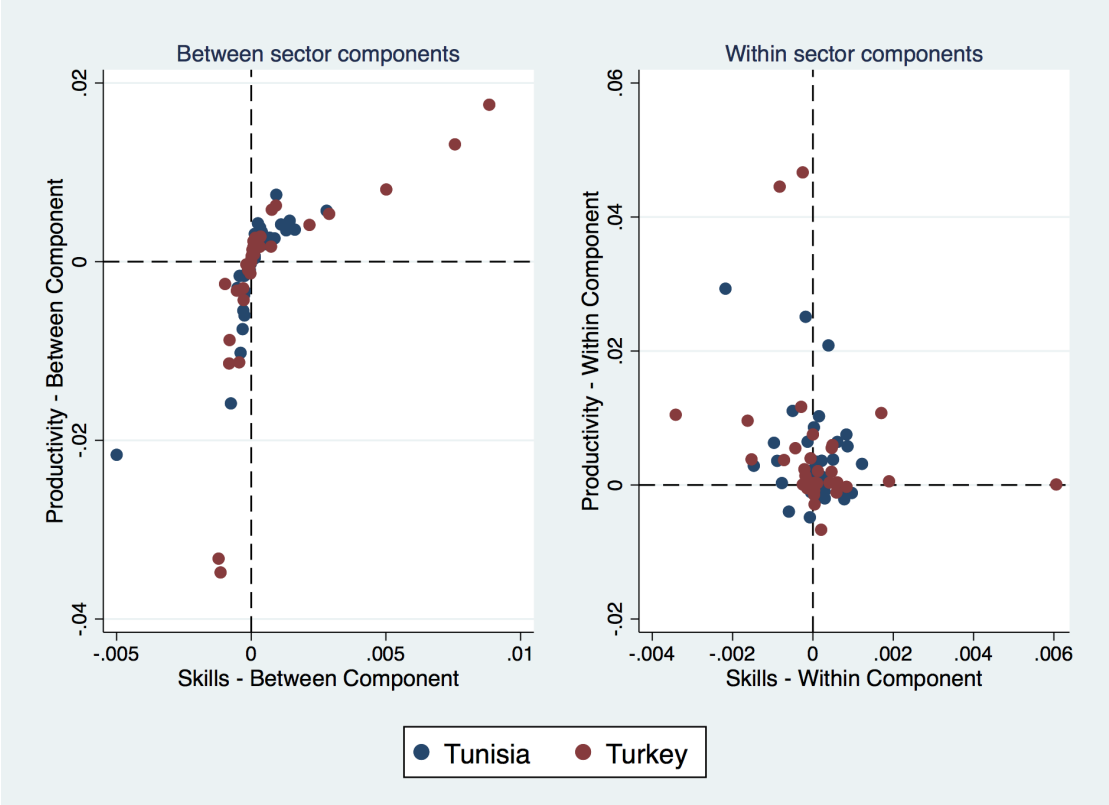


Figure 10: Productivity Decomposition Correlations, by sector

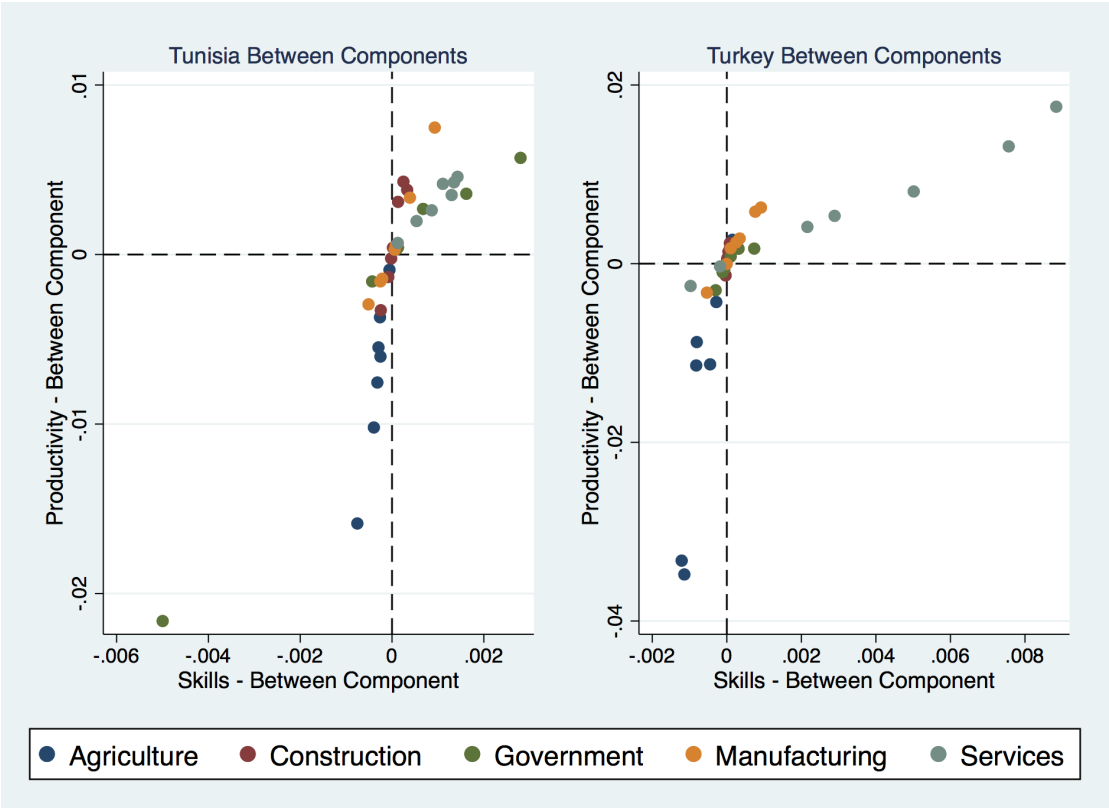


Figure 11: Turkey : Productivity Decomposition Correlations by sector

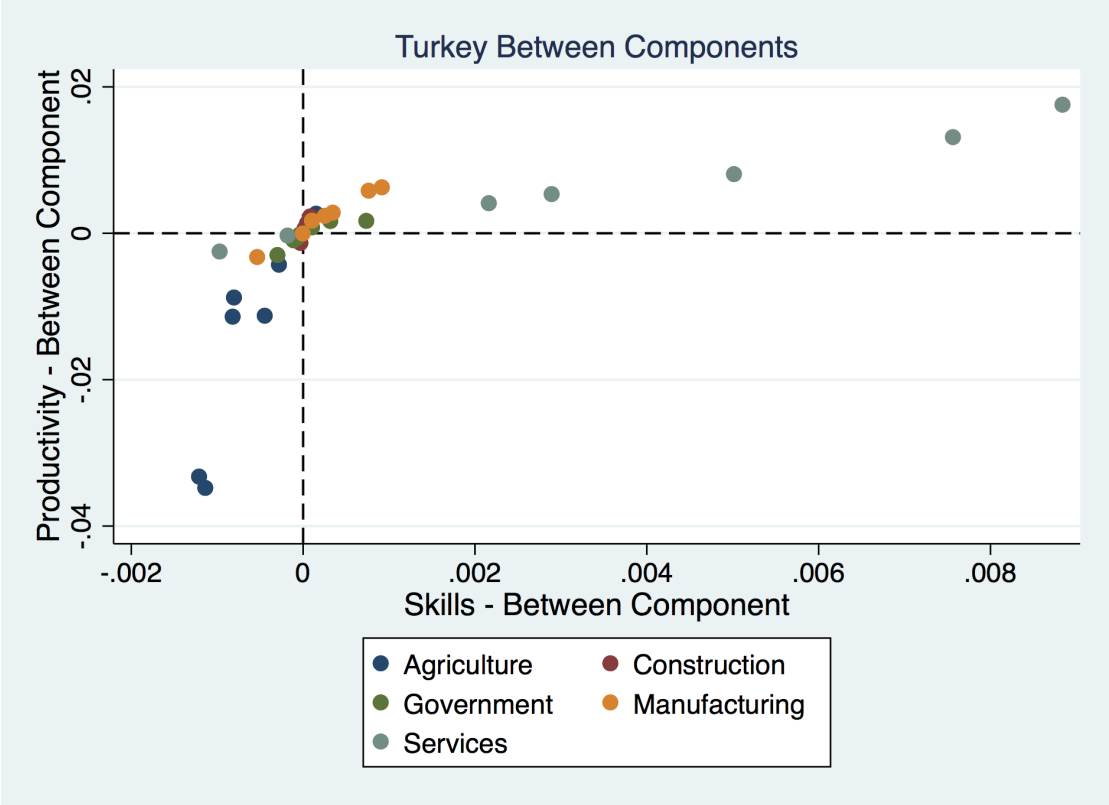
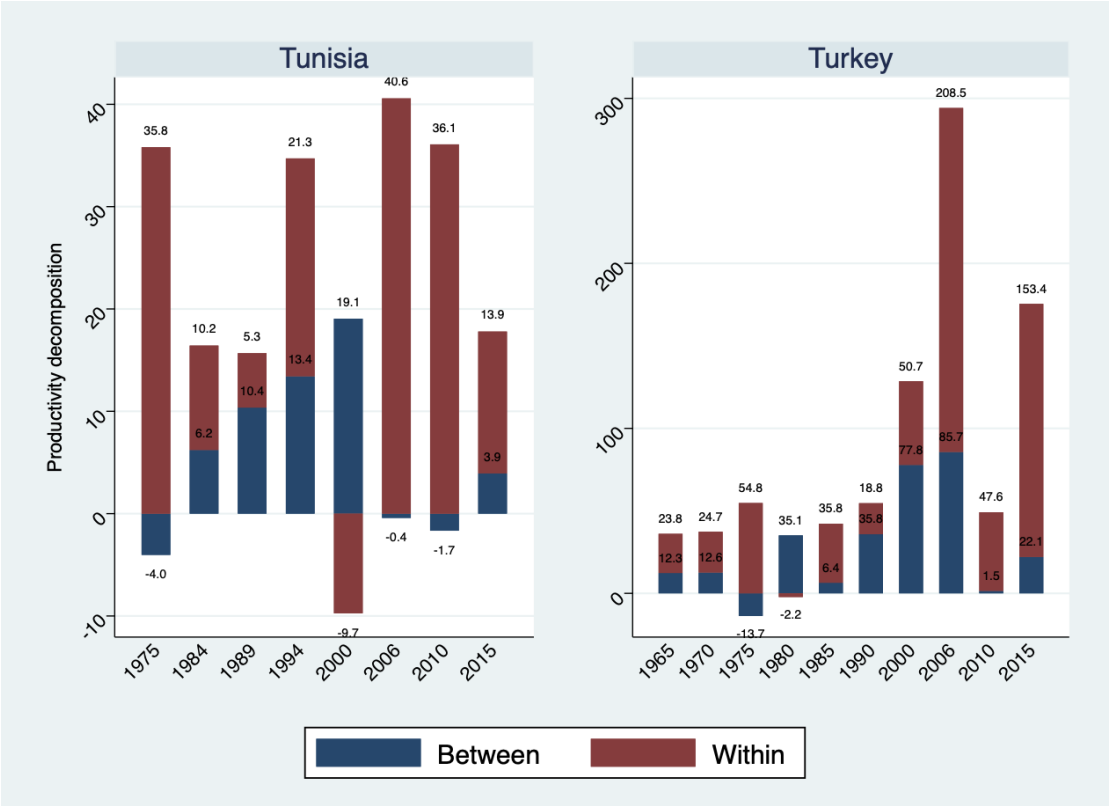
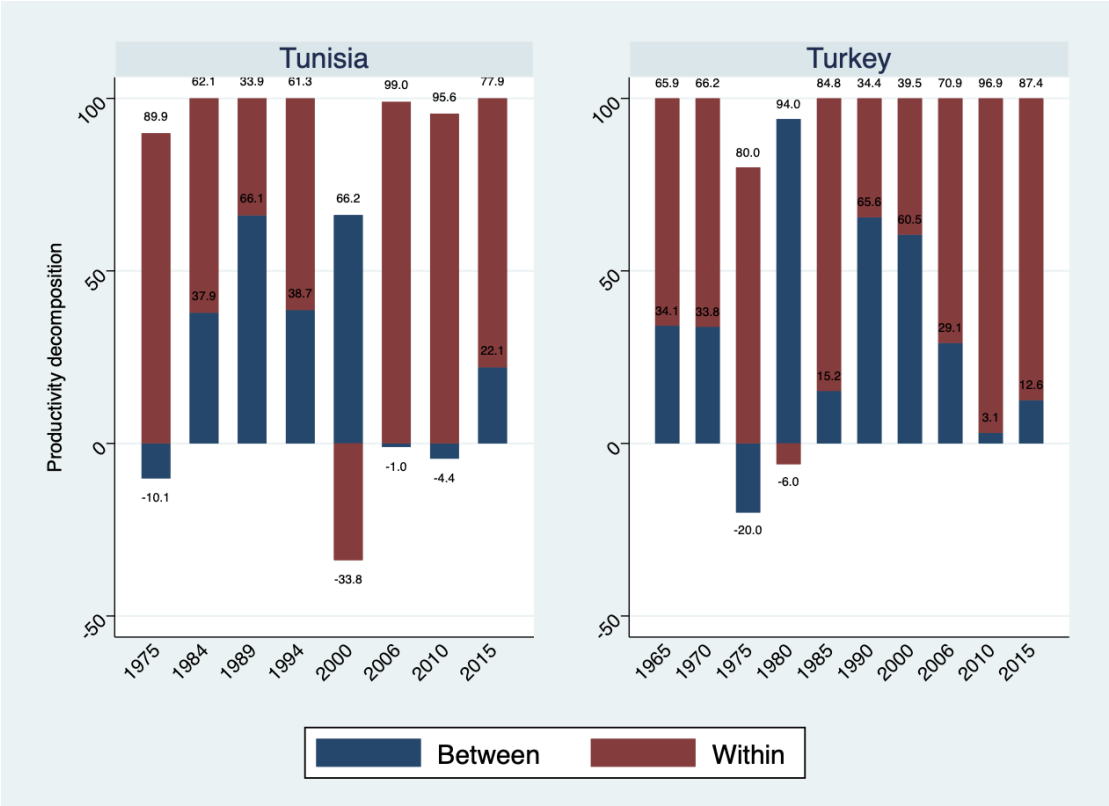


Figure 12: Total Productivity Decomposition



Note: The bars should be interpreted as representing the change between the current year and the prior year (annualized). For Tunisia, the prior year for 1975 is 1967. For Turkey, the prior year is 1960.

Figure 13: Structural Change and Within Component (as a % of total skills upgrading)



Note: The bars should be interpreted as representing the change between the current year and the prior year (annualized). For Tunisia, the prior year for 1975 is 1967. For Turkey, the prior year is 1960.

Figure 14: Productivity in Tunisia

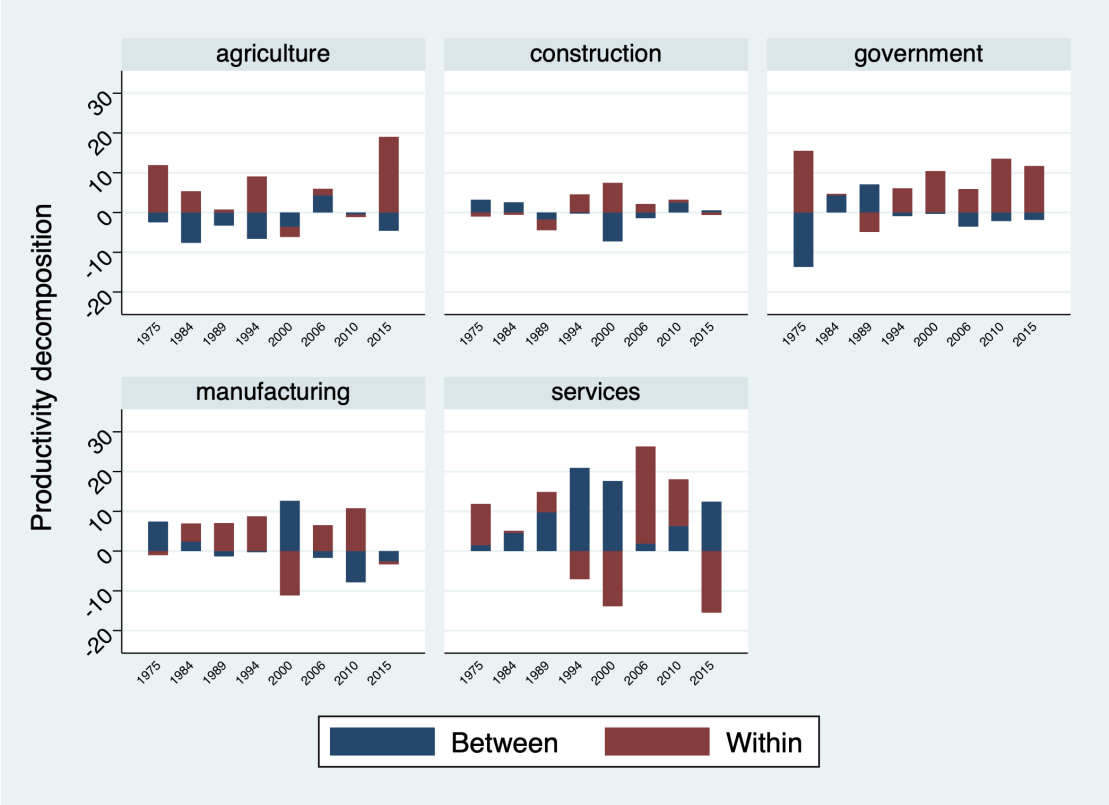


Figure 15: Productivity in Turkey

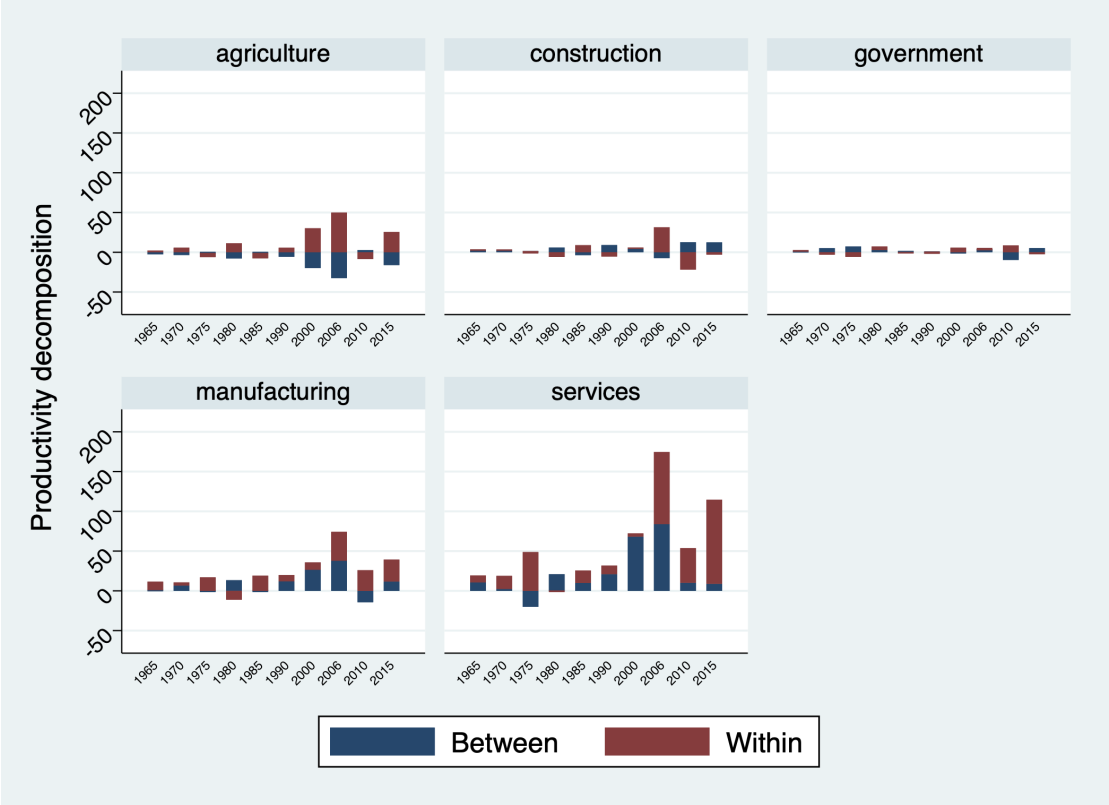


Figure 16: Productivity (levels) and Share of Employment (Tunisia)

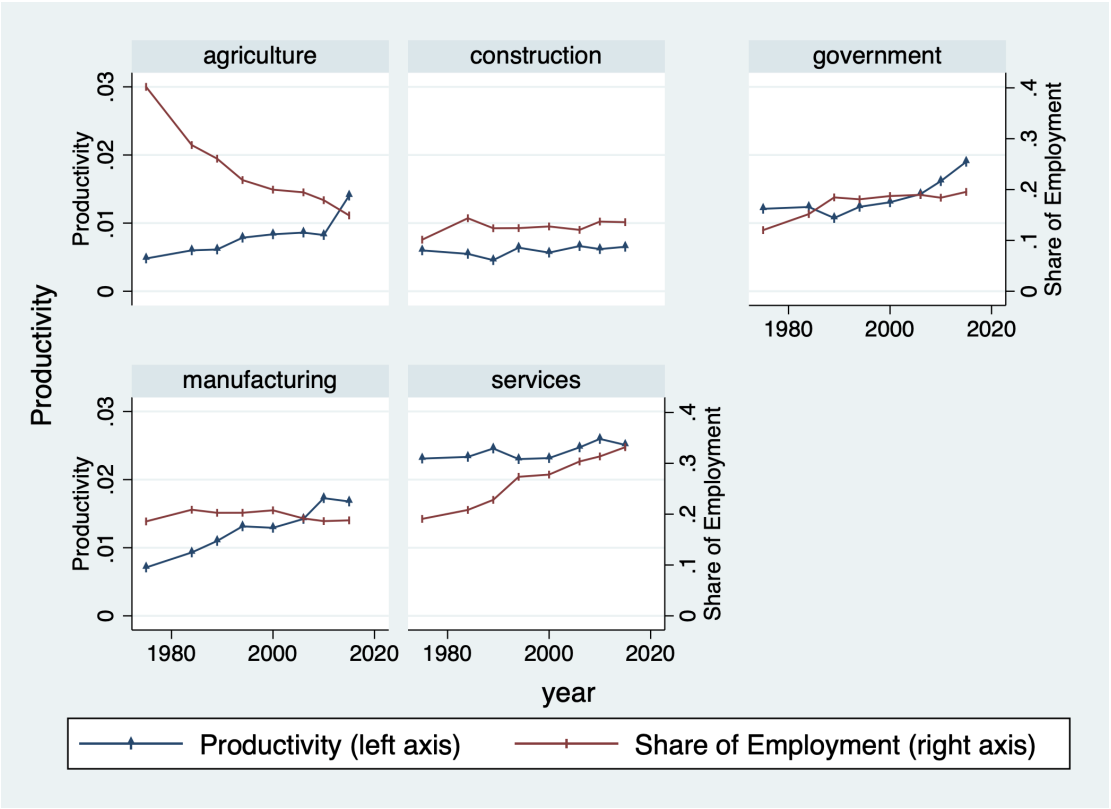


Figure 17: Share of Productivity (levels) and Share of Employment (Turkey)

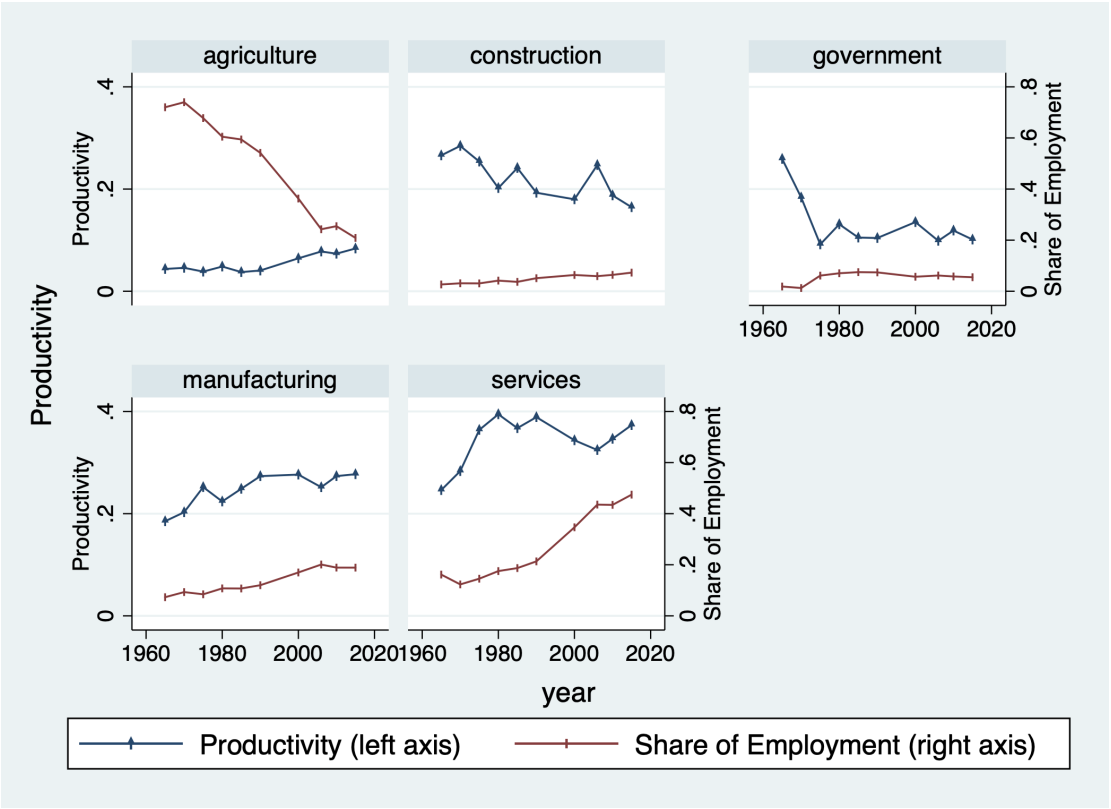


Figure 18: Skills Decomposition

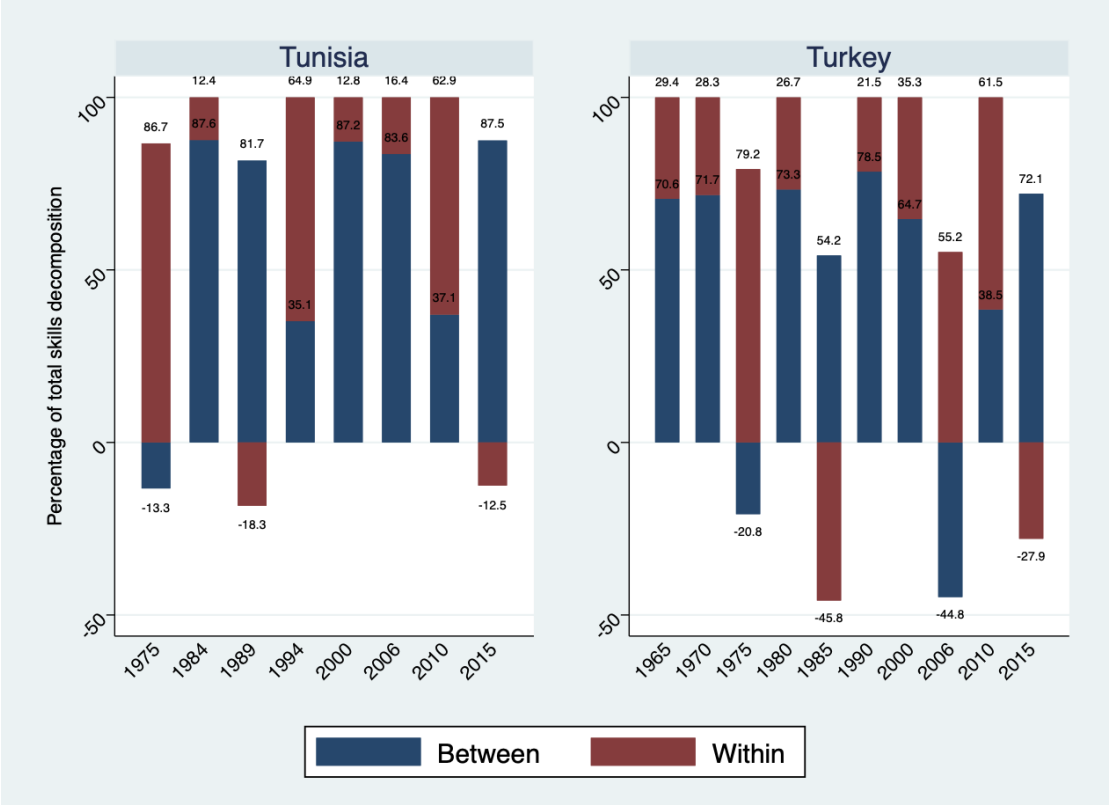


Figure 19: Turkey: Fitted versus Actual Productivity Estimates

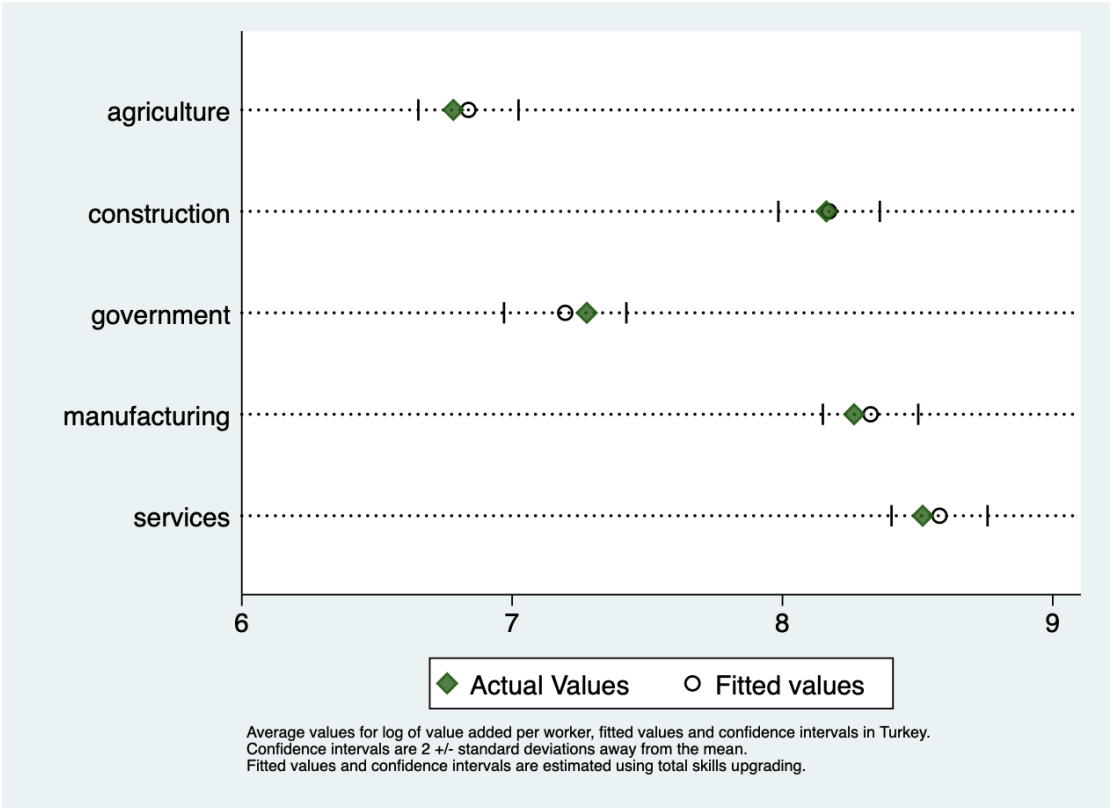


Figure 20: Tunisia: Fitted versus Actual Productivity Estimates