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Resource Misallocation in Turkey

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Abstract

This paper examines resource misallocation within narrow industries in Turkey. It finds that resource misallocation in Turkey is substantial. The hypothetical gain from moving to "U.S. efficiency" is 24.5 percent of manufacturing total factor productivity in 2014. The evolution of resource misallocation over time and across disaggregated sectors is also examined. Improvement in allocative efficiency was sizable between 2003 and 2013, but significantly slower after 2007. However, the earlier trend reversed in 2014 and resource misallocation worsened in Turkey's manufacturing. The cross-sector analysis reveals that misallocation is most pronounced in textiles, transport, food, and leather.

This paper is a product of the Macroeconomics and Growth Team, Development Research Group and the Macroeconomics and Fiscal Management Global Practice Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at hanguyen@worldbank.org.

RESOURCE MISALLOCATION IN TURKEY

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Keywords: Total factor productivity, across-firm misallocation, within-sector misallocation, firm-level data, firm heterogeneity, Turkey.

J.E.L Codes: D24, L25, O12.

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1. Introduction

Turkey’s economy expanded rapidly in the 2000s, and per capita income is now close to the threshold beyond which the World Bank classifies countries as high income. While part of this economic growth was attributable to human and physical capital accumulation, an important fraction was due to total factor productivity (TFP) growth (World Bank, 2014).

Growth in TFP can be divided into three different sources. The first one is via growth in technology, which is the most traditional thinking about TFP. The second source is the movement of factors from sectors with lower productivity (such as agriculture) to sectors with higher productivity (such as manufacturing). About two-thirds of the overall productivity gains in Turkey came from the shift of labor out of agriculture and into higher-productivity manufacturing and service industries (World Bank, 2014). The third source of improving a country’s TFP is via better allocation of resources within industries. This takes place when resources from firms with lower productivity move to firms with higher productivity. Since the seminal work of Restuccia and Rogerson (2008) and Hsieh and Klenow (2009), we know that across-firm resource misallocation within industries can lead to lower aggregate TFP. Across-firm resource misallocation is a consequence of highly productive firms not obtaining sufficient resources (in terms of capital and labor) to expand production, while firms with low productivity continue employing resources instead of shrinking and eventually exiting. This could be a result, for example, of politically connected firms having easier access to finance and therefore expanding production, despite their productivity being lower than that of less connected firms. This phenomenon could substantially reduce a country's total output and productivity because highly productive firms would be smaller and less productive ones would be larger than they should be at optimal allocation. Hsieh and Klenow (2009) estimate that if the problem of resource allocation in China and India is eliminated, that is, if capital and labor are hypothetically reallocated to equalize marginal products to the extent observed in the United States, manufacturing TFP can increase 30% to 50% in China and 40% to 60% in India.

In this paper, using Hsieh and Klenow’s (2009) framework (HK, henceforth), we measure how much aggregate manufacturing TFP in Turkey could increase if capital and labor were reallocated to equalize marginal products across firms within each four-digit sector to the extent observed in the United States in 1997. For Turkey, moving to ‘1997 U.S. efficiency’ could have boosted manufacturing TFP by 24.5% in 2014. Thanks to the availability of Turkish manufacturing data covering 11 years, from 2003 to 2014, we can track the improvement of resource allocation in Turkey over time. We find that resource allocation improved quite significantly. In 2003, the manufacturing TFP gap from the US caused by resource misallocation is 56.1%, while that in 2013 is only 18.4%. Finally, we break down resource misallocation by industries and by regions. The results reveal that resource misallocation is larger among textile, transport, food, and leather industries.

The rest of the paper is organized as follows: section 2 provides some background on Turkish economy; section 3 reviews the related literature; section 4 explains the analytical framework; section 5 describes the data set; section 6 presents the results; and finally, section 7 concludes.

2. Background on Turkey's economy[2]

Turkey is an upper middle income country and a member of G20. Turkey has the world's 17th largest nominal GDP (in PPP units) and stands at the threshold to high income today, with GNI per capita (Atlas method, current US$) at $10,830 in 2014.[3]

Turkey's economic development after 2001 resulted in impressive economic achievements. After a banking crisis in 2001, the country embarked on a concerted path of structural reforms supported by strong fiscal consolidation, strengthened banking supervision, and a shift to a flexible exchange rate regime with an independent central bank responsible for inflation targeting. The pro-market reform process was further enhanced and anchored by the EU Accession process. In the following period, Turkey`s economy grew on average by 6.9% annually until the Global Economic and Financial crisis.

Turkey had already started to exhaust the benefits of the reform momentum of the early 2000s. However, the global crisis and subsequent rapid recovery in Turkey had diverted attention from remaining structural weaknesses and considerably complicated macroeconomic management (World Bank, 2014). Following a swift rebound from the recession in the crisis in 2008-09, concerns over Turkey's vulnerability to tightening global liquidity and deteriorating political and regulatory environment caused a lack of private investment spending (World Bank, 2014). The interventions in independent regulatory institutions suggest that the principles of arms' length regulation had not yet put down deep roots. Furthermore, there have been growing concerns over the transparency in public tenders and the allocation of land development rights in Turkey (World Bank, 2014). The anchor provided by the EU Accession process had been weaker ever since the mid-2000s and Turkey had been losing market share in FDI to emerging markets as a whole since 2007. Against this backdrop, private investment, one of the main drivers of growth in the pre-2008 period, dropped sharply in 2012 and has stagnated since then. As a result, economic growth slowed since 2012.

[2] This section draws mostly from the World Bank Turkey`s Transitions Report (World Bank, 2014).
[3] The World Bank defines high income economies as those with a GNI per capita of $12,736 or more. Please see World Bank WDI database for Turkey`s historical GNI per capita performance and GDP ranking.

3. Literature review

This study is related to an overarching question on countries' TFP (total factor productivity): why are some countries' productivity levels higher than others? A traditional answer is the country's technology level. For example, in some countries, firms adopt advanced technologies and are innovative in producing new ones. In other countries, because of several reasons such as lack of access to finance or low levels of human capital, firms are not as good in terms of learning and producing new technologies. Conventional policy implications hence focus on factors affecting a country's aggregate technological absorption capacity. Examples of a country's technological absorption capacity include access to finance, education, FDI, and openness.

More recently, a new strand of literature has explored the role of resource misallocation for countries' aggregate TFP. The idea is that in addition to primitive technology, resource misallocation can hurt a country's aggregate productivity. As discussed in the introduction, resource misallocation refers to productive firms not being able to expand, and unproductive firms being larger than they should be. Because resources flow to the wrong firms, the country's total output is lower given the same input. This means the country has lower productivity. Policy implications for this approach are drastically unrelated to technology. The focuses are now competition policies and political economy.

Restuccia and Rogerson (2008), in a standard neoclassical growth model with heterogeneous firms, provide the first framework to examine how resource misallocation can affect aggregate productivity. They consider distortions that generate differences in the prices faced by individual firms. For example, politically connected firms may have lower interest rates on loans than unconnected firms. Restuccia and Rogerson (2008) term these policies as "idiosyncratic distortions". They emphasize that the productivity losses due to misallocation would be larger if the "distortions" are positively correlated with the level of productivity of firms. For example, if highly productive firms happen to be politically unconnected and have to pay higher interest rates, they will not have sufficient resources to expand. As a result, the country's aggregate productivity is reduced. On the other hand, if unconnected firms happen to be unproductive as well, the negative impacts of misallocation on aggregate productivity is certainly not as large.

Drawing on the seminal work of Restuccia and Rogerson (2008), a growing number of studies have quantified the costs generated by resource misallocation. Hsieh and Klenow (2009), in their landmark study, examine the quantitative effect of resource misallocation. The basic underlying assumption in their paper is that if resource misallocation is completely removed, the marginal products of labor and capital for all firms should be equalized. Therefore any unequal marginal products of production factors are due to resource misallocation. With this assumption, they estimate that if the problem of resource allocation in China and India is improved, meaning, if capital and labor are hypothetically reallocated to equalize marginal products to the extent observed in the United States, manufacturing TFP can increase 30% to 50% in China and 40% to 60% in India. Subsequent research following the methodology of Hsieh and Klenow (2009) confirms the quantitative importance of misallocations for several countries. Examples are Camacho and Conover (2010) for Colombia, Busso et al. (2013) for Latin American countries, and Kalemli-Ozcan and Sorensen (2012) and Cirera et al. (2015) for African countries.

4. Framework

In this section, we present the HK framework which constitutes the theoretical background to measurement of within sector misallocation.

Consider an economy with many sectors, denoted *s*. A final output Y is produced in each country using a Cobb-Douglas production technology:

$$Y = \prod_{s=1}^{S} Y_s^{\theta_s}, (1)$$

where θ_s is the value added share of sector s, and $\sum_{s=1}^{S} \theta_s = 1$.

Each sector's output Y_s is the aggregate of the individual firm's output Y_{si}, using the CES technology:

$$Y_s = \left[\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \quad (2)$$

where Y_{si} is the differentiated product by firm *i* in sector *s*.

Each firm produces a differentiated product with the standard Cobb-Douglas production function:

$$Y_{si} = A_{si} L_{si}^{1-\alpha_s} K_{si}^{\alpha_s}, \qquad (3)$$

where A_{si} stands for firm-specific productivity, K_{si} and L_{si} are the firm's capital and labor respectively, and α_s is the industry-specific capital share. Note that the assumption in this framework is that firms in the same narrowly-defined sector (i.e. 4-digit NACE) have the same production function.

Each establishment maximizes current profits:

$$\pi_{si} = (1 - \tau_{Ysi}) P_{si} Y_{si} - w L_{si} - (1 + \tau_{Ksi}) R K_{si}, \qquad (4)$$

where $P_{si} Y_{si}$ is the firm's value added (which is the firm's revenue minus the cost of intermediate inputs), *w* and *R* are the cost of one unit of labor and capital respectively. The term τ_{Ysi} denotes firm-specific output distortions that reduce firms' revenues. Many factors could contribute to output distortions, ranging from transportation costs to harassment from authorities. These factors could reduce output for a given set of input. The firm-specific "capital" distortions, which raise the cost of capital (relative to labor), is denoted with τ_{Ksi}. Credit market imperfections (such as differential access to finance) and labor market frictions could contribute to different "capital" distortions τ_{Ksi} across firms.

From Hsieh and Klenow (2009), we distinguish between two productivity measures, one expressed in physical units (TFPQ) and the other in monetary value (TFPR):

$$TFPQ_{si} = \frac{Y_{si}}{L_{si}^{1-\alpha_s} K_{si}^{\alpha_s}} \qquad (5)$$

$$TFPR_{si} = \frac{P_{si} Y_{si}}{L_{si}^{1-\alpha_s} K_{si}^{\alpha_s}} = P_{si} TFPQ_{si} \qquad (6)$$

It is important to note that it is normal that TFPQ differs across firms, different firms may have different productivity levels. However, in this framework, if there were no distortions, TFPR should be equalized across firms in the same industry. This is because of the assumption in the model that firms are monopolistically competitive. Without distortions, low productivity firms have less resources and produce less. Since their product is relatively scarce, they can charge a higher price, P_{si}, which equates $TFPR_{si}$ across firms *i*. In other words, in the absence of distortions, more capital and labor should be allocated to firms with higher TFPQ to the point where their higher output results in a lower price and the exact same TFPR as smaller firms. As a consequence, any dispersion of TFPR across firms within an industry is an indication of distortions. A firm with higher TFPR than the sector average is more "taxed", meaning, it suffers more obstacles, than other firms.

To empirically implement the HK framework, we follow HK and choose the elasticity of substitution $\sigma = 3$, *R*=10 (assuming the real interest rate=5% and the depreciation rate of 5%). Follow HK, we use capital share, α_s ,and labor share, $1 - \alpha_s$, from the U.S. manufacturing sectors. The underlying assumption is that capital and labor shares from sectors in the U.S. represent the least distorted environment. Any deviation of capital-labor share from the U.S.'s level is an indication of distortions.

The output and capital wedges can be computed as follows:

$$1 - \tau_{Ysi} = \frac{\sigma}{\sigma-1} \frac{wL_{si}}{(1-\alpha_s)P_{si}Y_{si}} \qquad (7)$$

$$1 + \tau_{Ksi} = \frac{\alpha_s}{1-\alpha_s} \frac{wL_{si}}{RK_{si}} \qquad (8)$$

Note that $wL_{si}$is firm *i*'s wage bill; $P_{si}Y_{si}$is the firm's value added. Both values are available in the census data. To understand the intuition of equation (8), we rewrite it as:

$$(1 + \tau_{Ksi}) \frac{1-\alpha_s}{\alpha_s} = \frac{wL_{si}}{RK_{si}} \qquad (9)$$

Note that $\frac{1-\alpha_s}{\alpha_s}$ is the labor-capital ratio in the undistorted (U.S.) environment. If firm *i*'s actual labor capital ratio $\frac{wL_{si}}{RK_{si}}$ is higher than the undistorted labor capital ratio, this indicates that the firms face difficulties accessing capital (relative to hiring labor), and as a result, use less capital than the optimal level. This is equivalent to stating the firm has a positive capital wedge τ_{Ksi}.

Armed with τ_{Ysi} and τ_{Ksi}, HK shows that TFPR can be calculated as:

$$TFPR_{si} = \frac{\sigma}{\sigma-1}\left(\frac{R}{\alpha_s}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}\frac{(1+\tau_{Ksi})^{\alpha_s}}{1-\tau_{Ysi}} \qquad (10)$$

Equation (10) implies that in the absence of distortions (i.e. τ_{Ksi}= 0 and τ_{Ysi} =0), TFPR is the same for all firms "*i*" within a sector "*s*". Using this equation, one can induce that a firm with higher τ_{Ksi} and/or higher τ_{Ysi} also has a higher TFPR.

In addition, the industry level $\overline{TFPR_s}$ is:

$$\overline{TFPR_s} = \frac{\sigma}{\sigma-1}\left(\frac{R}{\alpha_s\sum_{i=1}^{M_s}\left(\frac{1-\tau_{Ysi}}{1+\tau_{Ksi}}\right)\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s\sum_{i=1}^{M_s}(1-\tau_{Ysi})\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)}\right)^{1-\alpha_s} \qquad (11)$$

Note that when there are no distortions (i.e. τ_{Ksi}= 0 and τ_{Ysi} =0) for all i, the right hand side of (11) equals the right hand side of (10), which means that TFPR are equalized for all i.

Firm i's productivity can be calculated as:

$$A_{si} = \frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{(wL_{si})^{1-\alpha_s}K_{si}^{\alpha_s}} \qquad (12)$$

and the efficient industry's productivity level (when all marginal products are equalized) is:

$$\overline{A_s} = \left(\sum_{i=1}^{M_s} A_{si}^{\sigma-1}\right)^{\frac{1}{\sigma-1}} \qquad (13)$$

From (10) to (13), we can calculate the ratio of the actual TFP in the economy to the efficient level of TFP:

$$\frac{Y}{Y_{eff}} = \prod_{s=1}^{S}\left[\sum_{i=1}^{M_s}\left[\frac{A_{si}}{\overline{A_s}}\frac{\overline{TFPR_s}}{TFPR_{si}}\right]^{\sigma-1}\right]^{\frac{\theta_s}{\sigma-1}} \qquad (14)$$

We calculate the ratio of actual TFP to the efficient level of TFP and then aggregate this ratio across sectors using the Cobb-Douglas aggregator.

5. Data

We use the Annual Industry and Services Statistics (AISS) to carry out the empirical exercise. AISS is a survey data set conducted annually by the Turkish Statistics Institute (TURKSTAT) since 2003. AISS covers all firms which employ more than 20 workers and draws a sample from firms employing 20 or fewer workers. Our analysis is based on the entire coverage period of 2003 – 2014 with a particular focus on the manufacturing sector.

We exclude firms employing 20 or fewer workers, because only a subset of these firms are included in the data. We also observe some inconsistencies in sample weights of drawn firms in some years.[4] Therefore, we keep our focus on the firms that have more than 20 workers given that these firms constitute the whole population instead of a sample.

The data set covers a large set of variables including investment, sales, energy expenditures, material expenditures, number of employees, ownership type, location, and industry. The number of employees is available at the gender and paid/unpaid breakdown. Location is provided at the NUTS3 level (province), and industry classification is available in NACE Rev2 at 4-digit level.[5]

Investment expenditures are reported in three categories, namely, computer and programing, machinery and equipment, and buildings and structure. We calculate a firm level capital series by using the disaggregated investment series and corresponding depreciation rates. Following Taymaz and Yilmaz (2009), depreciation rates of 5%, 10%, and 30% are used for building and structure, machinery and equipment, and computer and programing, respectively, to construct initial capital stock and to apply the perpetual inventory method. For the firms that report non-zero investment at their initial year, we calculate capital stock by dividing the firms' average investment with the depreciation rate of investment. For the firms that report zero investment at their initial year, it is assumed that they cannot be producing without capital. Therefore, the initial capital stock is calculated at the year that they report positive investment and this amount is iterated back to the beginning year by dividing capital stock by the value $(1 - \delta)$ each year. After calculating a capital stock series for building and structure, machinery and equipment, and computer and programming, these series are aggregated to form the capital stock series of the firm.

All the monetary variables are reported in Turkish Lira with current prices. We normalize the input expenditures with the corresponding 3-digit deflators. The firm level output is deflated by 3-digit output price deflators.

[4] For instance, the sample weights are assigned to be 1 for all sampled firms in some years.
[5] NUTS stands for "Nomenclature des Unités Territoriales Statistiques".

Our empirical exercise also requires sector-level capital/labor ratios in the US, which are obtained from NBER manufacturing database. Since US sectors are coded according to the SIC (Standard Industrial Classification), we implement the necessary conversion between SIC and NACE while merging the US capital/labor ratios with our firm-level data.

In the data cleaning process we dropped observations at a number of different steps, ending up with a smaller data set than the original one. The original data set has 1,275,049 observations for the entire coverage period of 2003-2014. In the first step, we drop non-manufacturing firms because our focus is on manufacturing sector firms.[6] This step reduced the number of observations in our data set significantly to 352,150. In the second step, we restrict our data set only to the firms that have more than 20 workers because of the reasons explained above. This step further decreased the size of our data set to 222,393 firms. In the third step, we drop the firms that operate in a given year but have 0 capital stock. We assume that firms cannot operate without a capital stock and consider these observations as inconsistencies. This brought the number of observations down to 211,450. In the fourth step, in order to obtain the capital and labor shares from the United States, we had to match 4-digit NACE Rev2 codes with the relevant 4-digit SIC codes. We dropped the industries that did not have a close counterpart. Moreover, we also dropped industries that have labor share values greater than 1. These reductions decreased the size to 196,155. In the final step, we drop 4-digit industries that have fewer than 10 firms in a given year. Otherwise, analyzing the allocative efficiency in a 4-digit industry that has fewer than 10 firms would not have made much sense. Also, we eliminated any inconsistent observations that were left in the data set. In addition, following Hsieh and Klenow (2009), we trimmed the 1% tails of $\log\left(TFPR_{si}/\overline{TFPR}_s\right)$ and $\log\left(A_{si}/\overline{A}_s\right)$ across industries before calculating the gains from our hypothetical liberalization. The final data set has 181,052 observations.

[6] In addition, the calculation of the service sector's TFP is challenging. Since it is more problematic to assign the traditional Cobb-Douglas production function to the service sector than to the manufacturing sector, the estimated TFP for the service sector with a Cobb-Douglas production function would have larger measurement errors.

Table 1: Size of the Dataset						
	1st Step	2nd Step	3rd Step	4th Step	5th Step	6th Step
Year	Original Dataset	Manufacturing Firms	More Than 20 Workers	After Capital Stock	After Conversion	Final Dataset
2003	67,516	10,750	8,021	7,809	7,246	6,796
2004	71,973	13,157	10,182	9,811	9,100	8,438
2005	63,304	16,654	14,172	13,561	12,596	11,729
2006	85,016	17,446	15,302	14,738	13,675	12,811
2007	83,963	17,269	15,095	14,547	13,491	12,567
2008	82,662	31,134	17,793	16,860	15,466	14,264
2009	99,921	35,059	16,061	15,506	14,354	13,147
2010	106,714	33,890	21,218	20,305	18,792	17,190
2011	138,013	41,194	23,755	22,636	21,029	19,249
2012	147,916	43,281	25,856	24,578	22,875	21,115
2013	168,618	47,000	26,791	25,208	23,435	21,598
2014	159,433	45,316	28,147	25,891	24,096	22,148
Total	1,275,049	352,150	222,393	211,450	196,155	181,052
Source: TURKSTAT and authors' calculations.						

6. Results

6.1 Measuring distortions

Table 2 presents the benchmark results of the paper. The first column shows the year of the data coverage. The second column displays the number of firms in each year. Note that only firms with more than 20 workers are included in our data set. The third column shows the potential TFP gains if TFPR are equalized among firms within a sector (i.e. if the resource misallocation problem is completely removed). The fourth column shows the potential TFP gains if allocative efficiency in Turkey improves to the U.S. level (thus misallocation reduces to the U.S. level). The columns five through ten show the statistics for the distributions of TFPQ, $\log\left(A_{si}M_s^{\frac{1}{\sigma-1}}/\overline{A}_s\right)$, and of TFPR, $\log\left(TFPR_{si}/\overline{TFPR}_s\right)$, over time. The final two columns show the standard deviations of capital and output wedges.

Table 2: Baseline Results											
Year	**Firms**	**TFP Gains**		**TFPQ**			**TFPR**			**Wedge**	
		Equalizing TFPR	Moving to 1997 U.S. Efficiency	SD	75-25	90-10	SD	75-25	90-10	Capital SD	Output SD
2003	6,796	123.1	56.1	1.46	2.10	3.87	0.97	1.28	2.51	1.63	0.97
2004	8,438	89.2	32.4	1.28	1.81	3.38	0.85	1.12	2.20	1.62	0.88
2005	11,729	86.1	30.2	1.20	1.67	3.12	0.81	1.04	2.05	1.60	0.84
2006	12,811	79.5	25.6	1.14	1.61	2.98	0.76	1.01	1.93	1.57	0.86
2007	12,567	77.3	24.1	1.13	1.57	2.96	0.75	0.97	1.88	1.56	0.89
2008	14,264	77.1	23.9	1.13	1.56	2.96	0.74	0.96	1.90	1.58	0.90
2009	13,147	76.7	23.6	1.15	1.56	2.99	0.76	0.95	1.90	1.55	0.93
2010	17,190	70.2	19.1	1.10	1.46	2.83	0.74	0.93	1.88	1.57	0.94
2011	19,249	73.2	21.2	1.11	1.48	2.88	0.74	0.95	1.89	1.57	0.95
2012	21,115	69.7	18.8	1.08	1.44	2.78	0.73	0.92	1.85	1.58	0.94
2013	21,598	69.1	18.4	1.09	1.47	2.80	0.74	0.93	1.87	1.58	0.91
2014	22,148	78.0	24.5	1.11	1.50	2.85	0.76	0.96	1.88	1.59	0.90
Source: TURKSTAT and authors' calculations.											

The main take-away message of the paper is shown in columns 3 and 4. They display hypothetical aggregate TFP gains from removing misallocation over the years. Larger hypothetical gains imply that the resource misallocation across firms within a sector is more pronounced. The TFP gain of 78% in 2014 means that if resources are allocated efficiently across firms within a sector, i.e. more productive firms having more resources and less productive firms having less resources, Turkey's manufacturing TFP would increase by 78% (Table 2, column 3). Over time, Turkey has reduced the within-sector resource misallocation quite significantly. Potential TFP gains had been declining over time, from 123% in 2003 to 69% in 2013. However the speed of the improvement had markedly slowed down after 2007, except in 2010 when Turkey's economy bounced back from the global financial crisis and grew by around 9%. Moreover, the most recent data suggests that the earlier trend reversed in 2014, and resource misallocation worsened in Turkey's manufacturing industry. In fact, the potential TFP gains increased from 69% in 2013 to 78% in 2014.

Following Hsieh and Klenow (2009), we measure how much aggregate manufacturing TFP in Turkey could increase if capital and labor were reallocated to equalize marginal products across firms within each four-digit sector to the extent observed in the United States. The United States is a critical benchmark. Comparing countries with the United States has an advantage. To the extent the measurement errors of capital stock and marginal productivity are present to a similar extent in both the U.S. and Turkey data, the comparison would account for such errors. The TFP gain of 24.5% in 2014 implies that if the resource misallocation problem is at the U.S. level in 1997, Turkey's manufacturing TFP would increase by 24.5%. Similarly, the speed of allocative efficiency improvement started to slow down around 2007, and the trend has reversed in 2014.

Compared to the 1997 U.S. benchmark, Turkey's allocative efficiency improved by 8.3% from 2004 to 2007, or about 2.7% per year. A determined implementation of second-generation reforms over the next few years could produce similar improvements in Turkey, assuming a moderate speed of convergence to 'U.S efficiency'. This would constitute an important boost to manufacturing productivity growth, which nearly stagnated in recent years.

Consistent with the results on potential gains, TFPR dispersion declined significantly until 2007, suggesting decreased firm-level distortions. The standard deviation of TFPR dropped from 0.97 in 2003 to 0.75 in 2007. However, the TFPR dispersion had remained mostly unchanged after 2007 with its standard deviation staying around 0.74 before increasing to 0.76 in 2014. Although the improvement in TFPR dispersion tracked by standard deviation had stopped after 2007, it had continued at the edges of the distribution, albeit at a very slow pace. Nonetheless, the increase in TFPR dispersion in 2014 is also reflected in the tails of the distribution. Figure 1 plots the distribution of log TFPR, $\log\left(TFPR_{si}/\overline{TFPR}_s\right)$, as a measure of firm-specific distortions in Turkey. The plot has been demeaned in order to show distance from the sector-specific average. By plotting this measure of distortions over time, the most outstanding observation we have is that TFPR distribution in 2004 is more dispersed than those in other years. Moreover, the improvement came from the left tail, which contains the firms that have low TFPR. In other words, some of the firms lost their implicit subsides over time, leading to the left tail moving inwards towards the mean.

Table 2 shows that the dispersion of TFPQ also improved rapidly between 2003 and 2007, slowed substantially after 2007, and worsened in 2014. Figure 2 plots the distribution of log TFPQ, $\log\left(A_{si}M_s^{\frac{1}{\sigma-1}}/\overline{A}_s\right)$. There is clearly more TFPQ dispersion in 2004 than 2014. The TFPQ in 2004 has a thicker left tail than in 2014. On the other hand, there is almost no difference in the right tail between 2004 and 2014, implying that the improvement in TFPQ dispersion overtime has come from the unproductive firms. Although this exercise does not say anything about the dynamics of the improvement, results imply that either unproductive firms converged closer to the sector averages, or exit the market, or combination of both effects, leading to a thinner left tail and less misallocation. The elimination of firm specific distortions over time could have driven unproductive firms out of the market or could have downsized unproductive firms given that, on average, unproductive firms receive implicit subsidies while productive firms are subject to implicit tax.[7]

Figure 1: TFPR Dispersion over time

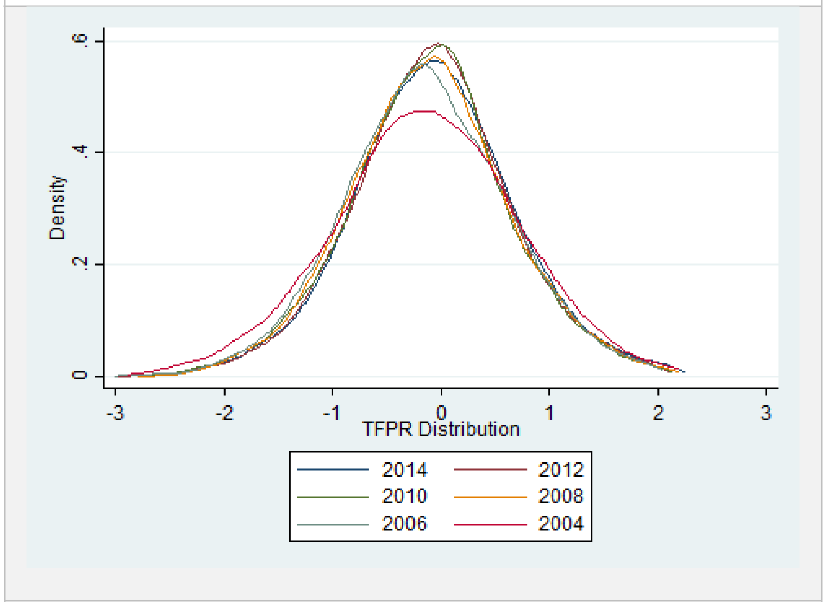
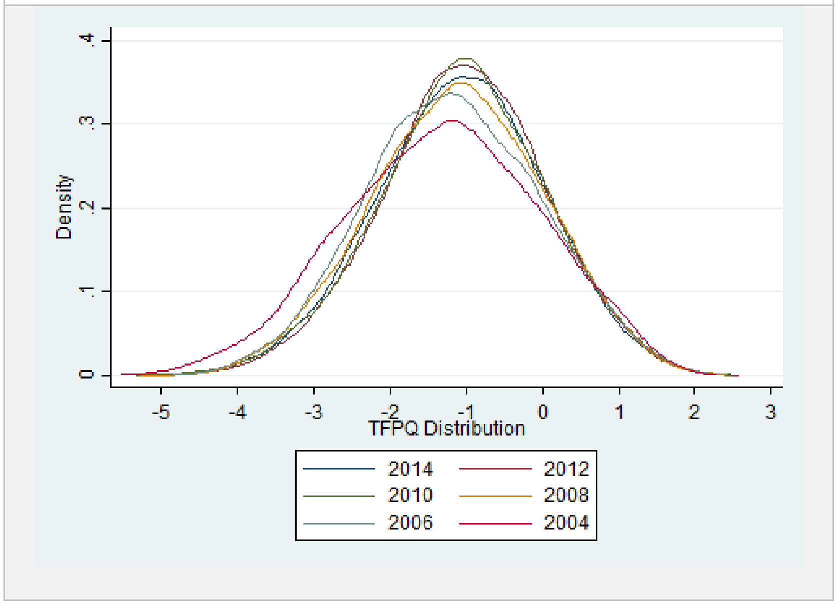


Figure 2: TFPQ Dispersion over time



[7] The relation between TFPR and TFPQ is discussed in more details in section 4.1.2, where results suggest strong positive correlation between TFPR and TFPQ.

These numbers clearly suggest that within-sector misallocation decreased over time in Turkey, more rapidly in the early 2000s. Interestingly, the timing coincides with Turkey's reforms in early 2000, some of which might have helped with reducing resource misallocation. Turkey's Transitions Report (World Bank, 2014) describes the early 2000 reforms in the finance sectors, and competition-based regulations and institutions, in details:

"The deep crisis of 2001 provided an opportunity to introduce wholesale changes to Turkey`s governance model and to overcome the inconsistencies between macroeconomic measures and microeconomic regulations and to get rid of incentives which had plagued repeated stabilization efforts throughout late 1980s and 1990s. After the banking crisis in 2001, the country embarked on a concerted path of structural reforms. Key structural reform measures focused on the five main areas involving state-business relations, enterprise, finance, infrastructure, cities, and public finance management.

Prior to 2001, political forces in Turkey, like in many other countries before, used and shaped financial sector policies and the operation of the financial system for political gain and influence, to the detriment of economic performance and welfare. The basic aim of the reforms was to develop a credible policy framework that would provide the proper incentives for the financial system to thrive and benefit the population in general. The approach followed, based on greater transparency and accountability in policymaking, increased sector competition and strong regulatory and legal steps to limit moral hazard, appears to have worked in fostering a stable, more efficient, and trustworthy financial sector. The financial sector reforms focused on four key areas: the enhancement of the Central Bank independence, the restricting and partial privatization of state-owned banks, the establishment of an independent regulator and the prompt resolution of failed private banks, the transparent recapitalization of the core of the banking system. Taken as a whole all these reforms contributed to a major change in the way of doing banking in Turkey.

Another important development was macroeconomic stabilization. Fiscal prudence and sustained declines in inflation and real interest rates led to a major restructuring in the balance sheets of the banking system and increased credit to the private sector. Turkey`s perceived country risk also declined significantly so that Turkey could benefit from in the increase in global capital inflows that were in abundance during 2000s. This liquidity provided the financial resources for private sector growth. Together macroeconomic stabilization at home and the "Great Moderation" in the world economy enhanced access to finance and lowered barriers for new firm entry and expansion. At the same time, Turkey benefited from the gradual emergence of "European Union (EU)-anchored" competition-based regulations and institutions. The adoption of generally pro-market trade, financial and regulatory policies- together with infrastructure and urbanization policies that supported domestic market integration have created the basis for productive *resource reallocations. As a result of these multifaceted regulatory reforms, Turkey progressively reduced the gap to the frontier in the World Bank`s Doing Business indicators."*

However, the reform momentum slowed significantly after 2007 (World Bank, 2014). Indicators from various data sources (such as Doing Business) also confirm the slowdown in institutional and business climate improvements after 2007. Interestingly, the timing of the slowdown also matches the slowdown in resource allocation improvement after 2007.

How is Turkey compared to other countries? To answer this question, we put these numbers in a cross-country context to get a sense of the economic magnitude of these numbers. Table 3 compares the latest available year in each country: Turkey in 2014, United States in 1997, India in 1994, and China in 2005.[8] There is more TFPQ dispersion in Turkey than in the United States and China, but less than India. The ratio of 75th to 25th percentiles of TFPQ in the latest year are 5.0 in India, 4.5 in Turkey, 3.6 in China and 3.2 in United States.[9]

Table 3 also provides TFPR dispersion statistics for the same group of country-years. The TFPR dispersion in Turkey is significantly more than that in the United States, while is only slightly more than those in China and India. These numbers suggest that distortions are greater in Turkey than in United States, China and India. The ratio of 75th to 25th percentiles of TFPR in the latest year are 2.6 in Turkey, 2.3 in China, 2.2 in India, and 1.7 in United States.

Table 3: Dispersion of TFPR and TFPQ

	U.S. (1997)		**Turkey (2014)**		**India (1994)**		**China (2005)**	
	TFPR	**TFPQ**	**TFPR**	**TFPQ**	**TFPR**	**TFPQ**	**TFPR**	**TFPQ**
S.D	0.49	0.84	0.76	1.11	0.67	1.23	0.63	0.95
75-25	0.53	1.17	0.96	1.50	0.81	1.60	0.82	1.28
90-10	1.19	2.18	1.88	2.85	1.60	3.11	1.59	2.44
N	194,669	194,669	22,148	22,148	41,006	41,006	211,304	211,304

Source: Authors' calculations, HK (2009).

What is the potential for TFP growth from a reduction in misallocation? We calculate "efficient" output to compare it with the actual output level to measure the hypothetical gains from removing the within-sector misallocation of resources (Table 4). Aggregate TFP gains, from full liberalization by equalizing marginal revenue products across the existing set of firms in each 4-digit industry, are around 78.0% in Turkey in 2014, compared to 127.5% in India in 1994 and 86.6% in China in 2005. Overall, Turkey's misallocation

[8] We rely on Hsieh and Klenow (2009) for the numbers of United States, China and India.
[9] Exponentials of the corresponding numbers in Table 2.

level in 2014 is smaller than China's in 2005 and India's in 1994. In 2005, however, it was at the same level as China in the same year.

How do we explain the different results regarding TFPR dispersion and TFP gains between Turkey, India and China? The answer is with TFPQ dispersion. If country A's TFPQ is more dispersed than country B's, country A's TFPR could be more dispersed than country B's, even if the levels of misallocation in the two countries are similar. Applying the same argument to Turkey, China, and India, since Turkey's TFPQ is more dispersed than that in China, Turkey's TFPR can be more dispersed and at the same time Turkey's misallocation is less severe than China's.

Another explanation is with industry weights. It can be seen from equation (14), when calculating TFP gains, we take industry weights into account. Thus, one can consider TFPR dispersion as the measure of unweighted misallocation, while do TFP gains as the measure of weighted misallocation. The results show that TFPR dispersion is higher in Turkey, but TFP gain is lower in Turkey. This is most likely because the sectors that have high TFPR dispersion have lower weight in GDP in Turkey, making TFP gains from reallocation of resources within sectors smaller compared to peer countries.

Table 4: TFP Gains From Equalizing TFPR Within Industries

	US	**Turkey**	**Turkey**	**India**	**China**
	1997	**2014**	**2005**	**1994**	**2005**
Full Liberalization	42.9	78.0	86.1	127.5	86.6
Moving to U.S. Efficiency	-	24.5	30.2	59.2	30.6
Source: Authors' calculations, HK (2009).					

6.2 Distortion and Productivity

In the absence of frictions, more capital and labor should be allocated to firms with higher TFPQ to the point where their higher output results in lower prices and the exact same TFPRs as those of smaller firms. Hence, TFPR would not vary across firms within an industry unless firms face distortions. However, in reality, capital and labor distortions engender TFPR dispersion within industries, as shown in Figure 1. Distortions would be particularly harmful if they are positively correlated with firm's physical productivity (i.e. they are higher for more productive firms). To see the relationship between productivity and distortions, Figure 3 plots TFPQ against TFPR. In the frictionless world, all firms would fall along the zero $\log\left(TFPR_{si}/\overline{TFPR_s}\right)$ line. Along this undistorted equilibrium line firms would differ only on their physical productivity, TFPQ. However, figure 3 shows that TFPR is strongly increasing in TFPQ in Turkey, suggesting that more productive firms face larger distortions. In other words, the figure implies that high productivity firms are subject to higher implicit taxes that keep these firms smaller than their optimal levels.

Similarly, low productivity firms receive implicit subsidies that enable these firms to expand and lower the firms' marginal products.

Figure 3: Productivity vs Distortions

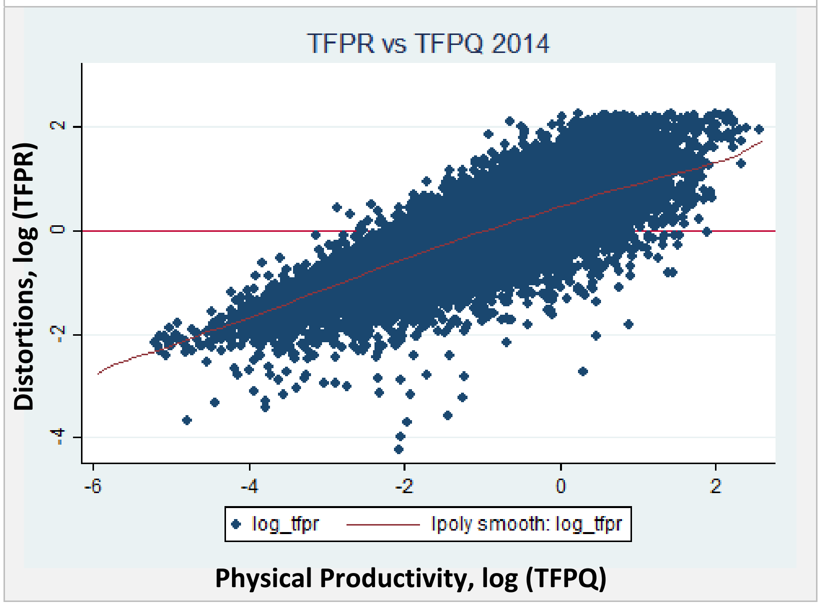


Figure 4: Productivity vs Capital Wedge

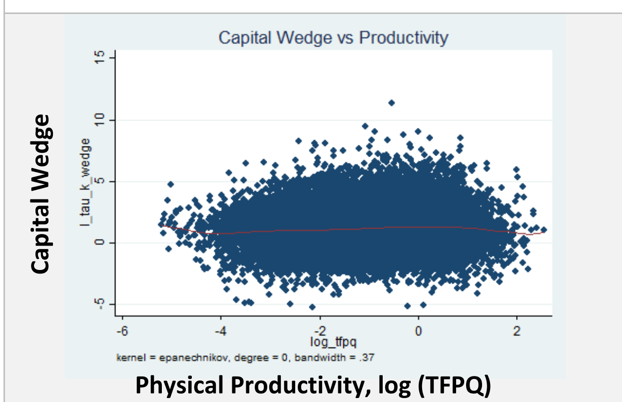
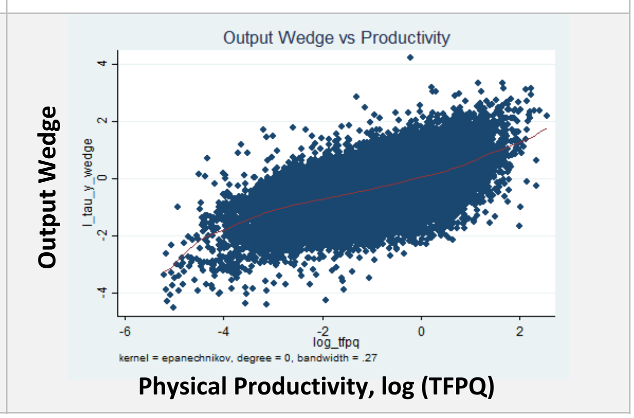


Figure 5: Productivity vs Output Wedge



To better understand the sources of distortions, we decompose the overall distortion into the "capital" wedge, $\log(1+\tau_{ksi})$, and the "output" wedge, $\log\left(\frac{1}{1-\tau_{ysi}}\right)$. Figure 4 shows that there is no systematic relation between the capital wedge and productivity level. At almost every productivity level, capital wedge dispersion is quite high, indicating that at every given level of productivity, some firms have an easier access to capital markets while some firms have difficulties. However, the capital wedge does not systematically increase as firm level productivity increases. This suggests that capital distortions are not the main drivers of resource misallocation in Turkey.

Figure 5 shows that output wedges are monotonically increasing in productivity. This suggests that compared to a frictionless equilibrium, productive firms are subject to a larger output wedge, causing them to produce less than their optimal output, while unproductive firms receive an implicit output subsidy and produce beyond their optimal level, resulting in an inefficient allocation of resources and thus lower aggregate TFP. Figure 4 and Figure 5 jointly suggest that the answers to resource misallocation in Turkey lies in the output markets, not in the factor markets. Thus, policy measures that focus on output markets and eliminate distortions can reduce misallocation and bolster aggregate TFP in Turkey.

6.3 Distortions and Firm Size

The relationship between distortions and size is an important dimension to examine to understand the costs of misallocation. Size is measured in terms of value added of the firms.

Figure 6 plots the relationship between firm size and productivity distribution of firms with respect to their sector averages, while Figure 7 plots the relationship between firm size and distortions. It is clear that there is a strong positive relationship between firm size and productivity, suggesting that larger firms are on average more productive than their smaller counterparts. Similarly, large firms have higher TFPR compared to the sector averages, whereas small firms have smaller TFPR than the sector averages. This implies that small firms are less productive, but receive implicit subsidies that grow them larger than otherwise they would. Moreover, on average, medium, and especially large, firms are more productive than their competitors, but they face greater implicit taxes that raise their marginal products and constrain their growth. As a result, these more productive, large firms remain smaller than they would otherwise. Overall, Figures 6 and 7 together imply that small, unproductive firms operate at the expense of large, productive firms, as a result of idiosyncratic distortions, leading to a significant misallocation of resources within industries. In the absence of distortions, small firms would cut their production and increase their prices, ending up with higher TFPR, whereas medium and large firms would expand their production and lower their prices, ending up with lower TFPR. Large, more productive firms would expand, while small less productive firms would downsize until TFPR across all firms equalized within industries.

Figure 6: Productivity vs Firm Size

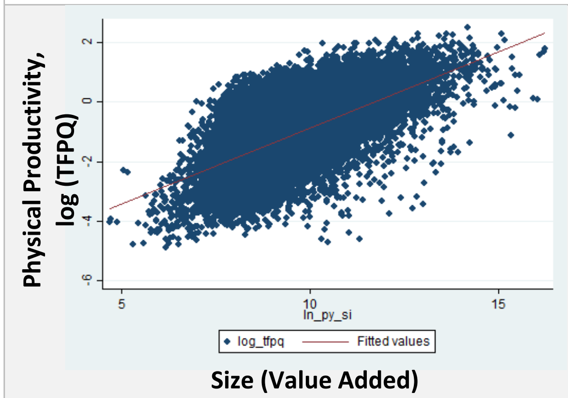
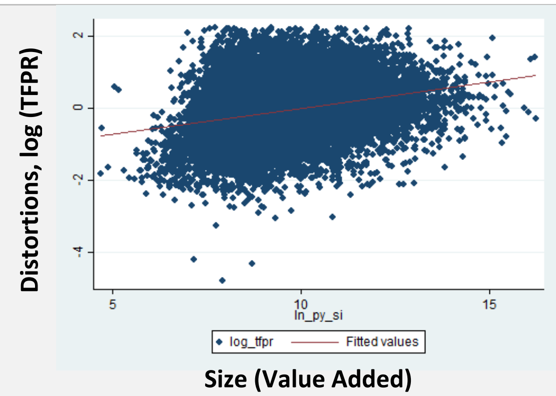


Figure 7: Distortions vs Firm Size



6.4 Misallocation by Industry

The results presented so far are for the manufacturing sector as a whole, weighted by the industry value added shares. By focusing on the aggregate outcome we might obscure important differences across industries. The finding will provide evidence for policymakers to focus on certain industries to address resource misallocation. Hence, it is instructive to investigate to what extent distortions vary across sectors.

We have grouped industries that are closely related under broader categories in order to reduce the number of industries. The food sector includes manufacturing of food products, beverages and tobacco products (NACE rev. 2 2-digit sector codes 10-12). The textiles sector includes manufacturing of textiles and wearing apparel (NACE rev. 2 2-digit sector codes 13-14). The chemicals sector includes manufacturing of chemicals and chemical products, rubber and plastic products (NACE rev. 2 2-digit sector codes 20 and 22). The metals sector includes manufacturing of basic metals and of fabricated metal products, except machinery and equipment (NACE rev. 2 2-digit sector codes 24 and 25). The transport sector includes manufacturing of motor vehicles, trailers and semi-trailers, and manufacturing of other transport equipment (NACE rev. 2 2-digit sector codes 29 and 30). Finally, the electronics sector includes manufacture of computer, electronic and optical products, and manufacturing of electrical equipment (NACE rev. 2 2-digit sector codes 26 and 27). The remaining sectors are stand-alone sectors, and do not include any other 2-digit sector. Table 5 shows the number of firms in each industry in each year.

Table 5: Number of Firms in Each Industry									
Year	**Elect.**	**Machinery**	**Metals**	**Furniture**	**Chemicals**	**Text.**	**Trans.**	**Food**	**Leather**
2003	237	367	587	196	571	2,829	268	584	96
2004	316	501	686	267	729	3,475	370	653	117
2005	388	772	1,065	426	1,025	4,605	577	856	186
2006	390	888	1,213	506	1,152	4,770	637	924	220
2007	426	938	1,169	535	1,151	4,511	673	874	222
2008	476	1,206	1,269	667	1,285	4,628	706	1,511	248
2009	486	1,026	1,296	612	1,234	4,027	724	1,415	216
2010	609	1,340	1,665	945	1,688	5,032	809	1,934	343
2011	664	1,497	2,028	1,120	1,856	5,637	793	2,117	398
2012	720	1,682	2,329	1,231	1,968	6,120	833	2,340	488
2013	771	1,759	2,438	1,257	2,009	6,252	865	2,231	505
2014	812	1,874	2,551	1,364	2,087	6,125	879	2,209	519
Source: TURKSTAT and authors' calculations.									

Table 6 presents the potential TFP gains if resource misallocation is removed in each of these stand-alone industries. Table 6 shows that potential TFP gains are above 80% in the Furniture and Chemicals sectors, and around 90% in the Textiles, Transportation, Food, and Leather sectors in 2014. Thus, the room for TFP growth by removing distortions and improving allocative efficiency is large in these sectors. Conversely, the potential TFP gains are about 50% in Machinery and Metals, implying that reforms can also yield meaningful TFP growth in these sectors.

The best performing sector is Electronics, where potential TFP gains are close to 0% in 2014. Also note that misallocation in Electronics was already low in 2003 in comparison to the other sectors. In 2011 and 2013, the potential TFP gains were negative in the Electronics sector, implying that equalizing TFPR within 4-digit industries would lead to lower aggregate TFP in this sector. This may be due to the relationship between distortions and productivity level. In section 6.2, we showed that TFPR is positively correlated with TFPQ in the manufacturing sector in Turkey, meaning that distortions favor less productive firms and punish more productive firms. However, if TFPR is negatively correlated with TFPQ, in other words, if distortions punish less productive firms and favor more productive firms, potential TFP gains can be negative. A closer look at the electronics sector in Turkey and a deeper analysis of market structure, infrastructure, rules, and regulations in this sector can provide valuable lessons for other sectors and policy makers.

Table 6: TFP Gains by Industries									
Year	**Elect.**	**Machinery**	**Metals**	**Furniture**	**Chemicals**	**Text.**	**Trans.**	**Food**	**Leather**
2003	41	90	141	80	119	147	89	165	370
2004	48	47	60	84	104	110	70	146	133
2005	21	68	67	54	82	103	84	131	128
2006	57	58	48	71	67	78	82	123	117
2007	11	57	30	73	63	77	99	124	68
2008	34	60	66	86	96	72	106	73	75
2009	28	64	75	55	100	64	99	73	89
2010	27	52	57	75	76	75	65	75	70
2011	-4	55	54	63	80	86	63	64	78
2012	7	41	53	75	75	84	79	63	80
2013	-2	46	71	94	73	79	105	71	81
2014	7	47	52	80	86	88	89	92	94
Source: TURKSTAT and authors' calculations.									

6.5 Misallocation by Technology Intensity of Sectors

In this section, we separately implement the same exercise by constraining the sample to individual technology classes to shed light on whether distortions and misallocation vary with the technology intensity. Misallocation would be particularly harmful if it systematically distorts resources in the more innovative and dynamic sectors.

In this section, we rely on Eurostat technology intensity classifications that are based on NACE Rev.2. The low technology class includes the following 2-digit sectors: food products, beverages, tobacco products, textiles, wearing apparel, leather and related products, wood and of products of wood and cork, except furniture, paper and paper products, printing and reproduction of recorded media, manufacturing of furniture, and other manufacturing.[10] The medium-low technology class includes coke and refined petroleum products, rubber and plastic products, non-metallic mineral products, basic metals, fabricated metal products, except machinery and equipment, and repair and installation of machinery and equipment.[11] The medium-high technology class includes manufacturing of chemicals and chemical products, electrical equipment, machinery and equipment n.e.c, vehicles, trailers and semi-trailers, and other transportation equipment.[12] The high technology class includes manufacturing of basic pharmaceutical products and

[10] NACE rev. 2 2-digit sector codes 10-18, 31, and 32.
[11] NACE rev. 2 2-digit sector codes 19, 22-25, and 33.
[12] NACE rev. 2 2-digit sector codes 20, 27-30.

pharmaceutical preparations, computer, electronic, and optical products. [13] Table 7 shows the number of firms in each technology class in each year.

Table 7: TFP Gains by Technology Classes								
	Low Tech		Medium-Low Tech		Medium-High Tech		High Tech	
Year	**Firms**	**TFP Gains**	**Firms**	**TFP Gains**	**Firms**	**TFP Gains**	**Firms**	**TFP Gains**
2003	4,153	161	1,564	121	1,007	69	79	535
2004	5,081	119	1,888	63	1,364	47	111	185
2005	6,896	104	2,769	71	1,949	58	123	142
2006	7,333	89	3,205	57	2,165	66	125	135
2007	7,049	84	3,140	49	2,239	59	146	276
2008	8,073	83	3,411	54	2,597	68	195	221
2009	7,234	62	3,270	60	2,464	77	175	209
2010	9,549	75	4,363	47	3,068	62	213	216
2011	10,662	74	5,116	47	3,263	66	211	252
2012	11,727	75	5,622	44	3,578	62	211	231
2013	11,869	81	5,783	56	3,745	58	213	175
2014	11,913	89	6,076	57	3,934	61	229	215
Source: TURKSTAT and authors' calculations.								

There is no systematic relationship between the technology intensity of sectors and misallocation, according to Table 7. However, the high tech class exhibits the highest frictions in Turkey, suggesting that the most innovative sectors are highly distorted.[14] Medium-low and medium-high tech classes are the best performing technology classes with respect to the allocative efficiency. The potential TFP gains are around 60% in these two technology classes in 2014. Although the potential TFP gains in these classes are lower than the remaining technology classes, the potential gains are still substantial. The potential gains are around 90% in low technology class in 2014, suggesting that aggregate TFP in this class can almost double if TFPR equalizes within 4-digit industries.

The aggregate TFP in high tech can more than double if distortions are eliminated in this technology class. The Turkish government has various subsidy and incentive programs for firms in high technology sectors in order to achieve its aspirations of increasing value added and technology content of production. Although there are eligibility criteria for these subsidies, programs do not control for productivity levels of firms. Perhaps industrial subsidies have supported less productive firms, and might have caused a larger misallocation in high technology class, compared to other technology classes. If this assertion is true, the

[13] NACE rev. 2 2-digit sector codes 21 and 26.
[14] The results should be taken with caution because of the small sample size for high tech firms.

availability of various and large incentive programs for high tech firms, which do not control for firm productivity, could explain larger dispersion in this class. However, we leave the identification of the reasons behind differences in technology classes for future research.

Table 8: TFP Gains From Full Liberalization

Year	Low Tech	Medium-Low Tech	Medium-High Tech	High Tech
2003	161	121	69	535
2004	119	63	47	185
2005	104	71	58	142
2006	89	57	66	135
2007	84	49	59	276
2008	83	54	68	221
2009	62	60	77	209
2010	75	47	62	216
2011	74	47	66	252
2012	75	44	62	231
2013	81	56	58	175
2014	89	57	61	215

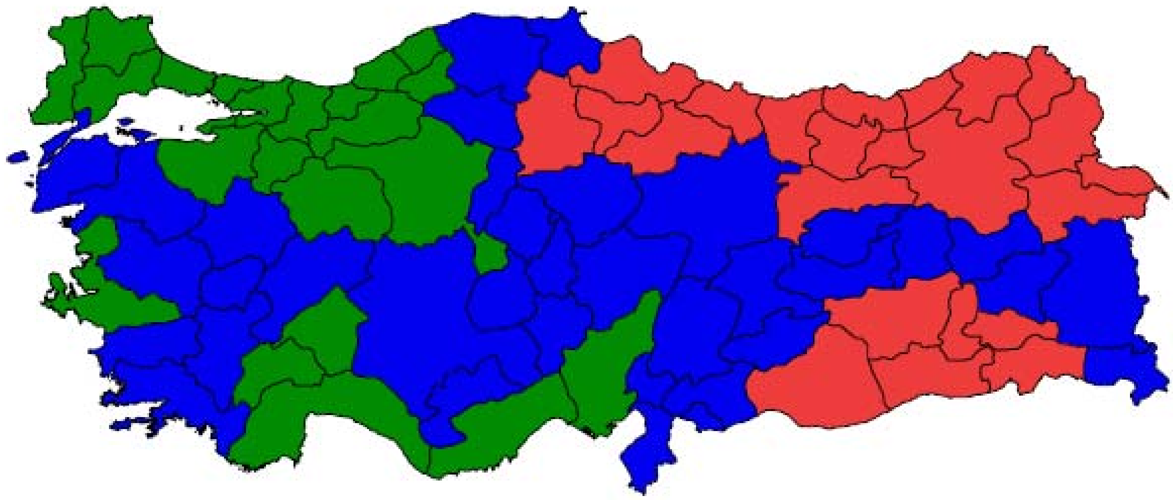
Source: TURKSTAT and authors' calculations.

6.6 Misallocation by Region

In this section, we separately implement the same exercise by constraining the sample to individual regions to examine the variation of distortions and misallocation among different regions. Unfortunately, a regional identifier is not available for 2013 and 2014, thus we restrict our regional analysis to the time frame of 2003-12.

Following Gonenc et al. (2012) and World Bank (2014), we group the regions of Turkey at the NUTS2 level into 3 sub-regions. We identify those sub-regions that had relatively low value added per capita in 2004 and experienced high job growth between 2004 and 2012 as "Tigers". Sub-regions that had high value added in 2004 are belonging to the "West", representing provinces that have traditionally acted as industrial growth centers. The rest of the sub-regions are identified as the "Others".

Figure 8: Regional Classification



West, Anatolian Tigers, Others

Source: World Bank (2014)

Table 8 suggests that the misallocation within Tigers is smaller than West and Others. This is an interesting result because it indicates that business environment in Tigers treat firms relatively equally compared to a more developed region like West.

Table 8 shows the hypothetical gains from equalizing TFPR within sectors for each region. The reallocation of resources from less productive firms to more productive firms within industries could increase TFP by about 81% in Others, 70% in West, and 46% in Tigers in 2012. The potential TFP gains are large in each region, thus new reform momentum can yield significant improvements in aggregate productivity in every region. Especially in West, where firms are disproportionately located, elimination of distortions could lead to a substantial rise in TFP not only in West, but also in aggregate manufacturing in Turkey, given that West has the largest weight among regions.

Table 9: TFP Gains by Regions						
	Anatolian Tigers		West		Others	
Year	Firms	TFP Gains	Firms	TFP Gains	Firms	TFP Gains
2003	864	146	5,405	117	113	142
2004	1,156	83	6,704	85	131	141
2005	1,743	68	9,308	89	171	137
2006	2,032	62	10,041	77	232	71
2007	1,969	56	9,806	76	248	77
2008	2,361	56	11,000	78	328	37
2009	2,073	48	10,196	80	305	36
2010	3,051	54	13,076	71	526	68
2011	3,594	44	14,500	72	646	63
2012	4,145	46	15,737	70	783	81
Source: TURKSTAT and authors' calculations.						

7. Conclusion

This paper uses Hsieh and Klenow's (2009) framework to quantitatively examine resource misallocation within narrow industries in Turkey. We find that Turkey's resource misallocation is substantial. The hypothetical gain of moving to 'U.S. efficiency' is 24.5% of manufacturing TFP in 2014. The availability of long panel data allows us to examine resource misallocation over time and by disaggregated sectors. Allocative efficiency improved since 2003, but began to slow down since 2007. Moreover, in 2014, the latest year of observation, the resource misallocation in Turkey worsened, reversing the earlier trend.

The finding suggests there is substantial room to improve TFP by reducing misallocation within sectors. Particularly, we have identified the four sectors where misallocation is most pronounced and gains are around 90%: textile, transport, food, and leather.

A first direction for further research would be to more closely examine drivers of reduction in misallocation in the past twelve years. Identifying causal relationships between changes in the regulatory environment or policies, and improvement in misallocation, could shed light on this important phenomena and could be useful for policy makers to design policies to address the misallocation issue.

A second, and related, avenue for future research is to look at cross-sectional differences in misallocation patterns among regions, industries, and technology classes, and to identify causes of such differences. One option is to analyze how regional and industrial subsidies affect differences in misallocation patterns across regions and industries. This analysis could help design policies to reduce regional gaps and boost aggregate productivity growth in the manufacturing sector.

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