

# CBT RESEARCH NOTES IN ECONOMICS

## Sectoral Sources of Labor Productivity in the 2001-2008 Era<sup>1</sup>

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**Abstract:** Aggregate labor productivity growth can be expressed by both productivity growth within individual sectors and reallocation of labor between sectors. An understanding of the dynamics of aggregate productivity growth requires insight into the contributions of these two effects. This note provides a glimpse of the sectoral sources of the aggregate labor productivity growth in Turkey between 2001 and 2008 conducting a simple analysis using information coming from the nine sectors of the Turkish economy. Productivity growth within the nine sectors explains 71.9 percent of the aggregate labor productivity growth in Turkey. Manufacturing (27.1 percent in total) contributes most to the labor productivity growth.

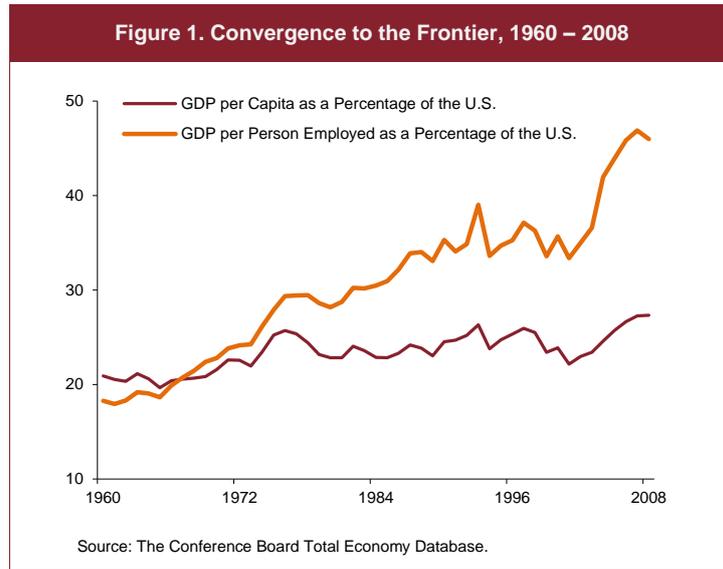
### 1. Introduction

Figure 1 shows GDP per capita and GDP per person employed in Turkey relative to the United States between 1960 and 2008.<sup>2,3</sup> Historically, per capita GDP in Turkey relative to the United States does not show a significant catching-up. For example, GDP per capita in Turkey increases from about 21 percent of the U.S. level in 1960 to 25.7 percent in 1976. Turkey experiences a relative deterioration starting with 1977 on as the GDP per capita shrinks to about 22 percent of the U.S. level in 2001. However, there is an upward trend between 2001 and 2008. GDP per capita in Turkey relative to the United States increases from about 22 percent in 2001 to about 27 percent in 2008. Moreover, labor productivity (measured as GDP per person employed) in Turkey increases from about 33 percent of the U.S. level in 2001 to 46 percent in 2008.

<sup>1</sup> The author thanks the editor and two anonymous referees for useful comments and suggestions. The views expressed herein are those of the author and not necessarily those of the Central Bank of the Republic of Turkey.

<sup>2</sup> Data are from the most recent version of the Conference Board Total Economy Database (January 2011). The level estimates are expressed in 2010 U.S. dollars, and converted at purchasing power parity to adjust for differences in relative price levels between countries. The Conference Board Total Economy Database is available at: <http://www.conference-board.org/data/economydatabase/>

<sup>3</sup> I do not include 2009 and 2010 to exclude the effects of the recent recession.



Aggregate labor productivity growth is determined by both productivity growth within individual sectors and the reallocation of the share of labor worked between sectors. An understanding of the dynamics of aggregate productivity growth requires insight into the contributions of these two effects. This note provides a glimpse of the sectoral sources of the aggregate labor productivity in Turkey between 2001 and 2008 conducting a simple analysis using information coming from the nine sectors of the Turkish economy.<sup>4</sup>

## 2. A Shift-Share Analysis

I conduct a shift-share analysis expressing the labor productivity for the economy as a whole as the productivity level by sector weighted by the sectoral employment shares:

$$\frac{Y_T}{L_T} - \frac{Y_0}{L_0} = \sum_{j=1}^J \theta_{j0} \left( \frac{Y_{jT}}{L_{jT}} - \frac{Y_{j0}}{L_{j0}} \right) + \sum_{j=1}^J (\theta_{jT} - \theta_{j0}) \frac{Y_{j0}}{L_{j0}} + \sum_{j=1}^J (\theta_{jT} - \theta_{j0}) \left( \frac{Y_{jT}}{L_{jT}} - \frac{Y_{j0}}{L_{j0}} \right) \quad (1)$$

<sup>4</sup> I study 2001 - 2008 era to focus on the relatively high growth period. There are other studies investigating the sectoral sources of the aggregate productivity in Turkey from a historical perspective. For example, Altuğ, Filiztekin, and Pamuk (2008) provide a comprehensive study of the sources of long-term economic growth for Turkey between 1880 and 2005. Adamopoulos and Akyol (2009) argue that movements in relative sectoral productivity differences in Turkey relative to the U.S. and Southern Europe (and the evolution of aggregate taxes in Turkey relative to these regions) can account quantitatively for most of Turkey's underperformance between 1960 and 2003. İmrohoroğlu, İmrohoroğlu, and Üngör (2010) argue that low agricultural productivity in Turkey accounts for the increased income gap between Turkey and Spain in the 1960s and 1970s.

The term on the left hand side is the labor productivity growth between years 0 and T,  $j$  is the sector, and  $\theta_{jT}$  is the share of employment in sector  $j$  in year T.<sup>5</sup>

The intra-sectoral effect, the first term on the right hand side of (1), shows the part of the overall productivity change which is caused by productivity growth within the sectors. This effect shows the growth of labor productivity that would have occurred even without any structural change. That is, it is due to the aggregate productivity gains obtained because of the internal improvements of productivity in each sector. The structural change effect, the sum of the second and the third terms on the right hand side of (1), captures the effect of the reallocation of factors between sectors towards industries with a higher initial level of labor productivity (static effect), or a higher rate of labor productivity growth (dynamic effect).

The static sectoral effect, the second term on the right hand side of (1), is the sum of changes in input shares, weighted by the initial productivity levels. It measures the growth of labor productivity due exclusively to the change in sector composition, and which would have occurred even without any change in the productivity of any sector during the period analyzed. The dynamic sectoral effect (or the interaction effect), the last term on the right hand side of (1), represents the joint effect of changes in employment shares and sectoral productivity. The dynamic sectoral effect can be either negative or positive, depending on whether sectors with a falling (rising) share show rising (falling) productivity (then it is negative) or sectors with a falling (rising) share show falling (rising) productivity (then it is positive).

### 3. Data

I use sectoral data for nine sectors in Turkey between 2001 and 2008. The sectors are 1) Agriculture, forestry, hunting and fishing; 2) Mining and quarrying; 3) Manufacturing; 4) Electricity, gas and water supply; 5) Construction; 6) Wholesale and retail trade, restaurants and hotels; 7) Transportation, communication and storage; 8) Finance, insurance, real estate and business services; and 9) Community, social and personal services. Sectoral GDP data (at basic prices in 1998) are from the Turkish Statistical Institute and sectoral employment data are from the Household Labor Force Survey of the Turkish Statistical Institute.<sup>6</sup> Summary statistics are presented in Table 1.

<sup>5</sup> See, i.e., Ark (1996); and Maudos, Pastor, and Serrano (2008) for the details of the shift-share analysis of productivity growth.

<sup>6</sup> The Turkish Statistical Institute has revised the Labor Force Survey results for 2004 and later by the new projections. Revisions for the earlier period are not completed yet. Thus pre-2004 employment data is adjusted to account for the changes in population projections.

Table 1. Sectoral Shares and Productivity in Turkey, 2001 – 2008

Sector	Employment Shares (%)		GDP Shares (%)		GDP per Worker (TL per person)		Average Annual Growth of Labor Productivity (%)
	2001	2008	2001	2008	2001	2008	2001 - 2008
Agriculture	33.2	23.7	10.4	9.7	1,269	1,878	5.8
Mining, quarrying	0.5	0.5	1.1	1.8	7,145	7,109	-0.1
Manufacturing	18.1	20.0	22.4	20.5	4,496	5,740	3.6
Electricity, gas, water	0.5	0.4	2.8	2.8	14,985	22,969	6.3
Construction	5.5	5.9	5.2	6.0	3,256	4,872	5.9
Wholesale, etc.	18.4	21.6	17.1	18.3	2,767	3,306	2.6
Transportation, etc.	5.1	5.1	15.6	18.0	8,790	13,801	6.7
Finance, etc.	3.6	5.5	13.4	9.8	12,409	12,210	-0.2
Community, etc.	15.2	17.3	12.1	13.0	2,354	2,215	-0.9

Source: Turkish Statistical Institute. Note: GDP shares are in current prices.

#### 4. Results

Table 2 shows the percentage contributions of the three effects to the overall labor productivity growth for nine sectors between 2001 and 2008. The columns report the separate effects: intra, static- and dynamic-shift effects and the total effect looking at the total contribution of the nine sectors between 2001 and 2008. The intra-sectoral effect dominates the outcome between 2001 and 2008. Productivity growth within the nine sectors explains 71.9 percent of the aggregate labor productivity growth in Turkey. Structural change explains the remaining 28.1 percent: 29.5 percent is due to the static sectoral effect, and minus 1.4 percent is due to the dynamic sectoral effect.<sup>7</sup>

There are considerable variations in the importance played by different sectors. For example, manufacturing (27.1 percent in total) contributes most to the labor productivity growth between 2001 and 2008. This is partly due to intra-growth in this sector (18.5 percent), but also due to the fact that manufacturing increases its share of employment and has higher labor productivity levels than the shrinking agriculture (contributing another 8.6 percent to overall labor productivity growth).

There are also high positive productivity growth contributions from transportation, communication and storage (21.7 percent in total); finance, insurance, real estate and business services (18.7 percent in total); and wholesale and retail trade, restaurants and hotels (16.6 percent in total).

<sup>7</sup> I replicate the analysis for different sample periods and observe similar findings. For example, productivity growth within the nine sectors (the intra-sectoral effect) explains 68.0 percent of the aggregate labor productivity growth between 2002 and 2007. These findings suggest that the qualitative nature of the results do not change if 2001 and 2008 are excluded.

Table 2. Sectoral Contributions, 2001 - 2008 (Percent)

	Intra	Static	Dynamic	Total
Agriculture	16.6	-9.9	-4.8	1.9
Mining, quarrying	0.0	0.5	0.0	0.5
Manufacturing	18.5	6.8	1.8	27.1
Electricity, gas, water	3.0	-0.3	-0.2	2.5
Construction	7.2	1.1	0.5	8.8
Wholesale, etc.	8.1	7.1	1.4	16.6
Transportation, etc.	20.8	0.6	0.3	21.7
Finance, etc.	-0.6	19.6	-0.3	18.7
Community, etc.	-1.7	4.1	-0.2	2.1
<b>Total</b>	<b>71.9</b>	<b>29.5</b>	<b>-1.4</b>	<b>100.0</b>

Source: Author's calculations.

#### 4.1. Intra-Sectoral Effect

Table 2 shows that the intra-sectoral effect is dominated by transportation, communication and storage; and manufacturing. Moreover, agriculture has positive contribution to the intra-sectoral effect.<sup>8</sup>

The intra-sectoral effect is negligible or negative in mining and quarrying; finance, insurance, real estate and business services; and community, social and personal services.

#### 4.2. Static and Dynamic Effects

The static sectoral effect accounts for 29.5 percent of labor productivity growth between 2001 and 2008. This positive static effect, in particular, comes from finance, insurance, real estate and business services.

The dynamic sectoral effect accounts for minus 1.4 percent of labor productivity growth between 2001 and 2008. This negative dynamic effect is in particular the result of a high productivity growth in agriculture for which the share in employment falls. Agricultural employment share falls from 33.2 percent in 2001 to 23.7 percent in 2008; and the average annual growth in labor productivity in agriculture is 5.8 percent between 2001 and 2008.

Agriculture has a positive contribution to the aggregate labor productivity growth (1.9 percent in total). However, the productivity levels in agriculture are lower than that of any other sector. Moreover, agriculture has the largest share of employment (see Table 1).

<sup>8</sup> In 2000-01 an important reform agenda was introduced in agriculture, with emphasis given to direct income support for farmers in place of more distortive and fiscally costly input and output subsidies, and the privatization of state-owned organizations which control agricultural output and input markets (see OECD 2006 for details). An investigation of whether there is any positive significant relationship between agricultural reform and productivity increases deserves special attention for further research (see, for example, the edited volume by Karapinar, Adaman, and Ozertan (2010) for an investigation of the effectiveness of 2000-01 agricultural reforms from a multi-disciplinary perspective).

## 5. Concluding Remarks

This note finds that productivity growth within the nine sectors explains 71.9 percent of the aggregate labor productivity growth in Turkey. Manufacturing (27.1 percent in total) contributes most to the labor productivity growth. The intra-sectoral effect is dominated by transportation, communication and storage since this sector is the most productive sector between 2001 and 2008 with an average annual growth rate of 6.7 percent.

The analysis above reveals that there are considerable variations in the importance played by different sectors. A broad policy message is that there is a need to understand the key drivers of competitiveness in each sector to be able to understand differences in growth rates across sectors in the Turkish economy. This requires attempts to supplement aggregate calculations with micro-level information about individual firms or narrowly defined industries.<sup>9</sup>

Another direction for further research is considering sectoral differences in capital accumulation, hours worked, capacity utilization, technology adoption, regulation, etc., which are omitted in this study. These factors may provide a more complete picture for the sectoral productivity differences in Turkey.<sup>10</sup>

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<sup>9</sup> See also Taymaz and Suiçmez (2005) for some policy suggestions to increase productivity both at the sector and firm level.

<sup>10</sup> See the McKinsey Productivity Study (2003) and Saygılı, Cihan, and Yurtoğlu (2005) for research in this direction.

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