



CBT RESEARCH NOTES IN ECONOMICS

On the Role of Productivity and Demographic Factors for Growth: The Case of Turkey, 2004-2012*

Murat Üngör M. Koray Kalafatçılar

Abstract: Turkey has the highest average annual growth rate of GDP (measured in constant local currency) and the fifth highest average annual growth rate of, purchasing power parity (PPP)-adjusted, per capita income among all the OECD countries between 2004 and 2012. This note studies the sources of this high growth era in a comparative perspective, decomposing GDP per capita into three components: labor productivity, the ratio of employment-to-working-age population, and the ratio of working-age to total population. We find that growth in output per worker accounts for most of the speed up in Turkey's GDP per capita growth during 2004-2007, with modest contributions from rising participation rates and increases in the working-age share of the total population. Similarly, declines in labor productivity are primarily responsible for contraction of output per capita during the 2007-2009 global recession. On the other hand, growth in employment-to-population ratio accounts for around two-thirds of growth in per capita output during 2009-2012. These findings suggest a productivity-based growth era before the global crisis and an employment-based growth era in the post-crisis period.

Özet: Türkiye, 2004-2012 döneminde, reel GSYİH (yerel para birimi cinsinden) büyümesi olarak OECD ülkeleri arasında en yüksek büyümeye; satın alma paritesi ile düzeltilmiş kişi başına GSYİH büyümesi olarak da OECD ülkeleri arasında en yüksek beşinci büyümeye sahip ülkedir. Bu çalışmada, verimlilik ve demografik unsurların kişi başına gelir büyümesi üzerine etkileri ülkeler arası karşılaştırma yapılarak sunulmuştur. Kişi başına gelir (i) emek verimliliği, (ii) istihdamın çalışabilir nüfusa oranı ve (iii) çalışabilir nüfusun toplam nüfusa oranı olarak üç bileşene ayrıştırılmıştır. 2004-2009 döneminde emek verimliliğindeki artışlar kişi başına gelir büyümesini etkileyen en önemli faktördür. Bununla birlikte, 2009-2012 döneminde istihdamın çalışabilir nüfusa oranındaki artışlar kişi başına gelirden gözlenen büyümenin üçte ikisine yakınına açıklayabilmektedir. Bu bulgular, incelenen dönemin kriz öncesi verimliliğe dayalı büyüme dönemi ve kriz sonrasında istihdam kaynaklı büyüme dönemi olarak ikiye ayrılabilmesine işaret etmektedir.

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“Mere increases in inputs, without an increase in the efficiency with which those inputs are used—investing in more machinery and infrastructure—must run into diminishing returns; input-driven growth is inevitably limited.” — **Paul Krugman** (1994, p. 67)

1. Introduction

There are many aspects of the process of long-run growth and economic development. The relationship between demographic change and economic development, for example, is one particular aspect; and there has been a debate among economists, demographers, and social scientists over the effects of population size and growth on economic growth, i.e., whether population growth restricts, or, promotes, or is independent of economic growth.¹ In recent years, possible effects of demography on the global economy have been receiving much more attention due to the changes in the age structure of the global population and the overwhelming concern with population ageing (see Appendix A.1).

The demographics of a population may impact the economy of a nation; supporting economic growth or impeding it, depending on the nature of the structure. In addition to productivity growth and factor accumulation, economic growth may tend to go together with demographic changes. Figure 1 presents some facts for Turkey regarding the changes in growth rates and demographics. Panel (a) in Figure 1 shows GDP per capita in Turkey relative to the U.S. between 1980 and 2012. Historically, Turkey’s economic catching-up with the developed economies has not been strong. For example, GDP per capita in Turkey increased from 23.5% of the U.S. level in 1980 to around 27% in 1993; and GDP per capita shrank to about 23% of the U.S. level in 2001. After that, GDP per capita in Turkey relative to the U.S. reached to around 32% in 2012.²

Panel (b) in Figure 1 displays the time-path of GDP (at 1998 prices) during 1998-2012, where the value for 1998 is normalized to 100. The 2001 crisis resulted in a substantial output loss and real GDP dropped by 5.7%. The economy came back from this deep growing at an average annual rate of 6.9% between 2002 and 2007.³ Turkey ranked third (after Estonia and Slovak Republic) among all the OECD countries with this growth rate during 2002-2007.⁴ Especially, very strong growth performances observed in 2004 and 2005; and the economy recorded a real growth of 9.4% in 2004 and of 8.4% in 2005. Real GDP growth

¹ It is beyond the scope of this study to examine these different arguments. See Bloom and Williamson (1998) and Bloom et al. (2003) for general discussions on this issue.

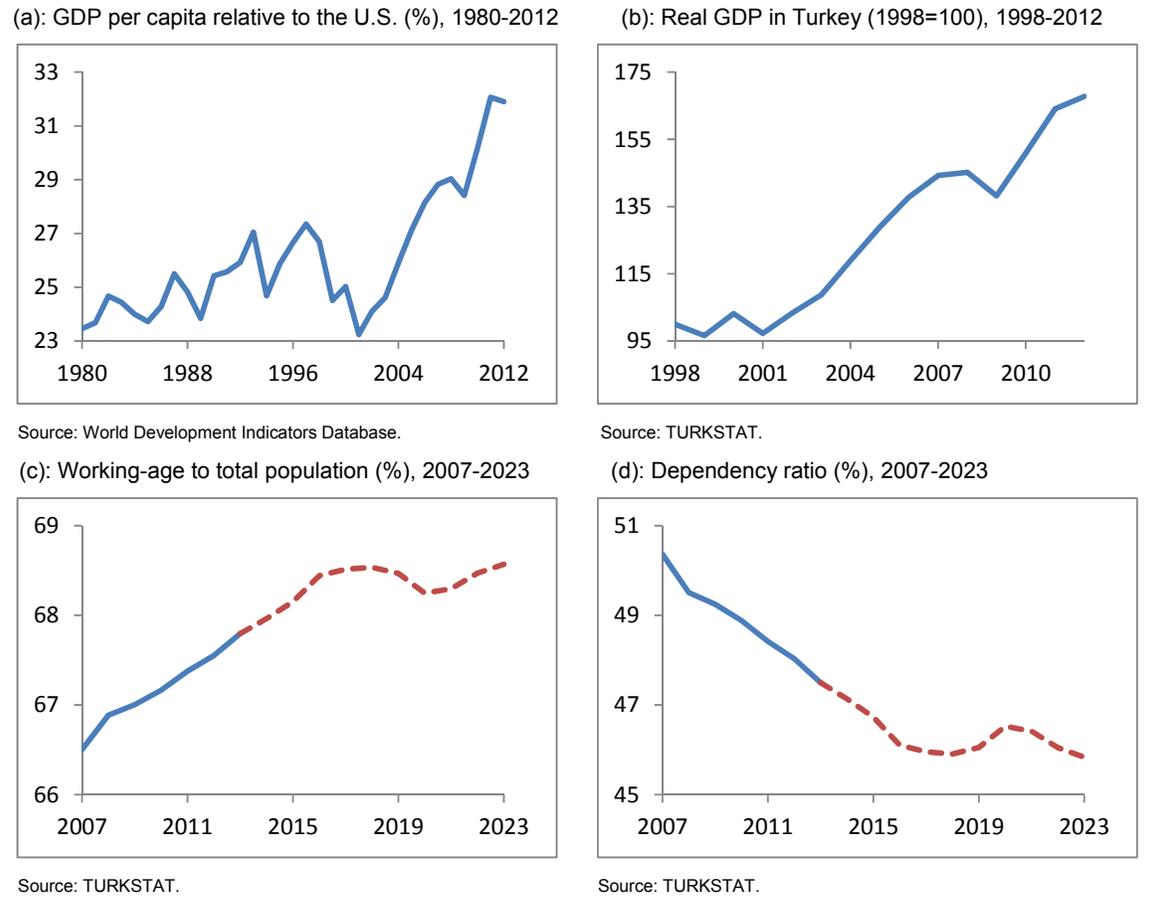
² We use GDP per capita at purchasing power parity in constant 2005 international dollars from the World Bank’s World Development Indicators database. See Üngör (2013) for a recent detailed comparative study on the convergence experience of Turkey.

³ The annualized percentage growth rate of variable x over the period t to $t+T$ is given as $100 * [(x_{t+T}/x_t)^{1/T} - 1]$.

⁴ We use GDP (constant local currency unit) from the World Bank’s World Development Indicators database.

rate was 6.9% in 2006 and it was 4.7% in 2007. There were declines in growth rates in 2008 and 2009 due to the global crisis. Real GDP grew by only 0.7% in 2008, and after contracting by 4.8% in 2009; the Turkish economy recorded a real growth of 9.2% in 2010 and of 8.8% in 2011. Turkey's rate of economic growth slowed to 2.2% in 2012.

Figure 1. Growth and demographics in Turkey



The lower panels in Figure 1 show the ratio of working-age people (15-64) to total population and the *dependency ratio* (defined as the numbers of under-15s and over-65s in the population as a proportion of those aged 15-64) for Turkey between 2007 and 2023.⁵ The size of working-age population not only grew in absolute terms, but also in relative terms. According to Panel (c) in Figure 1, the ratio of the working-age population to total population

⁵ Data for 2007-2012 are based on the Address Based Population Registration System, which are available at: http://www.tuik.gov.tr/PrelstatistikTablo.do?istab_id=1588. Data for 2013-2023 are from the projections of the TURKSTAT, which are available at: http://www.turkstat.gov.tr/PrelstatistikTablo.do?istab_id=244.

increased from 66.5% in 2007 to 67.6% in 2012. The projections suggest that there would be further increases and this ratio would be 68.6% in 2023. The dependency ratio, calculated as the young and the elderly population divided by the working-age population, reflects how many people each working-age person has to support. Panel (d) depicts that the dependency ratio decreased from 50.4% in 2007 to 48.0% in 2012. The projections suggest that there would be further decreases and the dependency ratio would be 45.8% in 2023.

Our objective in this study is to assess the roles of different factors (such as productivity, employment rate and demographics) on per capita income growth in Turkey in recent years. We study the effects of productivity and demographics on per capita income growth in Turkey in a comparative perspective, decomposing GDP per capita into three components: labor productivity, the ratio of employment-to-working-age population, and the ratio of working-age to total population. We find that output per worker is the most important component of per capita income growth during 2004-2009. On the other hand, growth in employment-to-population ratio accounts for around two-thirds of growth in per capita output between 2009 and 2012. Our findings are in line with the discussion provided by Gürsel and Soybilgen (2013). They use quarterly data, within a similar framework to our analysis, and underline the findings that a productivity-based growth dominated the per capita income growth before the global crisis and; it has been an employment-based growth era in the post-crisis period. We also provide a comparison with other fast-growing OECD countries and note the different contributions of different factors to per capita income growth in Chile, Poland, Korea, and the Slovak Republic.

2. A GDP Decomposition

2.1 Framework

We decompose GDP per capita (Y/P) at time t into three components: labor productivity (Y/L), the ratio of employment-to-working-age population (L/WP), and the ratio of working-age to total population (WP/P).⁶

$$(Y/P)_t = (Y/L)_t \times (L/WP)_t \times (WP/P)_t. \quad (1)$$

Here, Y is real GDP, P is total population, L is the employed population, and WP denotes the working-age population. Thus, real GDP per capita can be expressed as the product of real GDP per worker (or labor productivity), employment-to-working-age population, and the ratio of working-age to total population. We take logarithms and decompose the average annual growth rate of output per worker over a number of years, z , into

⁶ See, for example, Blanchard, 2004; Bloom et al., 2010; Marattin and Salotti, 2011 for similar decompositions.

$$\begin{aligned}
& \frac{\log[(Y/P)_{t+z}] - \log[(Y/P)_t]}{z} \\
&= \frac{\log[(Y/L)_{t+z}] - \log[(Y/L)_t]}{z} + \frac{\log[(L/WP)_{t+z}] - \log[(L/WP)_t]}{z} \\
&+ \frac{\log[(WP/P)_{t+z}] - \log[(WP/P)_t]}{z}.
\end{aligned} \tag{2}$$

This decomposition lets us to understand the magnitude of each contribution to per capita income growth, decomposing changes in output per capita into changes in output per worker (the first term on the right hand side), changes in the ratio of employment-to-working-age population (the second term on the right hand side), and changes in the demographic ratio (the last term on the right hand side). This decomposition is useful to distinguish the overall population from the working-age population and provides insights for the implications of the change in the age structure of the population (in addition to the changes in labor productivity) for economic growth.

2.2 Turkey, 2004-2012

We use the Turkish data to apply the accounting exercise presented in (2). Our sample period is 2004-2012. This period is a (relatively) high growth period for Turkey as shown in the upper panels in Figure 1. In addition, this period incorporates the recent revisions for national accounts, labor market and population statistics. GDP data is from the “Expenditure on the Gross Domestic Product (at 1998 prices)” table of the TURKSTAT.⁷ All other variables (population, labor force, and employment) are from the “Labour Force Status by Non-Institutional Population, Years and Sex” table of the TURKSTAT.^{8,9} Table 1 shows the results.

During 2004-2007, per capita income grew at 5.19% per year and output per worker grew at 4.61% per year. In other words, growth in output per worker accounts for more than 88% of growth in per capita output between 2004 and 2007. This means that growth in output per worker accounts for most of the speed up in Turkey’s GDP per capita growth during 2004-2007, with modest contributions from rising participation rates and increases in the working-age share of the total population. Similarly, declines in labor productivity are primarily responsible for contraction of output per capita during the 2007-2009 global recession. On

⁷ http://www.tuik.gov.tr/PrelstatistikTablo.do?istab_id=1000

⁸ http://www.tuik.gov.tr/PrelstatistikTablo.do?istab_id=1323

⁹ We use non-institutional population and non-institutional working age population. Non-institutional population comprises all the population excluding the residents of dormitories of universities, orphanage, rest homes for elderly persons, special hospitals, prisons and military barracks etc.; and non-institutional working age population indicates the population 15 years of age and over within the non-institutional population.

the other hand, the role of the labor productivity growth is diminished in the post-2009 era. The most important factor for per capita income growth is the observed increases in employment-to-working-age population ratio between 2009 and 2012: growth in employment-to-population ratio accounts for 64% of growth in per capita output between 2009 and 2012.

Table 1. Decomposing GDP per capita growth in Turkey (average annual changes, %)

<i>Period</i>	<i>Y/P</i>	<i>Contribution to output per capita of</i>		
		<i>Y/L</i>	<i>L/WP</i>	<i>WP/P</i>
2004-2005	6.80	5.88	0.49	0.43
2005-2006	5.43	4.91	0.09	0.43
2006-2007	3.34	3.03	-0.12	0.43
2007-2008	-0.53	-1.52	0.63	0.36
2008-2009	-6.11	-5.34	-1.39	0.62
2009-2010	7.63	2.76	4.37	0.51
2010-2011	6.97	1.91	4.51	0.54
2011-2012	0.53	-0.69	0.82	0.41
2004-2007	5.19	4.61	0.15	0.43
2007-2009	-3.32	-3.43	-0.38	0.49
2009-2012	5.05	1.33	3.23	0.49
2004-2012	3.01	1.37	1.17	0.47

Source: TURKSTAT, Authors' calculations.

2.3 A Comparison within the OECD Group

Turkey has the highest average annual growth rate of GDP (measured in constant local currency) and the fifth highest average annual growth rate of PPP-adjusted per capita income among all the OECD countries between 2004 and 2012 (Table 2). The average annual growth rate of GDP was 4.39% in Turkey and 4.37% in the Slovak Republic between 2004 and 2012. In terms of the growth rate of GDP per capita (PPP, constant 2005 international \$), Turkey ranked fifth during 2004-2012.

The findings presented in Table 1 suggest that Turkey experienced a productivity-based growth era before the global crisis and an employment-based growth era in the post-crisis period. Now we are interested to see whether the other fast-growing OECD countries presented in Table 2 show such pattern changes (in terms of the dominant factor of growth). Therefore, we repeat the accounting exercise for these high-growing OECD countries and report the contributions of (i) output per worker; (ii) employment-to-working-age population ratio; and (iii) the ratio of working-age to total population. The results are presented in Table

3.¹⁰ We observe that different factors are responsible for per capita GDP growth in the highest-growing OECD countries.

Table 2. Top growth performances in OECD countries, 2004-2012 (%)

<i>Country</i>	<i>GDP</i>	<i>GDP per capita</i>
Chile	4.30	3.29
Poland	4.19	4.07
Korea, Rep.	3.60	3.08
Slovak Republic	4.37	4.30
Turkey	4.39	3.07

Source: World Development Indicators Database.

Table 3 displays that output per worker is the most important component of per capita GDP growth in Korea and the Slovak Republic before and after the crisis. In Poland, growth in employment-to-working-age population ratio accounts for around 54% of growth in per capita output in between 2004 and 2007, while growth in output per worker accounts for all the increases in per capita output during 2009-2012. On the other hand, the dominant factor in Chile's per capita income growth during 2004-2011 is the rise of the employment-to-working-age population ratio. Specifically, the increases in the employment-to-working-age population ratio in Chile accounts for more than 80% of per capita GDP growth between 2004 and 2011.

Table 3. Sources of growth in OECD countries, (average annual changes, %)

<i>Country/Period</i>	<i>Y/P</i>	<i>Contribution to output per capita of</i>		
		<i>Y/L</i>	<i>L/WP</i>	<i>WP/P</i>
Chile				
2004-2007	3.77	0.41	2.85	0.51
2007-2009	0.29	0.18	-0.33	0.44
2009-2011	4.71	-0.34	4.82	0.23
Poland				
2004-2007	5.44	2.06	2.93	0.45
2007-2009	3.24	1.28	1.73	0.24
2009-2012	3.04	3.96	-0.75	-0.17
Korea				
2004-2007	4.25	3.37	0.68	0.21
2007-2009	0.70	1.14	-0.76	0.32
2009-2012	3.37	2.30	0.83	0.24
Slovak Republic				
2004-2007	8.05	5.39	2.19	0.47
2007-2009	0.07	0.09	-0.23	0.21
2009-2011	3.81	3.93	0.25	-0.37

Source: OECD, World Development Indicators Database, TURKSTAT, Authors' calculations.

¹⁰ Depending on the data availability we present the results in Table 3 with the end year being 2011 or 2012.

2.4 A Convergence Exercise

Our calculations in Table 1 show that growth in output per worker accounts for 45.5%; growth in employment-to-working-age population ratio accounts for 39.0%; and growth in the ratio of working-age to total population accounts for 15.5% of growth in per capita output in Turkey between 2004 and 2012. Now, we are interested in the question of what explains the convergence experience of Turkey (relative to the U.S.) in this period as shown in Panel (a) in Figure 1. Following Equation (1), relative GDP per capita depends on the ratio of the three factors at time t .¹¹

$$\frac{(Y/P)_t^{Turkey}}{(Y/P)_t^{US}} = \frac{(Y/L)_t^{Turkey}}{(Y/L)_t^{US}} \times \frac{(L/WP)_t^{Turkey}}{(L/WP)_t^{US}} \times \frac{(WP/P)_t^{Turkey}}{(WP/P)_t^{US}}. \quad (3)$$

We use Equation (3) to see which of these three measurable components of the data explain the evolution of GDP per capita in Turkey relative to the U.S. Table 4 reports real GDP per capita, real GDP per worker, the ratio of employment-to-working-age population, and the ratio of working-age to total population in Turkey relative to the U.S. between 2004 and 2012.¹² For example, in 2004, GDP per capita in Turkey relative to that of the U.S. was around 26%. By 2012, relative GDP per capita increased to around 32%. Output per worker increases both in Turkey and in the U.S. with the relative factor of 0.43 in 2012. This factor is very similar to that observed in 2004 (that is 0.42). Similarly, the ratio of working-age to total population increases both in Turkey and in the U.S. with the relative factor of 0.96 in 2012. This also is very similar to that observed in 2004 (that is 0.94). The high level of relative GDP per capita in Turkey in 2012, compared to 2004, is due to high relative employment-to-working-age population ratio.

Table 4 displays that the source of the convergence during 2004-2007 is aggregate labor productivity. During the global crisis of 2007-2009, declines in productivity gains in Turkey created obstacle for convergence, despite relative improvements in the ratio of employment-to-working-age population and the ratio of working-age to total population. In fact, average annual growth of labor productivity in Turkey during 2007-2009 was -3.37%. On

¹¹ See Bello et al. (2011) for a similar decomposition for the growth experience of Venezuela.

¹² Data for the U.S. are from the Economic Report of the President (2013), which are available at: <http://www.gpo.gov/fdsys/pkg/ERP-2013/content-detail.html>. Specifically, we use "Table B-34: Population by age group, 1940-2012" and "Table B-35: Civilian population and labor force, 1929-2012" for population and labor market statistics. To make international comparisons available, we use GDP at purchasing power parity in constant 2005 international dollars from the World Bank's World Development Indicators database for Turkey and the U.S.

the other hand, the corresponding figure for the U.S. was 0.40% in the same period.¹³ Finally, the source of the convergence during 2009-2012 is increases in employment-to-working-age population ratio in Turkey (and the declines of this ratio in the U.S.). This ratio increased from 0.41 in 2004 to 0.45 in 2012 in Turkey; while it decreased from 0.62 in 2004 to 0.59 in 2012 in the U.S.

Table 4. Sources of the convergence: Indicators relative to the U.S.

<i>Year</i>	<i>Y/P</i>	<i>Y/L</i>	<i>L/WP</i>	<i>WP/P</i>
2004	0.26	0.42	0.66	0.94
2005	0.27	0.44	0.66	0.94
2006	0.28	0.46	0.66	0.94
2007	0.29	0.47	0.66	0.94
2008	0.29	0.46	0.67	0.95
2009	0.29	0.43	0.69	0.95
2010	0.31	0.43	0.74	0.96
2011	0.32	0.44	0.77	0.96
2012	0.32	0.43	0.77	0.96

Source: Economic Report of the President (2013), World Development Indicators Database, TURKSTAT, Authors' calculations.

3. Concluding Remarks

This note has presented simple decomposition approaches to understand the sources of the per capita income growth in recent years in Turkey in a comparative perspective. Increasing employment-to-working-age population ratio and the ratio of working-age to total population will have positive contributions to per capita income growth in Turkey if the current trends are preserved. Our main findings are (i) growth in output per worker is responsible for per capita income growth before the global crisis (during 2004-2007); and (ii) the observed increases in employment-to-population ratio are responsible for per capita income growth after the crisis (during 2009-2012).

Different studies have emphasized the importance of several factors for the observed productivity increases, especially during the 2002-2007 period. The severity of the 2001 crisis made it a turning point to implement different economic reforms. These reforms were aimed to establish macroeconomic and financial stability and to improve the business environment. Among the institutional and structural reforms were the independence of the Central Bank of Turkey, the introduction of free-floating exchange rate regime, and the introduction of the inflation-targeting regime. In addition, there were economic reform

¹³ It is noted that in the downturn of 2008–2009, labor productivity actually rose as GDP plummeted in the U.S. (see McGrattan and Prescott, 2012); and the financial crisis of 2008 was followed by sharp contractions in aggregate output and employment and an unusual increase in aggregate total factor productivity in the U.S. (see Petrosky-Nadeau, 2013 and the references therein).

programs to have fiscal discipline and improve the banking system; to meliorate the investment climate and speed up the privatization; to attract foreign direct investment and maintain a floating exchange rate regime.¹⁴ A related issue is the growth of higher-tech activities in the 2000s. Noting that these sectors are more productive than the low-tech sectors, OECD (2012) reports that the share of medium-to-high-tech sectors in Turkey's total manufacturing exports increased from 30% to more than 60% during 2002-2008, and their share in total output rose from 23% to 30%.

A set of pro-employment incentives may be responsible for the observed increases in employment-to-population ratio in recent years. For example OECD-ILO (2011) reports that targeted measures, such as a general reduction of social security contributions, significant social security and corporate and VAT tax reductions for enterprises investing in less developed regions, to reduce non-wage labor costs introduced from 2008 encouraged the recruitment of workers, increased employment outside agriculture and helped reduced informality. A related aspect is that the so-called *Anatolian tigers* created many new jobs for the low-skilled, outside traditional agriculture. OECD (2012) reports that starting from 2007 their employment rate increased; and in 2011, workers with primary education or less represented 55% of total employment.

As emphasized, our findings indicate a productivity-based growth era before the global crisis and an employment-based growth era in the post-crisis period. One can argue that cyclical factors and measurement issues may well dominate any trend change over a short period. Having this in mind, it is important to have productivity growth for long-term sustainable growth, since input-driven growth is inevitably limited. We argue that our findings may stimulate thought-provoking questions for productivity dynamics and demographic changes in Turkey. One aspect of productivity growth is decomposing changes in output per worker into different components; showing the quantitative importance of capital deepening and total factor productivity (TFP) growth for aggregate output per worker growth. For example, in a recent study, Atiyas and Bakış (2013) find that TFP growth in the 1990s was very low; and by contrast, it vastly improved in the 2000s, increasing to over 3% per annum.¹⁵

One aspect of the demographic changes in Turkey is linked to the labor market via increasing female labor force participation rates and increasing employment rates in recent

¹⁴ OECD (2006, 2012), Yılmaz (2008), İsmihan and Metin-Özcan (2009), Gürsel (2011), Atiyas (2012), Aysan et al. (2013), Üngör (2013), among many others, discuss the details of the economic reforms and their impacts on aggregate economic performance of Turkey.

¹⁵ Atiyas and Bakış (2013) find that, in the period 2002-2010, among the 98 countries for which complete data is available, Turkey ranks 7th in terms of TFP growth calculated through the Solow residual. Üngör (2013) also finds significant growth in TFP in the post-2002 period.

years. For example, the dependency ratio in Turkey has been declining, driven by a decline in the proportion of young dependents in the population. A fall in the dependency ratio, especially the young dependency ratio, may raise female labor force participation. Rising female participation means that workforce growth is faster than growth in the working age population, which will raise growth of GDP per head so long as the extra labor force participants can find employment (Eastwood and Lipton, 2012). In Turkey, female labor force participation rate increased from 23.3% in 2004 to 29.5% in 2012. Although increasing in recent years, labor force participation rates of women are still very low in comparative perspective.¹⁶ We also argue that further research investigating the links between demographics and productivity growth may provide insight into cross-country productivity patterns, especially in the context of emerging markets (see, for example, Feyrer, 2007; Ilmakunnas and Miyakoshi, 2013).

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¹⁶ See, among many others, World Bank (2009) and Fraker and Özdemir (2011). An investigation of the reasons behind the historically low female labor force participation rates in Turkey is beyond the scope of this study.

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Appendix A.1 Global Population Ageing

The possible consequences of the unprecedented increase in global population over the age of 60/65 are among the highly debated topics in academic and policy circles in both developed and developing world.¹⁷ Panel (a) in Figure A.1 shows the proportion of elderly population by selected country groups (aged 65 years and over) during 1950-2050.¹⁸ The projections of the United Nations imply that at the global level, the share of those 65-plus has risen from 5.1% of world population in 1950 to around 7.7% in 2010, with the dramatic increase still ahead as those 65-plus are expected to reach 15.6% by 2050. In Panel (b)-(c) in Figure A.1, we examine all of the 34 OECD countries (and Brazil) from the OECD the “ALFS Summary tables” dataset.¹⁹ Panel (b) shows the ratios for Germany, Italy, and Japan. These three countries have the highest proportions of elderly population as of 2011 in the OECD group. Japan is the most notable case, since the percentage of elderly in the population is not only highest among the OECD countries but highest in the world.²⁰ The share of the population aged 65-plus rose rapidly to 24.1% in 2012 from 12.1% in 1990.

Panel (c) depicts the ratios for Brazil, Mexico, and Turkey. Mexico and Turkey have the lowest proportions of elderly population as of 2010/2011 among the OECD countries. Brazil, not member of the OECD group, has very similar ratios, throughout the time, to those of Mexico and Turkey. It is worth to emphasize that Mexico and Turkey have the lowest PPP-adjusted per capita incomes within the OECD group.²¹ Panel (d) compares the OECD data for Turkey with the recent updates of the Turkish population statistics. The Turkish Statistical Institute (TURKSTAT) reports the results of Address Based Population Registration System (ABPRS) during 2007-2012. We calculate the population over 65 as percentage of total population based on the ABPRS data. These data do not exactly match the OECD data. Nevertheless, the observation for 2012 is 7.5%. Population projections from the TURKSTAT show that the population of Turkey will continue ageing: elderly population, which is the

¹⁷ See, for example, Beard et al., 2011; Bloom and Sousa-Poza, 2013 and the references therein.

¹⁸ Data are from the United Nations' World Population Prospects (the 2012 Revision). We use the table “Percentage total population (both sexes combined) by broad age group, major area, region and country, 1950-2100”, which is available at: <http://esa.un.org/unpd/wpp/Excel-Data/population.htm>. Data are available in every five years, starting in 1950. We use the projections based on the medium fertility assumption of the database during 2015-2050. *More developed regions* comprise Europe, Northern America, Australia/New Zealand and Japan. *Less developed regions* comprise all regions of Africa, Asia (except Japan), Latin America and the Caribbean plus Melanesia, Micronesia and Polynesia.

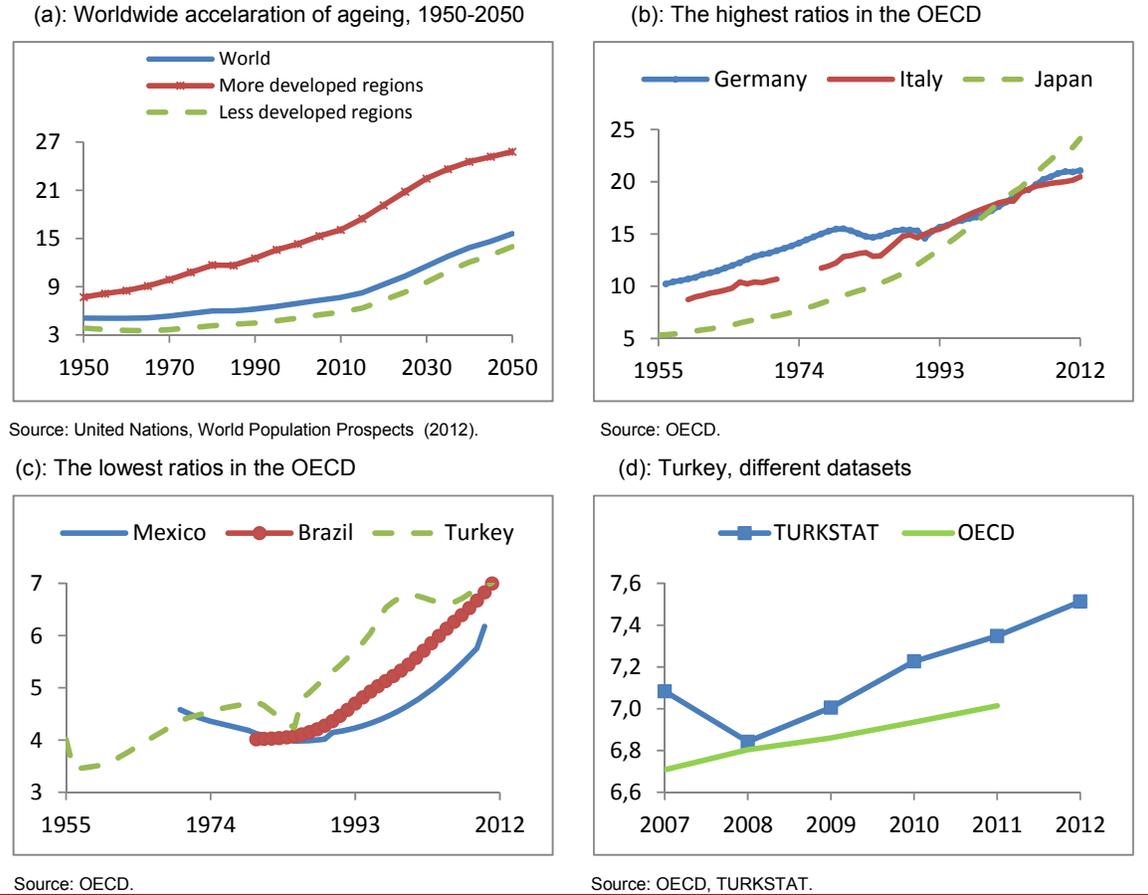
¹⁹ The “ALFS Summary tables” dataset is a subset of the Annual Labor Force Statistics database which presents annual labor force statistics and broad population series for 34 OECD member countries plus Brazil. The OECD countries are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

²⁰ <http://www.stat.go.jp/english/data/handbook/c02cont.htm>

²¹ We use GDP per capita at *purchasing power parity* in constant 2005 international dollars from the World Bank's World Development Indicators database: per capita income in Brazil, Mexico, Turkey and the U.S. are \$10,264, \$12,617, \$13,737, and \$43,063, respectively, in 2012.

population at 65-plus, is 5.7 million in 2012 (with a proportion of 7.5%) and this population will reach to 8.6 million people with a proportion of 10.2% in 2023.²² The figures for Turkey in 2012 and in 2023 are very low in comparison with the Japanese figure in 2012 (24.1%).

Figure A.1. Population over 65 as percentage of total population



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*Editör, Ekonomi Notları, TCMB İdare Merkezi, İstiklal Cad, No: 10, Kat:15, 06100, Ulus/Ankara/Türkiye.
E-mail: ekonomi.notlari@tcmb.gov.tr*

²² <http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=15844>