Some Thought Experiments on the Changes in Labor Supply in Turkey*

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November 5, 2012

Abstract

Turkey has the lowest hours worked (the product of total employment and annual hours per worker, divided by the size of the working-age population) among the OECD countries. We study the changes in hours of work following Ohanian et al. (2008) and find that the intratemporal first-order condition from the neoclassical growth model accounts for more than 80% of the decline in total hours worked between 1998 and 2009 in Turkey. Our findings suggest that the effective tax rates on consumption and the subsistence level of consumption play significant roles in explaining the hours worked in Turkey. The presence of government consumption in the utility function does not seem very important.

JEL classification: E20, E60, J22, O50.
Keywords: Labor supply; growth model; Turkey.

*The author would like to thank Ayşe İmrohoroğlu for many fruitful discussions on the topic of this paper. The views expressed herein are those of the author and not necessarily those of the Central Bank of the Republic of Turkey.

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1 Introduction

The recent literature documents large differences in hours of work across OECD countries, and presents evidence on how they have evolved over time.\footnote{Most of the discussion on this topic has been centered around the decline in aggregate hours of market work in Europe, particularly relative to the United States. The question, \textit{Why have Europeans worked less than Americans since the 1970s?}, has led to many studies exploring the changes in aggregate hours of work \textit{(see, for example, Bell and Freeman, 2001; Blanchard, 2004; Prescott, 2004; Alesina et al., 2005; Rogerson, 2008; Olovsson, 2009; Koyuncu, 2011; Erosa et al., 2012 and the references therein)}.} For example, Rogerson (2006) studies 21 OECD countries and argues that changes in technology and government are promising candidates to explain the broad changes over the period 1956-2003.\footnote{Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.} Ohanian et al. (2008) study the same countries between 1956 and 2004 using the intratemporal first-order condition from the neoclassical growth model, augmented with taxes on labor income and consumption expenditures. They find that the model can account for most of the trend changes in hours worked measured in the data.\footnote{McDaniel (2011) constructs a growth model extended to include home production and subsistence consumption to study differences in market hours worked for 15 OECD countries and finds that the forces influencing market hours in the selected OECD countries to be changes in labor income tax rates and productivity growth in the home and market sectors over the period 1960-2004. Recently, Ohanian and Raffo (2012) construct a new data set for total hours worked at the quarterly frequency which covers 14 OECD countries and spans the last 50 years. Using the new data, they document a large number of stylized facts regarding the business cycle properties of total hours and its components employment and hours per worker.} We study one country in depth that has not been covered by the studies mentioned above: Turkey. The reason is that Turkey has the lowest hours worked among the OECD countries. Figure 1 illustrates this point.

![Figure 1: Hours Worked in OECD, 1998-2010](image)
country, the measure of aggregate hours of work is the product of employment and annual hours of work per person in employment. To take into account the fact that countries differ in population size, our statistics are then normalized by the size of population aged 15-64.\textsuperscript{4} The dispersion of hours worked across countries is very large. During 1998-2010, Korea and Luxembourg are the two countries with the highest total hours worked per annum among all other OECD countries. On the other hand, Belgium and France are the two countries with the lowest total hours worked per annum among all other OECD countries (excluding Turkey). The striking observation is that the total hours worked in Turkey is lowest among the OECD members. Total hours worked in Turkey was 51.3\% of that of in Luxembourg, 55.3\% of that of in Korea, 83.5\% of that of in Belgium, and 88.6\% of that of in France in 2010.

This paper tries to determine the possible factors that are important for labor supply in Turkey. Specifically, we study the changes in hours of work following Ohanian et al. (2008) and investigate whether the neoclassical growth model can account for the changes in hours worked measured in the data. To do so, we focus on the key equation that determines the equilibrium worked hours: a static optimality condition that equates the marginal rate of substitution of consumption for leisure with the marginal product of labor. In our benchmark model, private and government consumption, in addition to the subsistence consumption, enter into the household’s utility function. The government levies proportional tax on consumption. We find that our benchmark model accounts for more than 80\% of the decline in total hours worked between 1998 and 2009.

We next explore the quantitative roles of the subsistence term, tax on consumption, and government consumption. We show that if the model ignores taxes on consumption income or the subsistence level in consumption, then its explanatory power decreases significantly. On the other hand, the presence of government consumption in the utility function does not seem very important. Having in mind that there are measurement problems regarding the effective tax rates on factor incomes for Turkey, we design some experiments illustrating the importance of the taxes on labor income. Our results suggest that time series data, which are needed for the calculation of the taxes on labor income, for variables such as Operating surplus of private unincorporated enterprises (OSPUE) and Household property and entrepreneurial income (PEI) should be documented by the statistical agencies in Turkey (as should be in many emerging market economies).

Understanding the evolution of labor supply in Turkey is relevant given the importance of labor input on the productivity measurement and on the catching-up process of the Turkish economy to the frontier. Therefore, this paper complements the studies focusing on the productivity growth in Turkey from a historical perspective. For example, Adamopoulos and Akyol (2009) state that the proximate explanation for Turkey’s underperformance to the

\textsuperscript{4}Data on civilian employment and population aged 15-64 for each country (except for Turkey) are from the OECD Annual Labour Force Statistics Summary Tables. Data on hours of work for each country (except for Turkey) are from the Conference Board Total Economy Database (January 2012). Data on employment and population aged 15+ for Turkey are from the Ministry of Development of Turkey, Economic and Social Indicators (1950-2010), Table 8.7. Labor statistics is calculated by the Ministry of Development according to labor statistics based on Address Based Population Registration System (ABPRS) covered by Household Labor Survey. We use the OECD series of average annual hours actually worked per person in total employment for Turkey.
U.S. and Southern Europe, from 1960 to 2003, lies in the relative deterioration of aggregate labor input and the less than stellar rise in relative labor productivity.

The paper is organized as follows. Section 2 presents the model economy and the key equation of interest following Ohanian at al. (2008). Section 3 presents a quantitative analysis with several experiments. Section 4 provides a brief discussion and Section 5 concludes.

2 Model Economy

The model is a variant of the neoclassical growth model and it follows Ohanian et al. (2008). The model considers the decision of consumption, labor and savings of an employed worker. It does not consider the decision of entering or not in the labor force as a job searcher.

The economy consists of a representative household with utility defined over streams of private consumption ($C_t$), government consumption ($G_t$), and leisure time ($\bar{H} - H_t$):

$$\sum_{t=0}^{\infty} \beta^t U(C_t + \lambda G_t, \bar{H} - H_t), \quad 0 < \beta < 1.$$  

(1)

The utility function is specified as:

$$U(.) = \alpha \log(C_t + \lambda G_t - \bar{C}) + (1 - \alpha) \frac{(\bar{H} - H_t)^{1-\gamma} - 1}{1-\gamma},$$

(2)

where $\gamma \geq 0$, $0 \leq \alpha \leq 1$, $0 \leq \lambda \leq 1$, and $\bar{C} \geq 0$. The parameter $\lambda$ measures how households value government consumption, $\bar{C}$ is a subsistence consumption term, and the parameter $\gamma$ governs the elasticity of substitution between leisure and consumption.

Technology is given by:

$$Y_t = A_t F(K_t, H_t) = A_t K_t^\theta H_t^{1-\theta},$$

(3)

where $A_t$ is efficiency, and $K_t$ and $H_t$ are capital and labor. Output is divided between consumption and investment and capital depreciates at rate $\delta$. The government levies proportional taxes on labor income and consumption given by $\tau_{h,t}$ and $\tau_{c,t}$, respectively. Government spending on goods and services in period $t$ is given by $G_t$, and the remaining tax revenues are used to finance a lump sum transfer $T_t$ so as to balance the budget each period.

2.1 The Equation of Interest

A full solution of the model involves the equilibrium values of consumption, labor, investment, and capital. Here we are concerned with the behavior of hours worked. The key equation is the first-order condition that equates the marginal rate of substitution between consumption and leisure to the marginal product of labor. Equating the household’s first-order condition for labor supply and the firm’s first-order condition for labor demand yields the equilibrium hours condition:
\[
\frac{U_2(C_t + \lambda G_t, \bar{H} - H_t)}{U_1(C_t + \lambda G_t, \bar{H} - H_t)} = (1 - \tau_t)A_tF_2(K_t, H_t). \tag{4}
\]

Here \((1 - \tau_t)\) is the so-called tax-wedge and is given by:

\[
(1 - \tau_t) = \frac{1 - \tau_{h,t}}{1 + \tau_{c,t}}. \tag{5}
\]

We focus only on consumption and labor taxes since these are the only taxes that have an impact on the theory’s static condition for equilibrium work hours. Given our functional form we have:

\[
\frac{H_t}{(H - H_t)^\gamma} = (1 - \tau_t)\frac{\alpha(1 - \theta)}{(1 - \alpha)} \frac{Y_t}{C_t + \lambda G_t - \bar{C}}. \tag{6}
\]

Given parameter values and actual data for the variables on the right-hand side of Equation (6), the model generates values for hours, which is defined as model hours. For any given country its predictive accuracy can be tested by using empirical time series data on taxes, aggregate output and consumption to generate model predicted \(H_t\), and then comparing these predicted hours per working-age population to actual data on hours worked.

It is worth to note that there is a wedge between the marginal rate of substitution and the marginal product of labor: the labor wedge. This wedge can be captured by introducing a time series for \(\Delta_t\) so that the following equation holds at each point in time:

\[
\frac{H_t}{(H - H_t)^\gamma} = (1 - \Delta_t)(1 - \tau_t)\frac{\alpha(1 - \theta)}{(1 - \alpha)} \frac{Y_t}{C_t + \lambda G_t - \bar{C}}. \tag{7}
\]

Note that \(\Delta_t\) denotes the after-tax wedge and it measures the deviation between the marginal rate of substitution and the marginal product of labor. By making appropriate assumptions for the parameters of the model, and given the time series, one can back out the labor wedge from Equation (7) in assessing the extent to which this first-order condition does not hold in the data. This approach builds upon a substantial body of research, including Chari et al. (2007) and Shimer (2010) and the references therein.

Instead of computing the labor wedge directly, we compare the model-predicted hours to the actual series for hours of work. This provides some perspective on the extent to which the model is able to account for the data. Moreover, it is easier to interpret a deviation between actual hours and model hours than it is to interpret the significance of a wedge of a given magnitude (Ohanian et al., 2008).

### 3 Quantitative Analysis

Since \(\alpha\) and \(\theta\) enter the Equation (6) as a constant of proportionality, then the values of these variables are irrelevant for accounting for changes in hours relative to a base year. We choose the value of \(\frac{\alpha(1 - \theta)}{(1 - \alpha)}\) so that the model hours are equal to the data for a base year,
which is labeled as period 0:

\[
\frac{H_t^P}{(H - H_t^P)\gamma} = \frac{1 - \tau_t}{1 - \tau_0} * C_t + \lambda G_t - \bar{C} * \frac{Y_t}{Y_0} * \frac{(H - H_0)\gamma}{H_0},
\]

where \(H_t^P\) is model-predicted hours.

### 3.1 Data and Parameterization

**Sample period and base year.** Our sample period is from 1998 to 2010. The reason we choose 1998 as the starting year is to study the revised national accounts in Turkey. The Turkish Statistical Institute (TurkStat) released the revision to GDP data in 2008. The main reason for this revision was to account for the structural changes in the economy since 1987 and to harmonize Turkey’s GDP estimates with the European System of Accounts (ESA 95). This revision updates the base year to 1998 from 1987, and includes both changes in methodology and coverage. With this revision, historical GDP series - both in real and nominal terms - as well as key macroeconomic ratios of Turkey such as shares of expenditure components in GDP have changed significantly (World Bank, 2008).\(^5\) We choose 2010 as the end year in our sample since the data on indirect taxes to compute the effective tax rate on consumption are available until 2010. We choose 1998 as base year for our benchmark results so that the model-predicted hours are equal to the data.

\(C_t, G_t, Y_t, H_t\). We use the time series of “Final Consumption Expenditure of Resident Households” for \(C_t\); “Government Final Consumption Expenditure” for \(G_t\); and “Gross Domestic Product” for \(Y_t\). National accounts are obtained from the Turkish Statistical Institute, Expenditure on the Gross Domestic Product (at 1998 prices) Tables. \(H_t\) denotes hours worked per working-age person and it is the product of total employment and annual hours per worker, divided by the size of the working-age population. Data on employment and population aged 15+ for Turkey are from the Ministry of Development of Turkey, Economic and Social Indicators (1950-2010), Table 8.7. We use the OECD series of average annual hours actually worked per person in total employment for Turkey. The concept used in the OECD is the total number of hours worked over the year divided by the average number of people in employment. Part-time workers are covered as well as full-time workers.

\(\tau_{c,t}, \tau_{h,t}\). We construct the time series for the effective tax rate on consumption, \(\tau_{c,t}\), following the procedure presented in Mendoza et al. (1994). Specifically, the effective tax rate on consumption is calculated as the sum of general taxes on goods and services and excise taxes divided by the sum of private final consumption expenditures and government non-wage consumption expenditures net of these indirect taxes. Data for indirect taxes are from the OECD Revenue Statistics. National accounts are obtained from the Turkish Statistical Institute, Expenditure on the Gross Domestic Product (at 1998 prices) Tables. We set \(\tau_{h,t} = 0\) because of the data problems. Specifically, data for \textit{Operating surplus of private unincorporated enterprises (OSPUE)}, \textit{Household property and entrepreneurial income (PEI)}, or \textit{Household gross operating system surplus and mixed income} are not available for Turkey.

\(^5\)Turkey’s national accounts were compiled on the basis of the 1968 SNA before the revision. The national accounts were restated according to the ESA 95 which comprises a more comprehensive and integrated set of accounts than the 1968 SNA.
Therefore, our benchmark model has only the effective tax rate on consumption. However, we do some experiments based on some hypothetical series on the effective tax rate on labor in Section 3.4.

**Parameters.** We follow Ohanian et al. (2008) for assigning values to the parameters of the model. The parameter values for our benchmark case are as follows: The value of $H$ is set to $14 \times 365 = 5110$. Our benchmark results assume that preferences are log in consumption and leisure, i.e., the limiting case as $\gamma$ tends to one. Government consumption is a perfect substitute for private consumption (i.e., $\lambda = 1$). We specify a value of $\bar{C}$ that is equal to 10% of total consumption (private and government) in 1998. We provide sensitivity analysis for each parameter in Section 3.3.

### 3.2 Benchmark Results

Panel (a) in Figure 2 compares model hours to actual hours. The data are plotted as a solid line and the model results are plotted as a dashed line. The model fits the data well. The model accounts for 83.02% of the decline in total hours worked between 1998 and 2009. The model under predicts the hours worked by around 1% on average during 1999-2005. Then, it over predicts the hours worked by around 2% on average during 2006-2009. Hours worked increased in Turkey since 2009. The model under predicts the hours worked by around 1.5% in 2010.

![Figure 2: Annual Hours Worked, Model Versus Data](image)

Panel (b) in Figure 2 decomposes the relative importance of taxes on consumption, $\tau_{c,t}$.

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6We compute this statistics as follows. The model predicts that total hours worked decreased from around 886 hours in 1998 to around 792 hours in 2009, a $100^*\ln(886/792)/11=1.02\%$ annual decrease. In the data the decrease is 1.22% (from around 886 hours to around 774 hours, a $100^*\ln(886/774)/11=1.22\%$ annual decrease. Thus, the model accounts for $100*1.02/1.22=83.02\%$ of the decline in total hours worked during 1998-2009.
the presence of government consumption in the utility function, $\lambda$, and the importance of the subsistence level of consumption, $\bar{C}$. If one ignores taxes on consumption or the subsistence level in consumption, then the model’s explanatory power decreases significantly. For example, the model can explain 60.87% of the decline in total hours worked between 1998 and 2009 if we ignore the subsistence level of consumption, i.e., $\bar{C} = 0$. The model can only explain 42.28% of the decline in total hours worked over 1998-2009 if there is no tax in the model, i.e., $\tau_{c,t} = 0$.

We next explore the quantitative role of government consumption. While the assumption that private and public consumption are additive is somewhat restrictive, consideration of the two extreme cases of $\lambda = 0$ and $\lambda = 1$ is informative to understand the importance of the government consumption for the analysis. Panel (b) in Figure 2 shows that the presence of government consumption in the utility function does not seem very important in terms of capturing the secular changes in hours worked in Turkey. For example, the model explains 82.30% of the decline in total hours worked between 1998 and 2009 if government consumption is not in the utility function, i.e., $\lambda = 0$, which is very close to the benchmark results (when $\lambda = 1$).

### 3.3 Sensitivity

Panel (a)-(e) in Figure 3 display sensitivity analysis with respect to the model parameters. Panel (a) shows the model results changing the value of the subsistence consumption term. Our experiments consist in eliminating, decreasing, and increasing the subsistence term $\bar{C}$: In particular, we consider $\bar{C} = 0$, $\bar{C} = 5\%$, and $\bar{C} = 20\%$. The model can explain 60.87% of the decline in total hours worked between 1998 and 2009 if $\bar{C} = 0$. On the other hand, if $\bar{C}$ is the half of the benchmark case (that is equal to 5% of total consumption in 1998), then the model can explain 71.44% of the decline in total hours worked over 1998-2009. If $\bar{C}$ is the twice of the benchmark case (that is equal to 20% of total consumption in 1998), then the model under predicts the hours worked by around 2.24% on average during 2003-2010. The results show that the subsistence is quantitatively important.

Panel (b) in Figure 3 shows the sensitivity analysis regarding $\lambda$. We present results for the case in which private and government consumption are perfect substitutes ($\lambda = 1$), as in the benchmark case, and compare them to the case in which (i) consumers do not value government at all ($\lambda = 0$), (ii) consumers do value government consumption less than the private consumption ($\lambda = 0.5$). The model-predicted hours are very similar in each case. The presence of government consumption in the utility is not quantitatively very important.

Panel (c) shows the implications of different values for the representative worker’s labor supply elasticity ($\gamma = 1$ and $\gamma = 2$). The qualitative nature of the results are similar. However, the model with $\gamma = 2$ accounts for 71.13% of the decline in total hours worked between 1998 and 2009, while the benchmark model with $\gamma = 1$ accounts for 83.02% of the decline in total hours worked during 1998-2009.

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$^7$ There is an immense literature on the value of the labor supply elasticity. For example, macroeconomic models of fluctuations in hours of work over the business cycle or across countries imply much larger labor supply elasticities than microeconometric estimates of hours elasticities (see, for example, Chetty et al., 2011, 2012 for recent detailed studies).
Figure 3: Sensitivity
Panel (d) shows the sensitivity analysis regarding $\bar{H}$. We observe that our results are robust to the value of $\bar{H}$. Decreasing the time endowment from 5110 to 4914 or 4718 does not significantly change the results. Panel (e) shows the sensitivity analysis for the base year choice. We repeat our calculations having 2002 as the base year instead of 1998 and observe that the results are very similar.

Panel (f) shows the impact of the measurement of the effective tax rate on consumption on hours worked. Our benchmark has consumption taxes based on the methodology proposed by Mendoza et al. (1994). Although Mendoza et al. (1994) formula is the one that is mostly used in the literature, Carey and Rabesona (2002) argue that a number of other indirect taxes should also be taken into account in computing the consumption tax (see, also, OECD, 2001; McDaniel, 2007). These are taxes on profits of fiscal monopolies, customs and import duties, taxes on specific services, other taxes on specific goods and services and taxes on the use of goods and performance activities except motor vehicle charges paid by others. We repeat our calculations computing the consumption tax series based on the Carey and Rabesona (2002) method and compare it with the benchmark case. The results are similar.

3.4 Labor Tax

We design the following experiments to illustrate the importance of the taxes on labor income on hours having in mind that there are data problems. We assume that this tax rate was 10% in 1998. Then we have three alternative scenarios in which this tax rate: (i) grows 1% each year; (ii) grows 2% each year; and (iii) grows 3% each year. Figure 4 shows the results of these experiments. We observe that the model, under these alternative scenarios, fits the data better than the benchmark model, especially for recent years. For example, the model under the first scenario accounts for 91.14% of the decline in total hours worked between 1998 and 2009. These experiments also illustrate that the higher the tax on labor income, the lower the aggregate hours worked.

![Figure 4: Model Results with a Hypothetical Tax on Labor Income](image-url)
4 Discussion

We emphasize that our labor supply measure is hours worked per working-age person. The two principal margins of work effort are hours actually worked by employees (intensive margin) and the fraction of the working-age population that works (extensive margin). Figure 5 shows the two margins of work effort for Turkey between 1998 and 2010.

Panel (a) in Figure 5 shows the behavior of the intensive margin in Turkey. We plot the data from the OECD (the series used in this paper) and from the Conference Board Total Economy Database (TED). The reason we include the TED data here is that this source is used in previous studies for Turkey (Adamopoulos and Akyol, 2009; Çiçek and Elgin, 2011a,b). Therefore, a comparison is useful. These two sources have differences before 2003. Data from the OECD and the TED coincide starting with 2003 since the TED uses the OECD sources to report average hours worked per person series for Turkey. The difference before 2003 is based on the TED methodology that average hours worked per person series for Turkey is approximated by that of Greece until 2003: trend for 1950 and 2003 assumed equal to Greece.8

According to the OECD data, an average Turkish worker worked 1,877 hours in 2010 (Turkey is ranked tenth among the OECD countries in 2010 after Korea, Chile, Mexico, Poland, Greece, Hungary, Portugal, Israel, Estonia) - that was around 38 hours per week with two weeks leave or 36 hours per week with 0 days leave.9

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8See the detailed data sources reported by the Conference Board Total Economy Database, which is available at: [http://www.conference-board.org/retrievefile.cfm?filename=DetailedSourcesI_Jan2012_rev1.xls&type=subsite](http://www.conference-board.org/retrievefile.cfm?filename=DetailedSourcesI_Jan2012_rev1.xls&type=subsite). The point that the TED approximates the hours for Turkey by those for Greece until 2003 is also noticed by Altuğ et al. (2008).

9The data for hours actually worked per person are intended for comparisons of trends over time; they may not be suitable for comparisons of the level of average annual hours of work for a given year because of
Panel (b) in Figure 5 depicts the time path for the extensive margin. Turkey has the lowest employment rate among all the OECD countries. Employment to working-age population ratio in Turkey decreased from 47.0% in 1998 to 41.2% in 2009 and it was 43.0% in 2010. Therefore, very low employment rate is responsible for the observation that Turkey has the lowest hours worked among all other OECD countries as shown in Figure 1.

One direction for future research is to disentangle the intensive margin of the total hours worked from the extensive margin. This could have important applications since Turkey has the lowest employment rate among all the OECD countries and low employment to population ratio may have significant effects on the aggregate economic activity (Conesa et al., 2002; Rogerson, 2004). A related direction is to study the labor input by gender. The low level of female employment in Turkey has attracted a great deal of attention by academics and policy makers in recent years (see, for example, Karaoglan and Okten, 2012 and the references therein). Assuming that hours of work per worker are constant across males and females (since hours per worker are not available for Turkey for any category), Adamopoulos and Akyol (2009) argue that the bulk of the decline in aggregate hours is accounted for by the decline in female hours over 1960-2003. According to the “Female Labor Force Participation in Turkey: Trends Determinants and Policy Framework” report from the Turkey’s State Planning Organization and the World Bank (2009), as of January 2009, female labor force participation rate in Turkey was 23.5%. As a comparison, this rate among the OECD averaged 62% in 2007. The report argues that increasing the number of women who are actively employed in Turkey would reduce poverty, increase national economic output, and lead to improvements in social indicators like health and children’s education outcomes.

5 Conclusion

This paper, following Ohanian et al. (2008), focuses on the static first-order condition implied by equilibrium and assess the extent to which this condition holds at each point in time in the data for Turkey between 1998 and 2010. While this is only one of the conditions imposed by equilibrium, it has proven to be a useful and widely-used diagnostic both to assess the model’s ability to account for observed changes in hours, and to provide information as to what types of additional factors would allow the model to better account for the data (Prescott, 2004; Ohanian et al., 2008). Our results indicate that this methodology is able to capture the changes in hours worked in Turkey, both in terms of the overall change in hours, and the timing of the changes. We think that future studies of the Turkish case may have important lessons since Turkey has the lowest hours worked among the OECD members.

differences in their sources, i.e., each country collects its own data, and their methods may be not always be perfectly comparable. Having this in mind we observe that, when we compare the average annual hours of workers in 34 OECD countries, average working hours in South Korea are longer than in any other member state of the OECD. For example, an average worker in Korea worked 2,204 hours in 2010 - that was around 44 hours per week with two weeks leave or 42 hours per week with 0 days leave.

There has been an increase in the labor force participation of women in recent years. According to the “Labour Force Status By Non-Institutional Population, Years And Sex” tables by TurkStat, female labor force participation rate was 30.3% as of July 2012. On the other hand, male participation rate was 71.9% as of July 2012.

10
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