Some Thought Experiments on the Changes in Labor Supply in Turkey

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- Why?

Hours Worked in OECD, 1998-2010: $H/N = h \times E/N$

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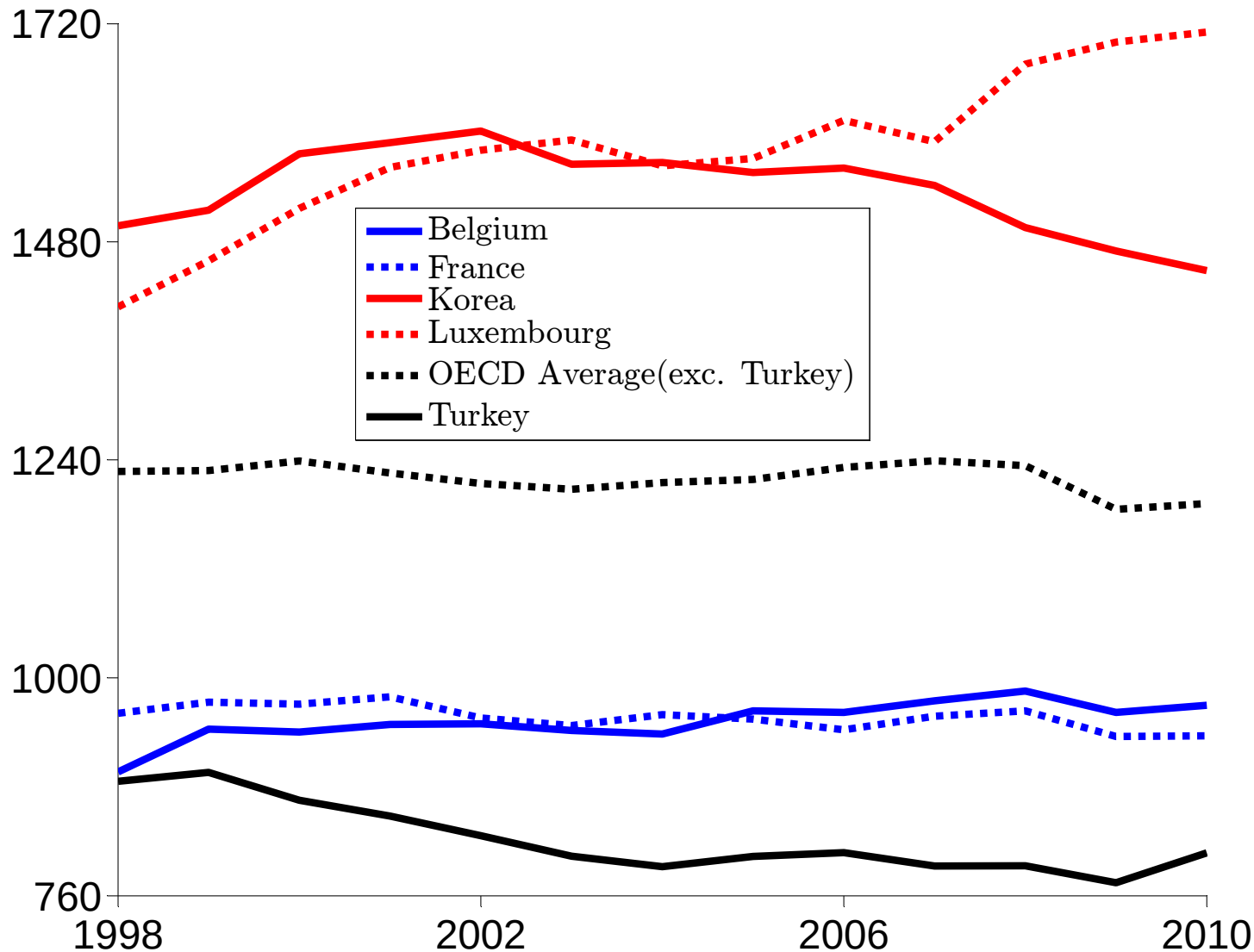
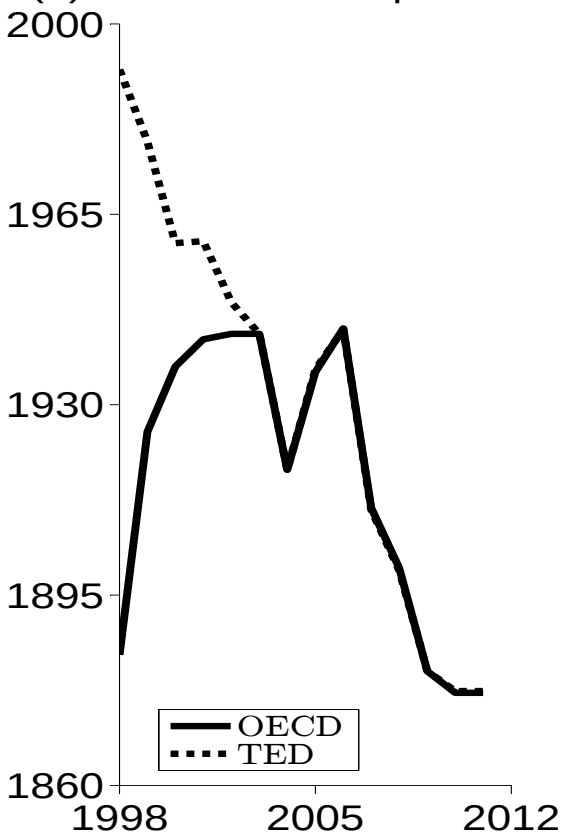
Turkey has the lowest hours worked among the OECD countries



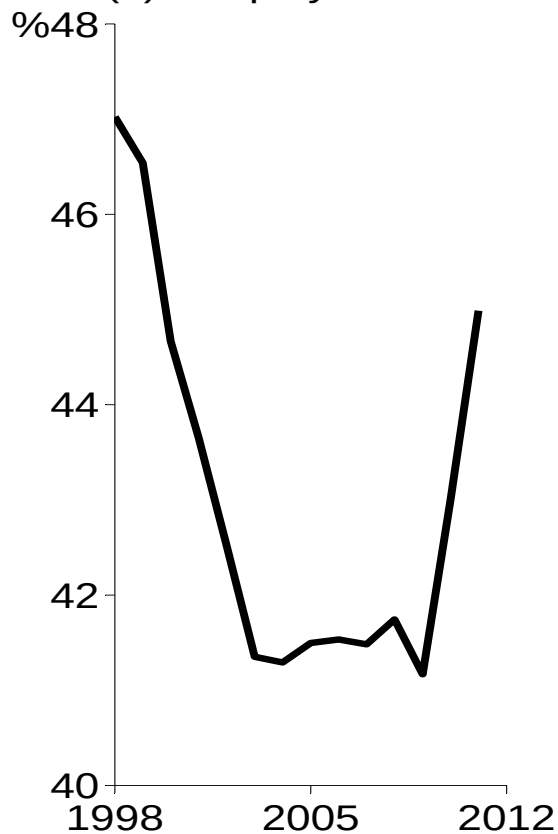
Two Margins of Labor Supply in Turkey, 1998-2011

$$\underbrace{H/N}_{\text{Total Hours}} = \underbrace{h}_{\text{Intensive Margin}} \times \underbrace{E/N}_{\text{Extensive Margin}}$$

(a): Hours worked per worker



(b): Employment rate



What Does This Paper Do?

- This paper tries to determine the possible factors that are important for labor supply in Turkey
- I follow Ohanian et al. (2008) and use a variant of the neoclassical growth model, augmented with government consumption, subsistence consumption, and taxes on labor income and consumption, to provide an explanation for the observed changes in hours of work
- I 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

Findings

- The benchmark model accounts for the decline in total hours worked during 1998-2009 in Turkey
- Hours worked increased in Turkey since 2009 and the model accounts for half of that increase between 2009 and 2011
- If the model ignores taxes on labor income and consumption, then its explanatory power decreases significantly
- The primary force driving changes in hours is the changes in the tax wedge
- The presence of government consumption in the utility function does not seem very important
- The subsistence term is quantitatively important during 2003-2011

MODEL

Households

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

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

- The utility function is specified as:

$$U(.) = \alpha \log(C_t + \lambda G_t - \bar{\mathrm{C}}) + (1 - \alpha)\frac{(\bar{\mathrm{H}} - H_t)^{1-\gamma} - 1}{1 - \gamma}, \tag{2}$$

  where $\gamma \geq 0$, $0 \leq \alpha \leq 1$, $0 \leq \lambda \leq 1$, and $\bar{\mathrm{C}} \geq 0$

- λ measures how households value government consumption
- $\bar{\mathrm{C}}$ is a subsistence consumption term
- γ governs the elasticity of substitution between leisure and consumption

Technology and Government

- Technology is given by:

$$Y_t = A_t F(K_t, H_t) = A_t K_t^{\theta} H_t^{1-\theta}, \tag{3}$$

  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 δ
- The government levies proportional taxes on labor income and consumption given by $\tau_{h,t}$ and $\tau_{c,t}$
- In addition to government consumption G_t, the government also uses its revenues to finance a lump-sum transfer T_t
- The tax wedge is defined as:

$$1 - \tau_t = \frac{1 - \tau_{h,t}}{1 + \tau_{c,t}} \tag{4}$$

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$$\frac{U_2(C_t + \lambda G_t, \bar{\mathrm{H}} - H_t)}{U_1(C_t + \lambda G_t, \bar{\mathrm{H}} - H_t)} = (1 - \tau_t) A_t F_2(K_t, H_t) \qquad (5)$$

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

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- For any given country its predictive accuracy can be tested by using time series data on taxes, aggregate output and consumption to generate model predicted H_t

DATA AND CALIBRATION

Strategy

- α and θ enter as a constant of proportionality, then the values of these variables are irrelevant for accounting for changes in hours relative to a base year
- I choose the value of $\frac{\alpha(1-\theta)}{(1-\alpha)}$ so that the model hours are equal to the data for a base year
- The sample period is from 1998 to 2011
- The value of $\bar{\mathrm{H}}$ is set to $14 * 365 = 5110$
- In the benchmark, preferences are logarithmic in consumption and leisure, i.e., the limiting case as γ tends to one
- Government consumption is a perfect substitute for private consumption, $\lambda = 1$
- Benchmark results are obtained in the absence of subsistence consumption, $\bar{\mathrm{C}} = 0$

Effective tax rates on factor incomes and consumption

Mendoza, Razin, and Tesar (1994, hereafter MRT) propose a method for computing average effective tax rates using national accounts and revenue statistics

- This method calculates effective tax rates as ratios between the revenues collected from a specific tax source and its taxable income base, reconstructed from national accounting data
- The tax rates reflect specific tax rates faced by a representative agent in a general equilibrium framework
- MRT computes times series of tax rates for G7 countries covering the period 1965-1988
- **Carey and Rabesona** (2002, hereafter CR) criticize MRT arguing that they abstract from a number of indirect taxes that should be taken into account

Tax Rate on Consumption

- MRT method

$$\tau_c = \frac{5110 + 5121}{C + G - GW - 5110 - 5121}$$

- CR adjustment

$$\tau_c = \frac{5110 + 5121 + 5122 + 5123 + 5126 + 5128 + 5200 - 5212}{C + G - GW}$$

Code	*Definiton*
C	Private final consumption expenditures
G	Government final consumption expenditures
GW	Government final wage consumption expenditures
5110	General taxes on goods and services
5121	Excise taxes
5122	Taxes on profits of fiscal monopolies
5123	Customs and import duties
5126	taxes on specific services
5128	Other taxes on specific goods and services
5200	Taxes on the use of goods and performance activities
5212	Motor vehicle charges paid by others

Tax Rate on Labor Income

- I cannot use the methods discussed by MRT and CR: data for *Operating surplus of private unincorporated enterprises (OSPUE)*, *Household property and entrepreneurial income (PEI)*, or *Household gross operating system surplus and mixed income* are not reported
- I follow Prescott (2004) and Prescott's calculation of $\tau_{h,t}$ is

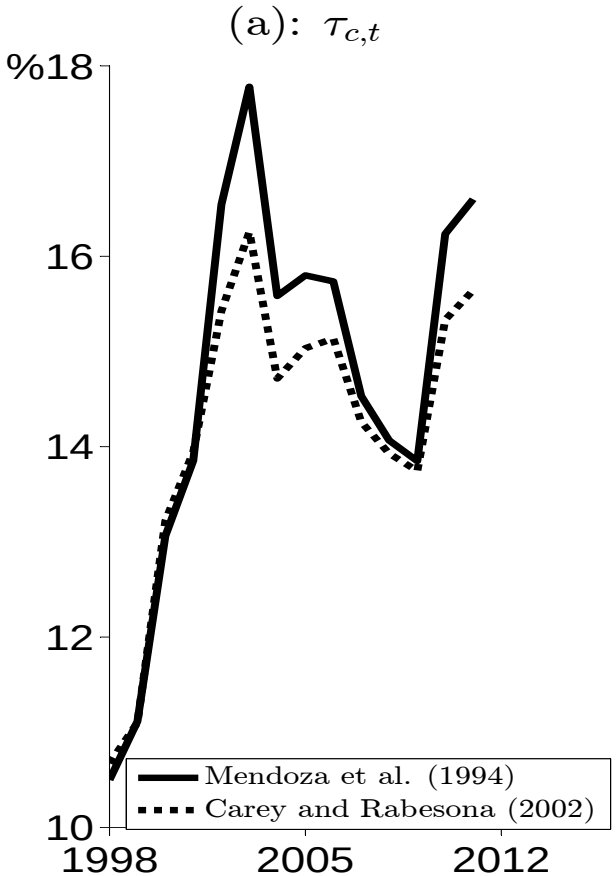
$$\tau_{h,t} = \tau_{ss,t} + \eta \bar{\tau}_{inc,t}$$

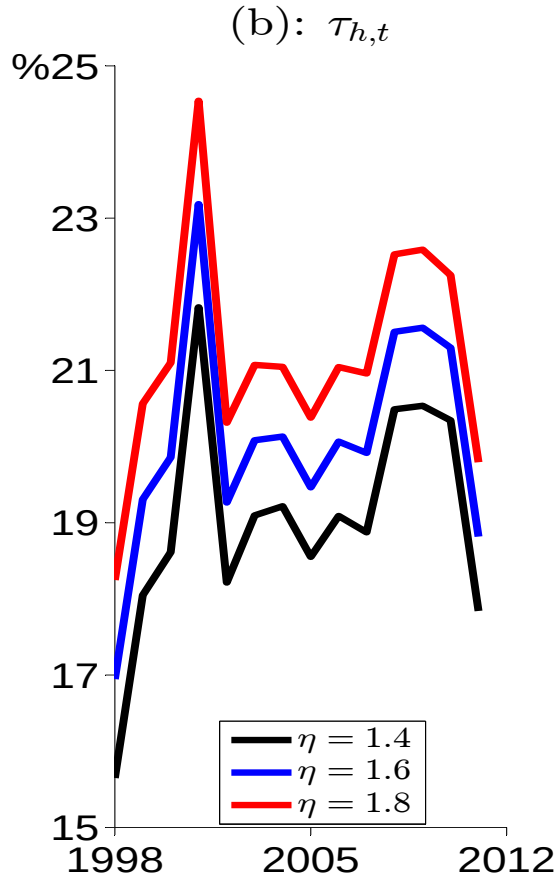
  Two taxes on $(\tau_{h,t})$: the social security tax with marginal rate $(\tau_{ss,t})$ and the income tax with marginal rate $(\tau_{inc,t})$
- η is the factor indicating to what extent the marginal income tax rates are higher than the average tax rates

$$\bar{\tau}_{inc,t} = \frac{Direct\ \ Taxes_t}{GDP_t - IT_t - Depreciation_t}, \qquad \tau_{ss,t} = \frac{Social\ \ Security\ \ Taxes_t}{(1-\theta)(GDP_t - IT_t)}$$

  Direct taxes are those paid by households and do not include corporate income taxes. Indirect taxation, IT_t, is given by the sum of general taxes on goods and services and excise taxes

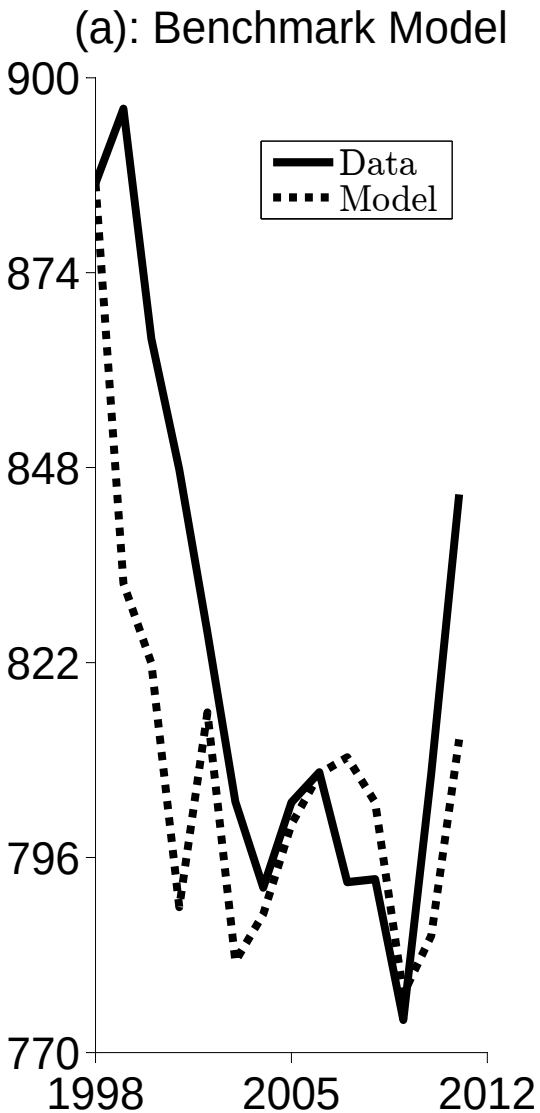
Tax Rates, 1998-2011

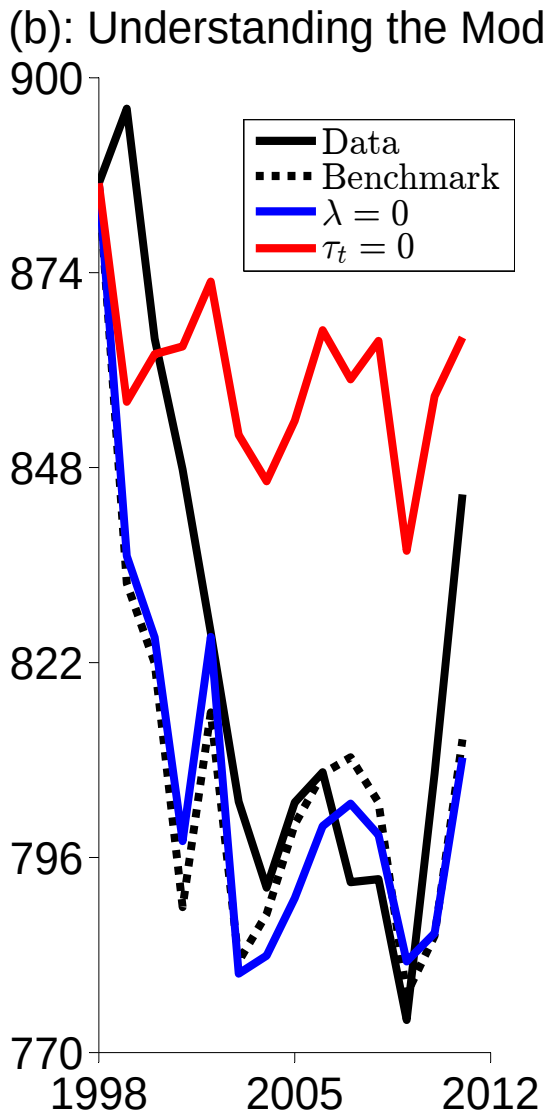




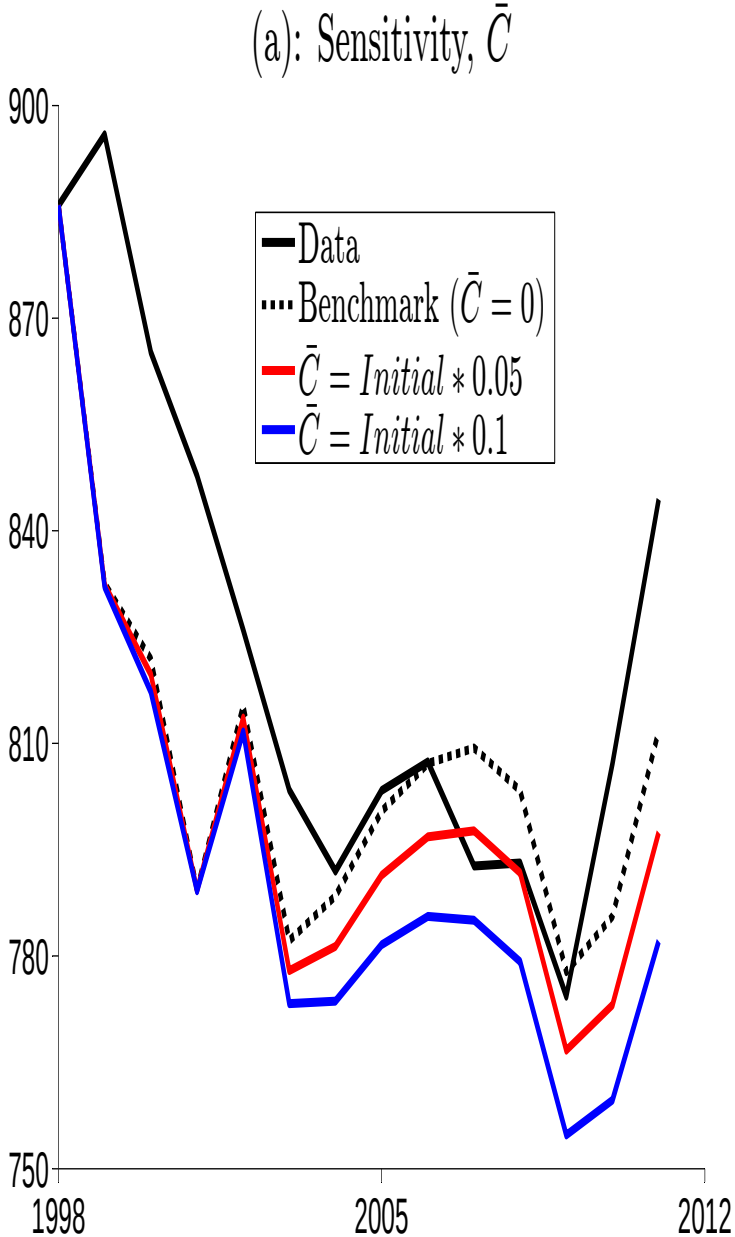
BENCHMARK RESULTS

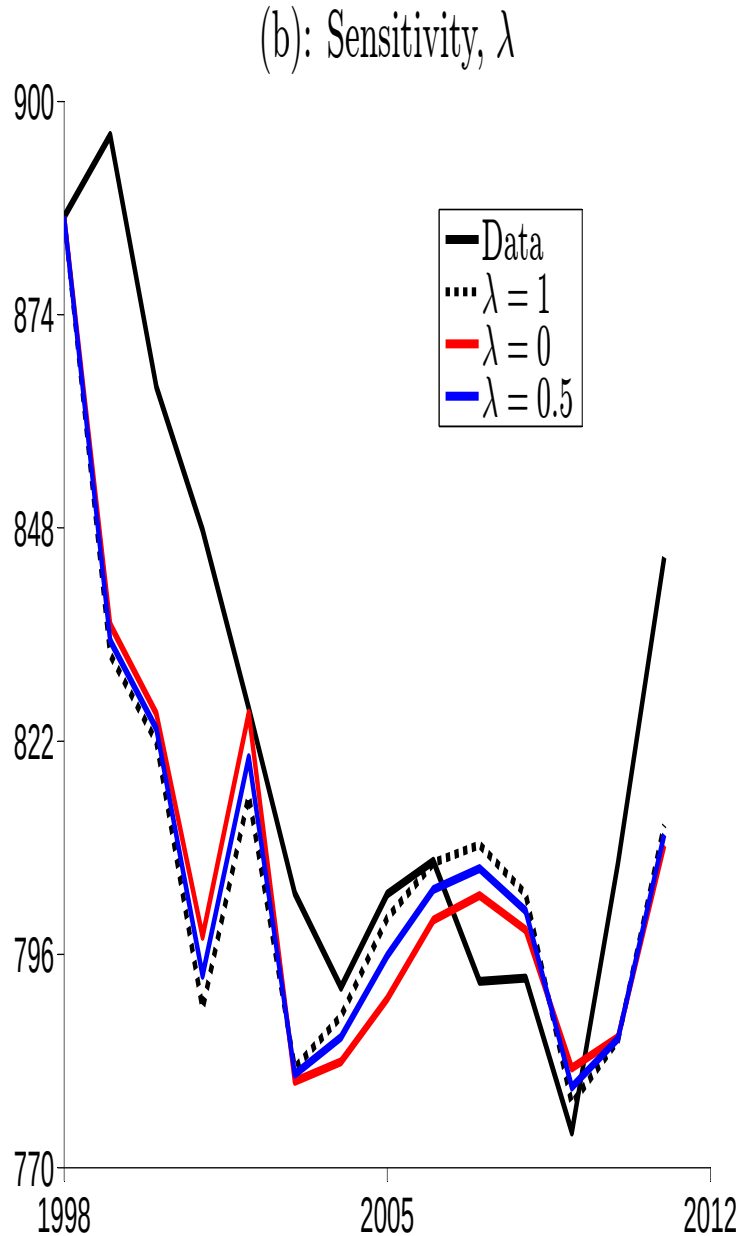
Annual Hours Worked, Model Versus Data

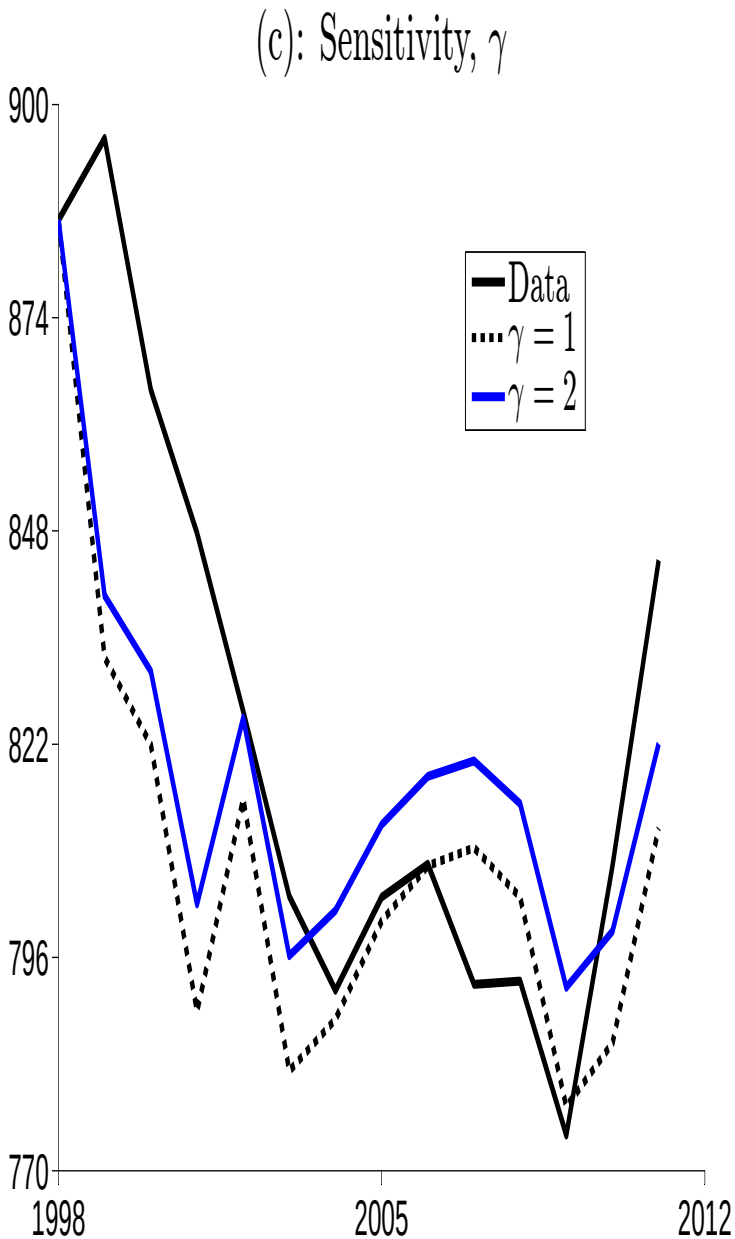


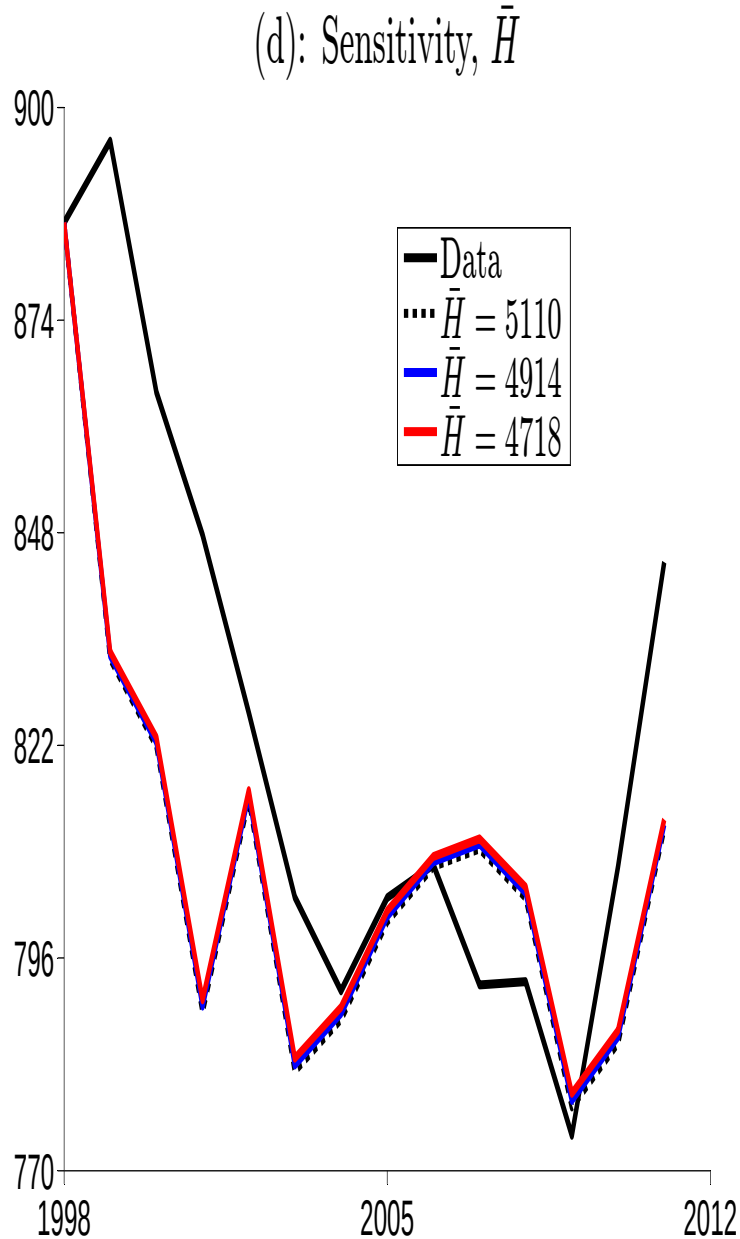


SENSITIVITY

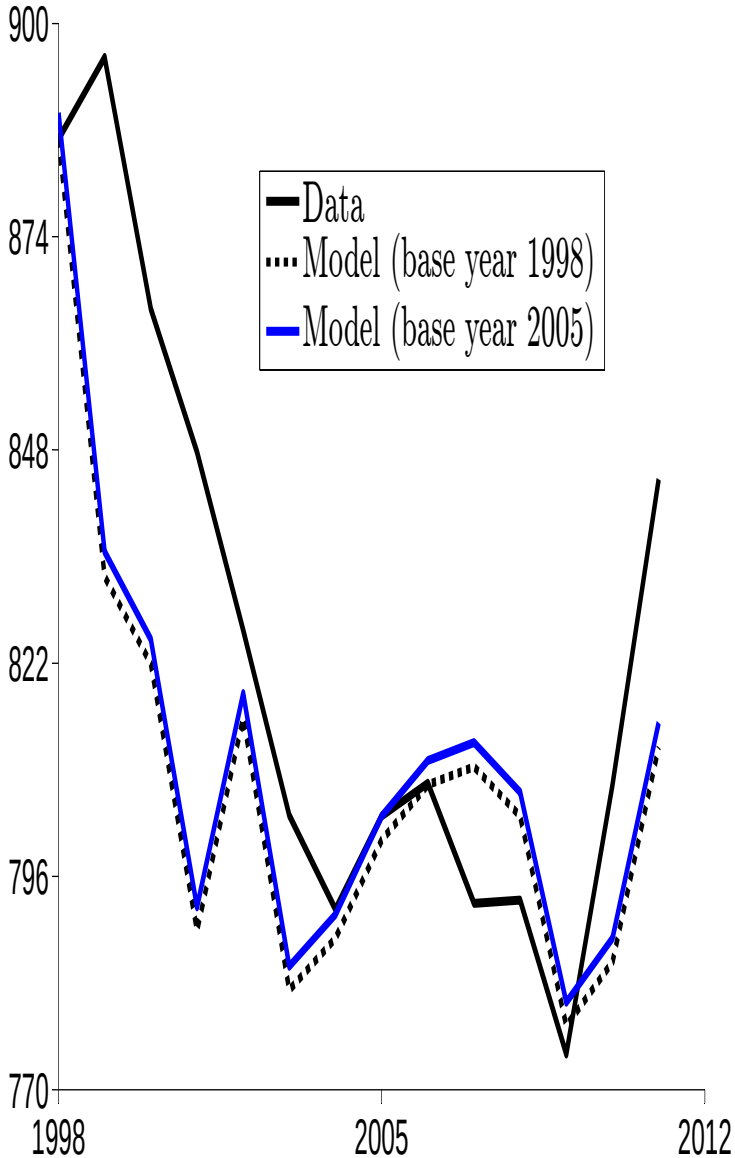

(a): Sensitivity, $\bar{C}$
900
870
840
810
780
750
1998
2005
2012
Data
Benchmark $(\bar{C} = 0)$
$\bar{C} = Initial * 0.05$
$\bar{C} = Initial * 0.1$


(b): Sensitivity, λ
900
874
848
822
796
770
1998
2005
2012
Data
$\lambda = 1$
$\lambda = 0$
$\lambda = 0.5$

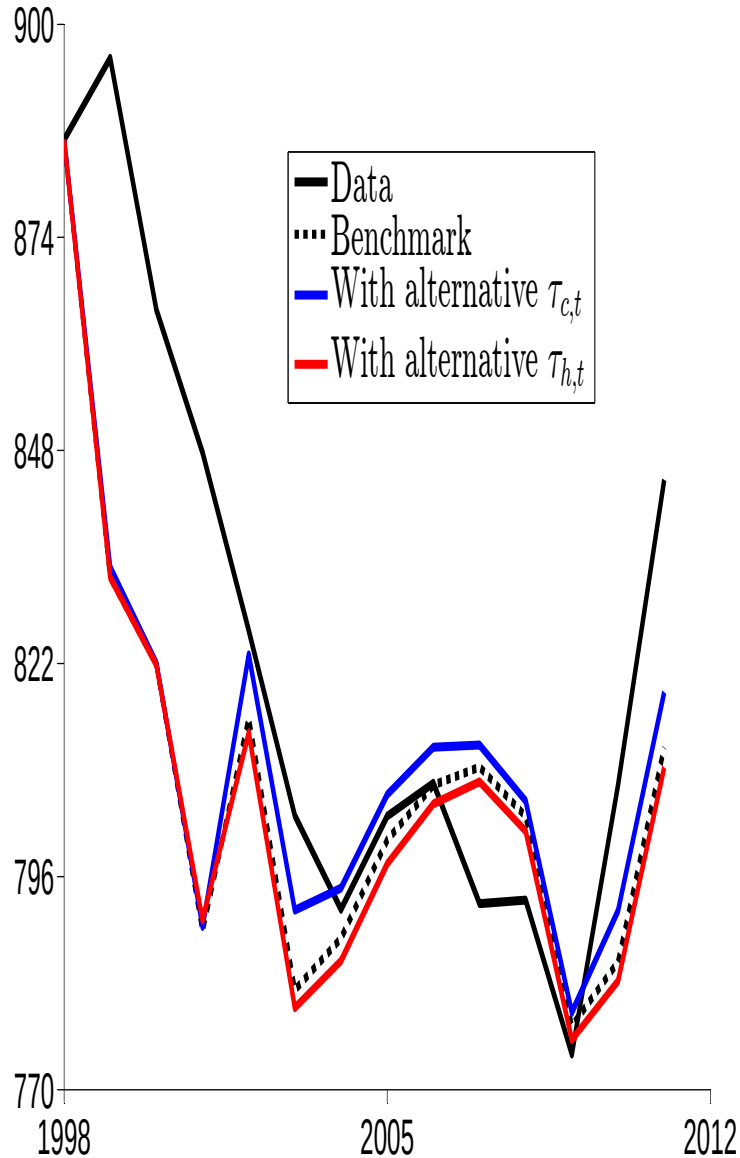

(c): Sensitivity, γ
900
874
848
822
796
770
1998
2005
2012
Data
$\gamma = 1$
$\gamma = 2$


(d): Sensitivity, $\bar{H}$
900
874
848
822
796
770
1998
2005
2012
Data
$\bar{H} = 5110$
$\bar{H} = 4914$
$\bar{H} = 4718$

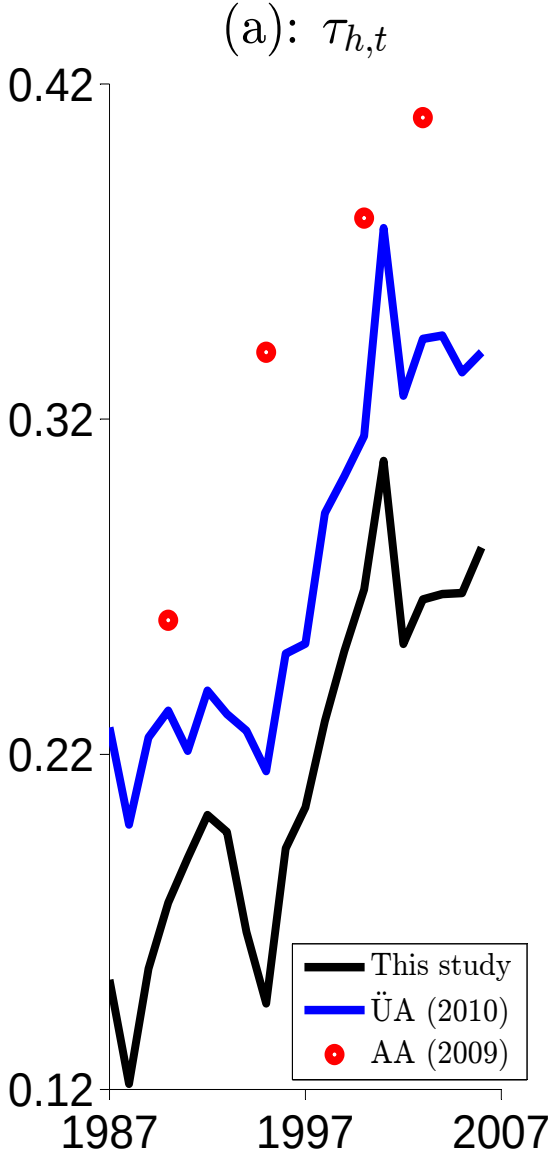
(e): Sensitivity, base year

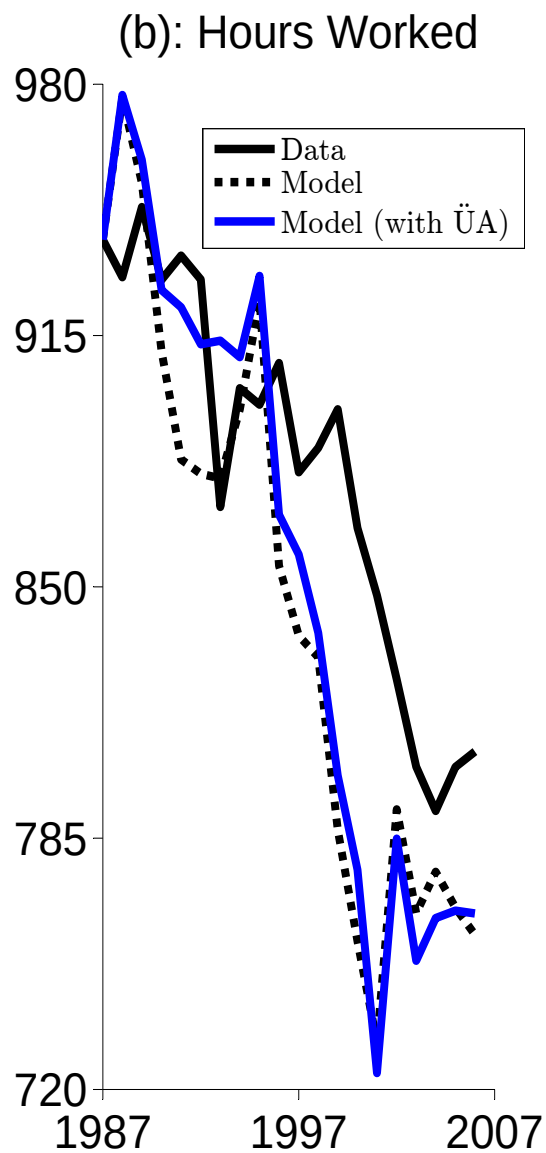


(f): Sensitivity, $\tau_{c,t}$, $\tau_{h,t}$



Results for the 1987-2006 Period





CONCLUDING REMARKS

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- 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
- The quantitative importance of the tax wedge for explaining the secular changes in annual hours worked in Turkey
    - Other possible effects of the tax wedge on the overall economic activity: higher labor income and consumption taxes also have consequences for entrepreneurship and risk-taking by discouraging new business creation

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