Employment Effects of Minimum Wages in Inflexible Labor Markets

Ozturk, Orgul

University of South Carolina

2006

Employment Effects of Minimum Wages in Inflexible Labor Markets

Orgul Demet Ozturk[‡]

July 13, 2009

Abstract

This paper structurally models and estimates the employment effects of a minimum wage regulation in an inflexible labor market with fixed employment costs. When there are fixed costs associated with employment, minimum-wage regulation not only results in a reduction in employment among low-productivity workers but also shifts the distribution of hours for the available jobs in the market, resulting in a scarcity of part-time jobs. Thus, for sufficiently high employment costs, a minimum wage makes it less likely for "marginal" workers to enter and stay in the labor market. I estimate the model using survey data from Turkey. I find a significant reduction in employment due to the loss of part-time jobs caused by the national minimum-wage policy in this highly inflexible labor market.

Keywords: Fixed employment costs, labor market inflexibility, minimum wage, female labor force participation, part-time jobs, hours constraints

(JEL CODES: J2 J3 E2)

[*]First version May 2003.

[†]University of South Carolina, Economics Department, Moore School of Business, Columbia SC, 29208. e-mail: odozturk@moore.sc.edu

[‡]I am grateful for the valuable feedback provided by John Kennan, James Walker, Maurizio Mazzocco, John Gordanier, Insan Tunali, Seokjin Woo, Sudip Gupta, Jeremy Sandford, Shiv Saini, Jonathan Hore, Hugette Sun, Lucas Davis, Alan Manning, Daniel Hamermesh, and three anonymous referees. I also thank the participants of the 2007 ZEW workshop "Institutions and Labor Markets," the 2008 SOLE Conference, the International METU Economics Conference, the Annual MEA Conference, the University of Wisconsin-Madison Labor Workshop, and workshop attendees at Concordia University-Montreal, Kansas State University, Lake Forest College, University of South Carolina, University of South Florida, and University of St. Thomas.

1 Introduction

The observation that labor contracts are restricted in terms of the length of workweeks has long been a component of economic modeling. There are many studies that analyze how labor supply is affected when workers cannot choose how much to work but are limited to a number of wage-hours offers (see for example Oi,1962; Moffitt, 1982; Barzel, 1973). This paper studies the labor supply and demand behavior in an economy where such restrictions are created by labor market inflexibilities and pronounced through the interaction of these inflexibilities with a minimum wage regulation.

Most studies on the effects of the minimum wage concentrate on changes in the margin of employment. Analyses are usually conducted to reveal either the percentage of workers losing their jobs when the minimum wage increases or the percentage of individuals who are motivated by higher wages to obtain a job. Katz and Krueger (1992), Card and Krueger (1994), and Campoliati, Gunderson, and Riddell (2006) look at the effects of the minimum wage on employment by part-time and full-time positions. However, to my knowledge, other than Ozturk (2008), who uses aggregate time-series data for OECD countries, there is no other study that analyzes the employment effects of a minimum wage regulation by studying its effect on the hours distribution of jobs and capturing its negative impact on the availability of flexible, part-time job options in inflexible labor markets.

Another shortcoming in this literature is that the majority of the empirical evidence comes from US and provides very few economically significant effects on employment, either positive or negative. This is not a surprising result because, as has been noted (for example by Kennan, 1998) before, the minimum wage has never been high enough to create a significant effect in the US . Existing U.S. base models in the literature cannot be expected to explain the workings of minimum wages in developing countries as Lemos(2009) points out, as the developing world differs significantly with respect to the role of the minimum wage in the labor market and also the macroeconomic structures and laws surrounding it. For example, in many developing countries, the minimum wage is set as a living wage for a family, not for an individual, as the main target group is the male breadwinner. Thus, the employment effects would be expected to have different dimensions than in developed countries. In addition, in many countries the indexation of minimum wages is automatic, unlike the US, which always maintains the relative importance of minimum wages, thereby restricting the employer's ability to adjust for and mitigate the effects of the minimum wage.

Not only developing countries but also female labor supply is overlooked in most previous minimum-wage studies, which usually examine the impacts on teenage employment. Furthermore, even though there is a vast literature on female labor supply, structural modeling of the labor-supply behavior of women, especially in an international context, is very rare. Women behave differently than men in the labor market, mostly due to their traditional roles as homemakers. Because they have the option to dedicate their time to the home, it is easier for women than for men to decide not to work in the labor market, especially when the available jobs are restrictive in terms of the hours they can work. Moreover, given the majority of the female workforce is characterized as "low-productivity labor" in many developing countries, changes in minimum wages that cause restrictions in the hours distribution of available jobs are more like to reduce female employment compared to any other group. Thus, one will expect to see larger effects of the minimum wage on employment for women, especially in developing countries.

Another important factor in this dynamic is labor-market inflexibility. The flexibility of labor markets became central to policymaking, especially in Europe after several OECD reports and influential economic work that suggested that the high unemployment of Europe was due to the strong employment-protection laws in these countries. The effect of institutional inflexibilities on employment has been studied extensively in the European context; for example, research by Bertola (1990) and Blanchard and Jimeno (1995) attempts to explain the high unemployment rates in Europe. Additionally, Blanchard (2005) provides a detailed review of the history of unemployment in Europe and the inflexibility literature that market inflexibility inspired. In most of the studies reviewed, the minimum wage is not modeled separately but aggregated in a general measure of labor-market flexibility, and employment effects are analyzed with macro data. Using individual-level data, the present paper isolates the minimum wage in Turkey and studies its effects on individuals' labor-market participation decisions when combined with "other" labor-market "inflexibilities.

Given the gaps in the literature described above, this paper contributes to the minimum-wage literature by modeling minimum wage as a potential source of such work restrictions when high labor costs exist. Moreover, this paper contributes to the literature by analyzing the minimum-wage effects in a developing country. The main claim of the present paper is that it is prohibitively expensive for firms to employ workers for short workweeks at a minimum wage when the labor market is inflexible due to fixed employment costs. When employers offer contracts that specify a minimum number of hours to be worked, it results in a shift in the distribution of hours for the available jobs in the market, restricting the number of part-time jobs. Part-time jobs play a crucial role in the labor-market participation decisions of marginal workers, especially women, because women may prefer flexible schedules. Part-time jobs in many cases serve as a gateway to full-time jobs and ease the transition from household production to market work. Thus, when employment costs are high, a minimum wage makes it less likely that marginal workers will enter and stay in the labor market.

The paper is organized as follows. The next section discusses the characteristics of Turkey's female labor force and labor market. The third section introduces the theoretical model. The fourth section gives the econometric specification of the model. Section 5 provides the description of the data used, details of the estimation, and the estimation results. Section 6 provides counterfactual simulations and discusses policy implications. Section 7 concludes the paper.

2 Female Labor Force Participation in Turkey

Over the last 50 years, the labor-force participation rate of Turkish women has declined significantly and remained unexpectedly low, especially in urban areas. Approximately 72 percent of women participated in the labor force in 1955, but only 23 percent participated in 2005. Moreover, in 2005, the participation rate was only 18 percent among urban women (SIS HLFS, 2005). Over this same period, female participation rates, on average, doubled worldwide and almost tripled for married women in most countries going through social changes comparable to those of Turkey.

The initial drop in the female labor-force participation rate in Turkey has been attributed to the massive urbanization of the workforce after the 1950s. Before then, small-scale, family-level agriculture had been employing nearly all of the women in rural areas. Given the distinction between household duties and work is blurred in agriculture, it is easier for rural women to meet the conditions to be considered employed. It has been argued that when women move to cities, they cannot find a place for themselves in the labor force of urban Turkey (Dayioglu, 1998; Ozar, 1996; Tunali, 1997). In cities, market work and household duties are incompatible. Hence, women have to concentrate on one of them. Most of these women have little human capital, so they are employable only in marginal jobs. Faced with this, most choose not to participate in the workforce.

Even though this misplaced-marginal-worker theory can explain the initial decline in female employment, it fails to capture the persistence of the low presence of females in the labor market. The continued decline in the participation rate is unexpected because the social status of women has improved significantly over the past decades. Through vast public programs, increased emphasis on compulsory schooling, and the introduction of secularity in all aspects of social life, the educational attainment of women has increased substantially. This has been accompanied by a considerable drop in the total fertility rate (from 6.6 births per women in the 1950s to 3.3 in 1988 and 2.16 in 2001) and a gradual increase in the average age of first marriage and age of first birth (Shorter, 1995). Previous empirical evidence implies that these changes should lead to a higher female labor-force participation rate (Mincer, 1985; Schultz, 1990; Goldin 1995).

The lack of responsiveness of employment levels to the changing social and demographic environment is not the only striking feature of the Turkish female labor force. Even though employment levels are low–only 24 percent of women between ages 15 to 65 were employed in Turkey in 2008, compared to 65 percent in the United States, 59 percent in the European Union, and about 60 percent for OECD countries excluding Turkey (OECD, 2008)–Turkish women supply long hours when they do work; Part-time job holders constitute mere 6 percent of all female workers in Turkey(OECD 2007). In OECD countries, on average 28 percent of all female workers work part time, and this ratio reaches as high as 60 percent in some countries (OECD 2007).

This paper proposes that Turkish women have a low rate of labor-force participation due to the extreme scarcity of part-time jobs, resulting from the constraints on hours implied by the interaction of the minimum wage and market inflexibility. This paper shows that, indeed, if there had been fewer restrictions on work hours, the Turkish female labor-force participation rate would have been about 6 times higher over the years of the survey period analyzed in this paper (1988-1999).

This effect may seem very high; however, given the fact that the minimum wage is binding for a significant portion of workers, it is a plausible estimate. According to the Pension Insurance Agency's (SSK) statistics, about 43 percent of all registered workers are employed at the minimum wage. This corresponds to about 3 million workers. Moreover, Turkey has a large informal labor market. Prior research estimates that during the data period under study, informal labor was between 7% and 34 % (depending on the definition used) in urban areas (Bulutay and Tasti, 2004). Including these workers brings the number of workers directly affected by the minimum wage regulation up to about 5.5 million workers. In the present paper, employment is defined as either employment in the formal sector or employment in nonmarginal jobs (part-time jobs are not considered marginal). Because the paper's purpose is to explain the failure to utilize the increased productivity of women in nonmarginal jobs by making flexible hours available, this is a reasonable assumption.

Over the years of the survey period analyzed in this paper (1988-1999), the minimum wage changed 12 times, doubling in nominal value in most cases. However, with the high inflation Turkey was experiencing at the time, the real value of the currency has more of a wavy look for the seven biannual data points used in the present study. In U.S. Dollar terms (using the 1988 TL/Dollar exchange rate), the real minimum wage was around 30-45 cents per hour throughout the study period. The highlighted parameters in Table 1 (the rest of the estimates can be found in the Appendix) indicate that an increase in the minimum wage was accompanied by a decline in employment probability and part-time job incidence, but an increase in hours worked for individuals who were still working. Existing minimum-wage models cannot explain all three of these patterns simultaneously (see Neumark and Wascher 2007 for an excellent review of minimum-wage studies).

Table 1: Employment and Part-time Probabilities and Hours of Work in Turkey for Urban Females with Log Real Minimum Wage (1988TL)

Dependent Variable	Employment		Part-time Employment		Log Hours
Method of Estimation	Probit		Probit		OLS
	β	*elasticity*	β	*elasticity*	β
Lagged Minimum Wage	-1.018	-0.143	-1.437	-0.230	
	(0.207)**	(0.029)**	(0.539)**	(0.086)**	
Log Lagged Minimum Wage					0.205
					(0.027)**
Post Secondary	2.480	0.756	1.021	0.204	-0.242
	(0.046)**	(0.012)**	(0.188)**	(0.045)**	(0.025)**

For coefficient estimates of all controls see the Appendix part II.

Standard errors in parentheses

**: significant at 1% significance level. *: significant at 5% significance level.

Another relevant factor is the length of the workweek. In most countries, part-time positions tend to be low-paying, low-benefit jobs frequently occupied by women. Some women, especially married women, may prefer flexibility of hours over higher pay when looking for a job. For example, Falzone (2000) shows with U.S. data that part-time work offers an efficient alternative for married women in the labor market when earnings are not the only consideration. However, in Turkey, part-time jobs are different, as illustrated in Table 2. Specifically, in the Turkish labor market, part-time workers earn on average almost 3 times as much as full-time workers. Most part-time workers are university graduates and high-productivity workers. The share of part-time workers was 31 percent among college-educated women in the 1988 Turkish Household Labor Force Survey. Among women with less education, on the other hand, this figure was only 10 percent. The summary statistics also show that the higher the years of schooling completed, the lower the average number of hours worked per week. This interesting phenomenon can be explained with the model introduced in this paper; average part-time wages are higher simply because there are almost no part-time jobs in the low-paying sectors of the market. Putting it differently, low-productivity workers cannot obtain part-time jobs, but high-productivity workers can, creating this so called "part-time wage premium."

Table 2:	Female Labor Force Participation in 1988 Data					
	Wages - Part-time versus Full-time Jobs					
	# of obs.	mean	st.dev.	min.	max.	median
if h < 40	87	1.85	5.29	0.11	48.94	1.17
if h>=40	474	0.74	0.97	0.05	18.43	0.58
	Share of Part-timers by Education					
	# of obs.			% part-timers		
college graduates	154			31.13		
non-college graduates	407			10.03		
	Hours of Work by Schooling					
	# of obs.	mean	st.dev.	min.	max.	median
primary school or less	189	42.79	9.03	15	84	40
middle school	35	42.48	4.68	40	58	40
high school	183	40.36	5.98	20	64	40
college or more	154	35.58	9.19	15	54	40

This is not the first paper that calls attention to the link between the lack of part-time jobs and the low female labor-force participation rate in Turkey. Baslevent (2001) documents a negative correlation between part-time employment and female labor-force participation. Moreover, Baslevent and Tunali (2005) point out that the absence of a linear relationship between tax and benefit payments and hours of work makes part-time employees very undesirable in the Turkish labor market.

According to various OECD reports, Turkey is among the least flexible labor markets worldwide with respect to employment. The main sources of inflexibility in this market are the policies regarding nonwage monetary burdens associated with employment resulting from the labor law that was in effect between 1947 and 2003, roughly the time period I am interested in. This paper captures the inflexible nature of Turkey's economy and evaluates the impact of the minimum wage on female employment through inflexible working hours. It is true that nonwage labor costs by themselves can create restrictions on the length of the workweek–and the model introduced in this paper captures this–but the minimum wage magnifies these hours restrictions, resulting in a reduction in part-time jobs as well as employment.

3 Model

The model used in this paper builds on the labor supply model introduced in Moffitt (1982). In this model each worker faces a restriction on the lowest number of hours she can work: her required minimum hours. She also chooses her desired number of hours, which she can work only if her desired workweek is longer than her required minimum. If her desired workweek is shorter than her required minimum, she is considered "constrained" and has to choose between working more hours than she wants or not working at all.

I extend this base model by modeling the marginal productivity determination and letting wages vary by the length of workweek. Because the per-hour fixed cost of employment decreases as the workweek gets longer, average productivity increases. Thus, employers are willing to pay higher hourly wages for longer workweeks, which generates a full-time wage premium within the model. The addition of increasing average productivity and the zero-profit condition in the model leads to a different modeling of the constraints on working hours.

In Moffitt's model, if the difference between the required minimum and the desired length of the workweek is greater than some estimated level, D, the worker chooses not to work when constrained. This D is a function of the shape of the individual's indifference curves, but is treated as constant across workers in Moffitt's model. In my model, instead of estimating such a constant, I allow for utility comparisons for workers who are constrained, and choose the utility maximizing option from this constrained set. Thus, I allow D to vary across individuals.

I will introduce the model in two subsections: the first subsection analyzes how the interaction of the minimum wage and fixed costs results in constraints on hours. The second subsection explains how supply-side decisions are affected by these constraints. Table 3 summarizes the notation used.

Table 3:	Notation
π	: Marginal productivity of the potential worker
f	: Fixed cost of employment per week per employee (in U.S. dollars)
w_h	: Hourly wage = average productivity $\left(w_h = \dfrac{\pi h - f}{h} < \pi\right)$
w^{min}	: Minimum hourly wage
h^*	: Desired hours (length of workweek maximizing potential worker's utility)
L^*	: Optimal level of leisure (h*+L*=T=weekly time endowment)
h_0	: Required minimum hours
	$\left(\text{Hours of work required for a worker to produce the value of the minimum wage on average per hour. Required minimum hours is the } h \text{ that solves } w^{min} = \dfrac{\pi h - f}{h} \text{ that is } h_0 = \dfrac{f}{\pi_i - w^{min}}\right)$
h_{00}	: Absolute required minimum hours
	$\left(= \dfrac{f}{\pi}\text{. This is also the required minimum hours when there is no minimum wage}\right)$

3.1 Demand Side: Constraints on Hours of Work

Consider an economy where technology is linear and labor is the only input of production. Each potential worker has a constant marginal productivity (π). Given these assumptions, firms will offer everyone jobs with working hours they optimally choose to supply (h^*) at an hourly wage (w_h) equal to their average productivity, which is equal to their marginal productivity ($w_h = \pi$).

Now, consider two individuals with different marginal productivity ($\pi_a > \pi_b$) but the same level of desired hours. Any given firm will hire them both and pay hourly wages (w_h) equal to their average productivity, $w_{ha} = \pi_a$ and $w_{hb} = \pi_b$ respectively. However, if there is a minimum wage in this economy (suppose it is set at a level between w_{hb} and w_{ha}), no worker with an average productivity less than the minimum wage ($\pi_b = w_{hb} < w^{min}$) will be offered any job. Because average productivity is constant, there will be no constraints on the hours worked by the individuals who are offered jobs. That is, a worker with productivity π_a can still work her desired level of hours. Nevertheless, an individual with a productivity π_b will no longer be employed by anybody.

Suppose now there are costs associated with each job equal to f dollars per worker for each workweek. As a result, each worker starts producing a surplus value for the employer after the first $\frac{f}{\pi}$ hours. I call this "the absolute required minimum hours" and denote it with h_{00}. The key point in this model is the increasing average productivity: the cost of employment will make a worker's average productivity, as well as the hourly wage she earns, dependent on the number of hours she works. This hourly wage is less than what it is when there are no fixed costs since now the total value of the workers production will be reduced by the costs associated with her employment [1]. The average hours curve in Figure 1 shows us the "menu" of jobs (defined as a pair of working hours and an hourly wage) the worker will consider in her utility maximization.

However, minimum wage regulation is such that it does not take the existence of fixed costs into account and requires a constant hourly wage independent of the length of the workweek (w^{min})[2]. Therefore, when there are fixed costs, minimum wage regulation creates an interval of hours where the average productivity is lower than the minimum wage for every worker. This results in restrictions on the minimum number of hours each worker can work (h_0). That is, some of the jobs (jobs with hours less than h_0) in the "menu" that the worker considers will no longer be offered to her by the employers. Solving the hourly wage equation for h where average productivity is equal to the minimum wage gives

$$h_{0i} = \frac{f}{\pi_i - w^{min}}, \tag{1}$$

which is an increasing function of the fixed-employment costs and the minimum wage, but a decreasing function of the worker's productivity. Figure 1 illustrates how the minimum number of hours that a given worker needs to supply decreases as the productivity level increases ($\pi_a > \pi_c > w^{min} \implies h_{0a} < h_{0c}$). In other words, a worker with a higher productivity will have more options on her "menu of jobs" with a wider range of hours.

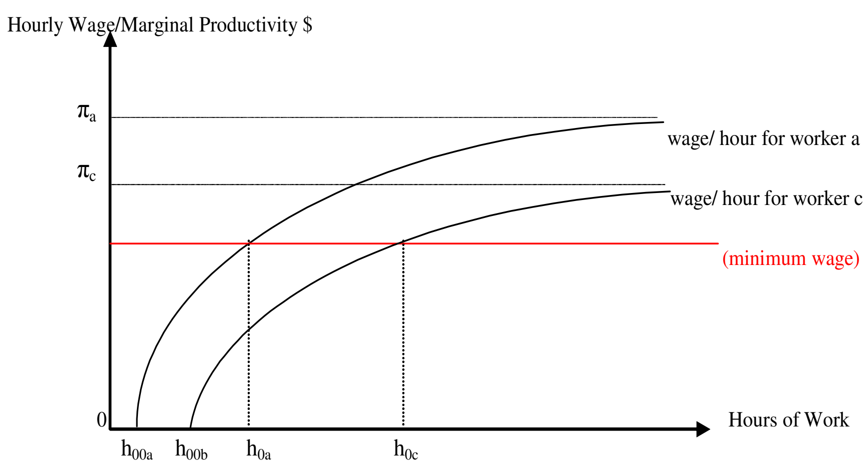

Figure 1

[1] $w_h = \frac{\pi h - f}{h} < \pi$

[2] In this paper, the minimum wage is set to be an hourly wage for two reasons. First, most of the relevant literature works with datasets in which the minimum wage is measured hourly. Second, the employment effects implied by this model will be in the same direction but magnified if the minimum wage was set in any other manner, such as a weekly or a monthly minimum wage.

3.2 Supply Side: Participation Decision with Constraints on Working Hours

Suppose that on the supply side of the labor market, there are individuals maximizing the utility function $U = U(C_i, h_i\ ;\ A_i,\ \epsilon_{1i}, \epsilon_{2i})$ choosing the amount of work hours they want to supply (h_i^*) and the level of a composite market good they want to consume (C_i^*) given their individual observable characteristics (A_i) and the unobservable heterogeneity in terms of hours preference and productivity $(\epsilon_{1i}, \epsilon_{2i})$.

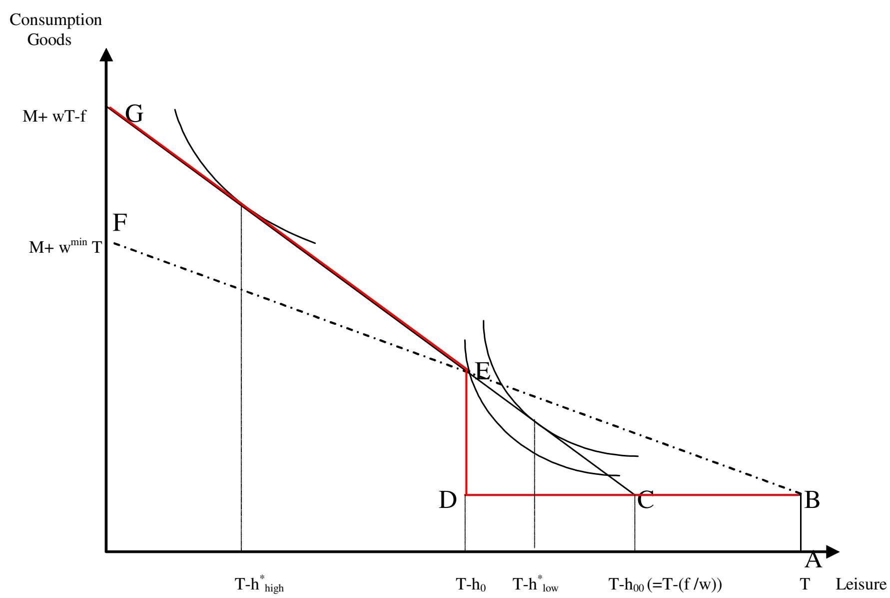

Figure 2

If the potential worker wants to supply a higher number of hours than she is required as a minimum, she will not be restricted. However, even a worker with a productivity level higher than the minimum wage will face unemployment if she does not want to work a long workweek (i.e., women who have a higher opportunity cost of working). Figure 2 demonstrates this situation, showing two workers with the same productivity$-\pi$ (slope of the line CEG), which is higher than the minimum wage (slope of the line BEF)$-$ but different levels of desired hours h_{high}^* and h_{low}^*. An individual with desired hours equal to h_{high}^* will not be constrained by the demand side. However, an individual with h_{low}^* will face the choice between working h_0(corresponding to the corner labeled E) and not working at all (the corner labeled B) since she will not be offered her optimal job any more. An individual with desired hours equal to h_{high}^* will not be constrained by demand–side factors. However, an individual with h_{low}^*will face the choice of working h_0(corresponding to the corner labeled E) and not working at all (the corner labeled B)

because she will not be offered her optimal job.

The above discussion shows that a minimum wage can have significant employment-reducing effects when there are high fixed costs. Moreover, these effects are felt more severely by low-productivity individuals because lower productivity implies a higher required minimum hours. Individuals who prefer shorter workweeks (i.e., individuals who have a high opportunity cost) who supply fewer hours to the market will also be affected more by the minimum wage in this market.

4 Econometric Specification

In the model, there are workers who work their desired hours and workers who work their required minimums. Moreover, there are three groups of nonworkers. The first group consists of the ones who willingly opt out of the labor market regardless of the minimum wage. The second group includes the ones who choose not to work the long hours they are offered. The third group is made up of people who want to work but are not offered any jobs because their marginal productivity is less than the minimum wage. The main econometric difficulty arises from the fact that it is not possible to observe which workers are at their required lower bounds and which are working their desired hours. Moreover, I cannot observe which nonparticipants are constrained and would like to supply positive hours and which would not. I only know who is working, who is not working, and the actual working hours for each worker. I assume the behavioral structure producing the observed behavior and utilize the model to recover the parameters that maximize its fit. I start by assuming that everybody has the following utility function,

$$U(C_i, L_i;\ A_i, \epsilon_i) = \left(\frac{\alpha_2(T - Li) - \alpha_1}{\alpha_2^2}\right) \exp\left(\frac{\alpha_2\left(\alpha_{0+}\alpha_2 C_i + \alpha_3 A_i + \epsilon_{1i}\right) - \alpha_1}{\alpha_2 h_i - \alpha_1}\right),$$

which is subject to the following set of constraints[3]

$$C_i = M_i + \pi_i h_i - \gamma_i f$$
$$L_i + h_i = T\ ,$$

[3] $C_i = M_i + w_{ih} h_i \Longrightarrow C_i = M_i + \left(\frac{\pi_i h_i - \gamma_i f}{h_i}\right) h_i \Longrightarrow C_i = M_i + \pi_i h_i - \gamma_i f.$

This budget constraint can also be used to model fixed costs that are directly incurred by employees facing a single wage offer (π) and choosing how much to work at the hourly wage net of the fixed costs (w_h). With the production technology used in this paper,these two models will yield identical results with the same interpretation.

where A_i is a vector of demographic characteristics, M_i is non-labor income, C_i is the composite good (the numéraire), L_i is leisure and T is the fixed weekly time endowment that can be divided between leisure and work. γ_i is a dummy that is equal to 1 if the individual works and 0 if not. This "weird" utility function was chosen because it gives a linear labor supply function, which is widely used in the literature. That is, conditional on choosing to work a positive number of hours, the optimal number of working hours is given by the following expression:

$$h_i^* = T - L_i^* = \alpha_0 + \alpha_1 \pi_i + \alpha_2 (M_i - f) + \alpha_3 A_i + \epsilon_{i1} \ . \tag{2}$$

Restrictions $\alpha_1 > \alpha_2 h_i^*$ and $\alpha_2 \leq 0$ guarantee quasiconcavity of the utility function and its monotonicity in disposable income. Whereas $\alpha_1 > \alpha_2 h_i^*$ implies that the compensated wage effect is greater than or equal to zero, α_1, can be positive or negative (See Hausman, 1985 or Pencavel, 1986). The second constraint $\alpha_2 \leqslant 0$ assures that leisure is not inferior.

Marginal productivity is given by the following equation:

$$\pi_i = \exp(X_i \beta + \epsilon_{i2}) \ , \tag{3}$$

where X_i represents individual productivity characteristics. The error terms ϵ_1 and ϵ_2 are assumed to be independently distributed as normals with means equal to zero and standard deviations equal to σ_1 and σ_2, respectively.

If an individual desires to work a positive number of hours, has a marginal productivity greater than the minimum wage, and has a higher utility from working her required minimum hours than not working, she actively participates in the labor force. Otherwise, she does not work. As stated earlier, I do not observe either h^* or h_0. However, if the individual is active in the labor market, I know h_i, the observed working hours. Given that, in this model, h_i is either the desired number of hours or the minimum required hours, I can use the conditions governing the participation decision to construct the rules determining the choice of work hours. Figure 3 illustrates the regions regarding participation behavior in the plane of desired and required minimum hours[4].

As long as the individual desires longer workweeks than the minimum workweek that she is offered, she is not constrained by the minimum-hours requirement and she works her desired number of hours. However, when a woman's desired number of hours is positive but less than the required minimum hours she is offered, she is forced to choose between not working and working the required minimum. She works h_0 hours at minimum wage[5]

[4] See the first section in the appendix for an illustration of the choice of hours using the utility function.
[5] Minimum wage is equal to the (minimum) hourly wage at the required minimum hours.

only if it is more desirable to do so than not working. That is,

$$\begin{aligned} h_i &= h_i^* \quad \text{if } h_i^* > h_0 \text{ and } \pi_i > w^{min} && (I)^6 \\ &= h_0 \quad \text{if } h_0 > h_i^* \text{ and } U(h_i = h_0) > U(h_i = 0) && (II) \end{aligned} .$$

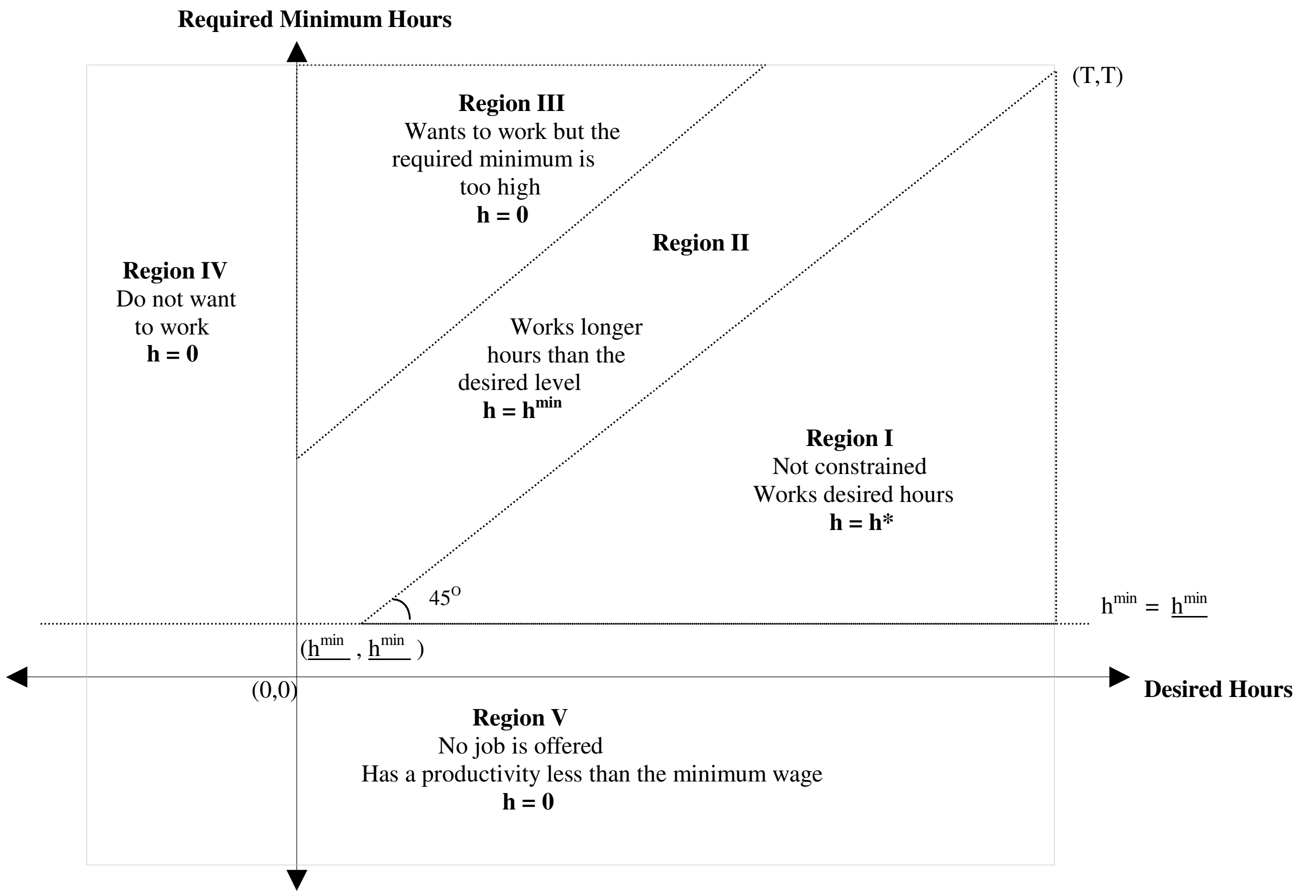

Figure 3

Similarly, there are three groups among the nonparticipants. The first group is the group of individuals who would supply positive hours if they were not constrained. They are asked to work longer hours than they are willing to supply. When facing this choice, they prefer not to participate in the labor force. On the other hand, for the second group of nonparticipants, the desired workweek is less than or equal to zero. These are the individuals who willingly choose not to work regardless of the minimum required number

[6] This constraint means that the worker will only be offered a job with a positive wage if her productivity is greater than the minimum wage. This constraint is imposed for technical reason during the optimization since if $\pi_i < w^{min}$ then $h_0 < 0$ and is less than h^*. By imposing this constraint, I can substitute minimum wage as a wage for the job that comes with minimum required hours since minimum wage is equal to the (minimum) hourly wage at the required minimum hours.

of hours. The last group of nonworkers consists of individuals who are undesirable in the market when there is a minimum wage; that is, their productivity is lower than the minimum wage. In summary,

$$
\begin{array}{llll}
h_i = 0 & & \text{if } h_0 > h_i^* \; > 0 \text{ but } U(h_i = h_0) < U(h_i = 0) & (III) \\
& \text{or} & \text{if } \pi_i > w^{min} \text{ but } h_i^* \leq 0 & (IV) \\
& \text{or} & \text{if } \pi_i < w^{min} & (V)\;.
\end{array}
$$

Given these regions of participation, the probability of working $h_i = h$ hours can be written as the probability of observing h either as h^*or as h_0; that is,

$$
Q \;=\; \left(\begin{array}{c} \Pr(h_i = h^*,\; h_i^* > h_0 > 0 \;|X_i,\; A_i,\; \sigma_1,\; \sigma_2,\; w^{min},\; M_i) \\ +\Pr\left[\begin{array}{c} h = h_0,\; h_0 > h_i^* > 0,\; U(h_i = h_0) \\ > U(h_i = 0)|\; X_i,\; A_i,\; \sigma_1,\; \sigma_2,\; w^{min},\; M_i \end{array} \right] \end{array} \right). \tag{4}
$$

The probability of not working, on the other hand, is the combined probability of being in regions III, IV or V and can be expressed as

$$
q \;=\; \left(\begin{array}{c} \Pr(h_0 > h_i^* > 0, U(h_i = h_0) < U(h_i = 0)|\; X_i, A_i, \sigma_1, \sigma_2, w^{min}, M_i) \\ +\Pr(h_i^* = 0\;,\; \pi_i > w^{min}|\; X_i, A_i, \sigma_1, \sigma_2, w^{min}, M_i) \\ +\Pr(w^{min} > \pi_i \;|\; X_i, A_i, \sigma_1, \sigma_2, w^{min}, M_i) \end{array} \right). \tag{5}
$$

Thus[7], the log likelihood function, $\log L$, is

$$
\log L \;=\; \sum_{h>0} \log Q + \sum_{h=0} \log q \tag{6}
$$

[7]See the second section in the appendix for details of this derivation.

5 Estimation

5.1 Data:

I have data from the Turkish Household Labor Force Survey (HLFS) for the years 1988, 1989, 1994, and 1999. This survey was conducted biannually (April and October) by the State Institute of Statistics of Turkey from (October only) to and has been conducted quarterly since 2000. In total, 14,000 to 23,000 households have been surveyed at each data collection point, both from rural and urban areas. I have province information and hourly wages from the 1988 October data but not from the later surveys. I used data from all surveys for the simple probability model estimates and hours regressions. For the structural estimation, because individual wage information is needed, only the 1988 data are used[8].

In the October 1988 round of the Turkish HLFS, 102,062 individuals residing in 22,320 households nationwide were surveyed. In this dataset, participation for women was around 18 percent in cities, very similar to the census results. Participation rates varied greatly with education and marital status. There were significant drops in participation rates for individuals with less than a college education (e.g., 73 percent at the college level and 8 percent for primary school graduates) and for married women (38 percent for single women, 11 percent for married women). In the survey, nonworking women were asked if they would like to work, and the percentage of women who were ready to start working was higher among married and low-educated women (although only slightly in some cases). This suggests that nonworking women tend to be the ones who are staying out of the market due to demand-side restrictions.

For the empirical analysis, I use a subsample of 6,445 women between the ages of 20 and 55 who were married and living together with their husband in cities with 400,000 or more people. Women in the sample either did not work the week preceding the interview or were employed as wage and salary workers. I only use data for women who were working at most one job and who were not currently enrolled in school, either full time or part time. Table 4 gives the descriptive statistics for the women in my sample.

[8]Estimates provided in Table 2 are robust across years. Thus, I expect that the stuctural model estimates will hold for other years too.

Table 4: Descriptive Statistics						
Variables	# of obs.	mean	st.dev.	min.	max.	median
Hours worked (if working)	561	40.01	9.16	15	84	40
Hourly earnings						
Minimum wages						
# of children of aged 0-5[9]	2804	1.38	0.61	1	4	1
# of children of aged 6-14	3753	1.86	0.94	1	6	2
Education	6445	4.66	3.671	0	15	5
Age	6445	34.62	9.16	20	55	34
		Hours of Work by Schooling				
	# of obs.	mean	st.dev.	min.	max.	median
primary school or less	189	42.79	9.03	15	84	40
middle school	35	42.48	4.68	40	58	40
high school	183	40.36	5.98	20	64	40
college or more	154	35.58	9.19	15	54	40

In this subsample, the mean level of education is about 5 years. Seventy-four percent of the women interviewed have 7 or fewer years of schooling (the last degree they obtained was for primary school). University graduates constitute 6 percent of the women and about 37 percent of the workers in the subsample. The labor force participation rate for this subsample is about 9 percent. These women work 40 hours on average. Eighty-three percent of the working women work 40 hours or more, and only 5 percent work 20 hours or fewer (8 percent of women work between 25 and 40 hours, and 9 percent work fewer than 25 hours).

[9] conditional on having a child

Table 5:	Variable Definitions	
A_i	demographic variables	
	age	between 20 and 55
	age squared	age squared/100
	years of schooling	0 = no schooling
		3 = literate but has no degree
		5 = primary school
		8 = middle school
		11 = high school
		15 = college or more
	years of schooling squared	years of schooling squared/100
	young children	number of children between ages 0-5
	young children squared	number of young children squared
	older children	number of children between ages 6-14
	older children squared	number of older children squared
X_i	productivity variables	
	middle school	dummy (0-1)
	high school	dummy (0-1)
	college	dummy (0-1)
	potential experience	age - years of schooling - 6
		(6 is the age at schooling begins)
	potential experience squared	potential experience squared/100
M_i	non-labor income	$\frac{\text{household income–own labor income}}{\text{number of household members}}$

I use different educational indicators, family variables, and individual demographic indicators as the explanatory variables in the estimation. Table 5 lists the variables used in all steps of estimation with explanations. There are a few problems with the data; for example, wages and a nonlabor income measure are not directly available. There is also no record of asset income. I use the weekly value of per-member income of the household, excluding women's own earnings as a proxy for the nonlabor income. I only have monthly incomes recorded; thus, I divide the figures by four to obtain an approximate weekly number. In the survey, individuals report their usual working hours per week and how much they worked the week before the survey. However, they report how much they earned for the month preceding the interview. I approximate the weekly labor income using these figures, making sure that the individuals were working for the whole month for which they report the income. Three observations that do not meet this criterion are excluded from the sample used for the analysis.

The dataset is cross-sectional and the nominal level of the minimum wage is constant across the country. I generate variations in the minimum wage using the province-level

CPI[10]. I keep the prices in Ankara (the capital city) as the base and divide the minimum wage in the other provinces with the ratio of their prices to the prices in the capital. This measure reflects the differences in the real value of the minimum wage across individuals even though they all face the same nominal level. I made the same adjustment to nonlabor income and wage measures. I convert all values into U.S. Dollars using the average Dollar/Turkish Lira exchange rate for October 1988, the month that the survey took place.

I estimate the model using Maximum Simulated Likelihood (MSL). This method replaces the actual probabilities defining the likelihood function with simulated probabilities. The simulated probabilities are generated by a Logit-Smoothed Accept-Reject Simulator (LS-AR Simulator) following Train(2003)[11].

5.2 Results

Married women's time outside of the market is valued higher because the division of labor in the household requires them to be the main producers at home in most cultures. Thus, females of a given market productivity are expected to supply fewer hours of labor than their male counterparts. These women are also expected to decide not participate in the labor force if they would be required to work long hours at the jobs available to them. This is what I observe in the present data. The share of housewives among nonparticipating women is strikingly high in the Turkish data; Seventy-nine percent of women who do not participate in the labor force state "being a housewife" as the reason for not doing so. Household duties keep women at home when the labor market options are not attractive enough. My estimates provide support for this not-so-new idea. Looking at Table 6 we can see that having young children in the household decreases a woman's desired weekly work hours. Whereas having only one young child at the household results in a 6-hour decrease in desired hours, having two young children results in a 10-hour decrease. The effect of having older children on hours choice is similar, but its magnitude diminishes as the number of children in this age group increases in the household. The average woman with a child between the ages of 6 and 14 wants to work about 3 hours fewer compared to her counterpart with no children in this age range.

The estimates of the marginal productivity parameters suggest significant economic returns to education, especially at the college and high school levels. Everything else equal, college-educated women earn about one hundred percent more per hour compared to

[10] I use 1995 prices, the earliest year for which CPI exists for all the provinces I have in the data.

[11] The description of the simulation process excluded in this version of the paper but can be provided/added upon request.

women with no education. The wage return to a college education is more than double the wage return to a high school degree (again compared to women with no education). This partially explains the discrepancy between participation rates across different education levels.

The mean of the productivity estimates is 54 cents for the working individuals. That is, the average worker produces 54 cents worth of goods or services per hour. The distribution of these productivity measures has a standard deviation of 17 cents, with values ranging from 0.03 to 2.34 dollars for the entire sample. According to these estimates, 9 percent of the women in the sample have a simulated productivity that is less than the minimum wage, which ranges from 32 to 34 cents per hour across 14 cities.

The number of desired work hours decreases for nonlabor income, but the effect is not very significant economically. In this case, nonlabor income approximated using the labor incomes of the other family members in the household. The sum of family income excluding the wife's income divided by the family size. Keeping this in mind, the estimate for α_2 suggests that by every hundred extra dollars the other family members earn per person, the desired hours of a potential worker decreases by 3 hours per week.

Table 6: MSL Estimates

Desired and Required Minimum Hours	estimate	st.dev
Constant (α_0)	21.49	3.82
Wage (α_1)	4.81	1.01
Nonlabor income (α_2)	-0.03	1.08E-3
Years of schooling	0.88	0.09
Years of schooling squared	-3.55	0.65
Age	0.84	0.17
Age squared	-1.67	0.25
Young kids	-2.47	0.77
Older kids	-3.49	0.42
Young kids squared	-2.71	0.59
Older kids squared	0.52	0.17
Fixed employment cost (f)	5.38	0.26
Marginal Product		
Constant	-1.54	0.01
Middle school	0.20	0.01
High school	0.44	0.02
College	0.93	0.03
Potential experience	1.6E-3	3.03E-4
Potential experience squared	-5.4E-5	5.23E-6
σ_1	8.11	0.09
σ_2	0.42	0.01
Log likelihood	-3028	

The coefficients for the age variables imply that desired hours increases up to age 33 and declines thereafter. Such a pattern, in terms of hours worked, does not appear in the data. However, we know that not all workers work their desired number of hours. According to the estimation, about 40 percent of the workers in the sample are constrained to work at the minimum number of hours. Given this, Figure 4 illustrates why we fail to observe such a pattern with the hours data. The number of hours worked at the low and high ends of the age distribution is still high due to the higher proportion of constrained workers in those age groups. In other words, because both younger and older works have higher numbers of desired hours, a smaller proportion of middle-aged workers are constrained to the minimum number of hours.

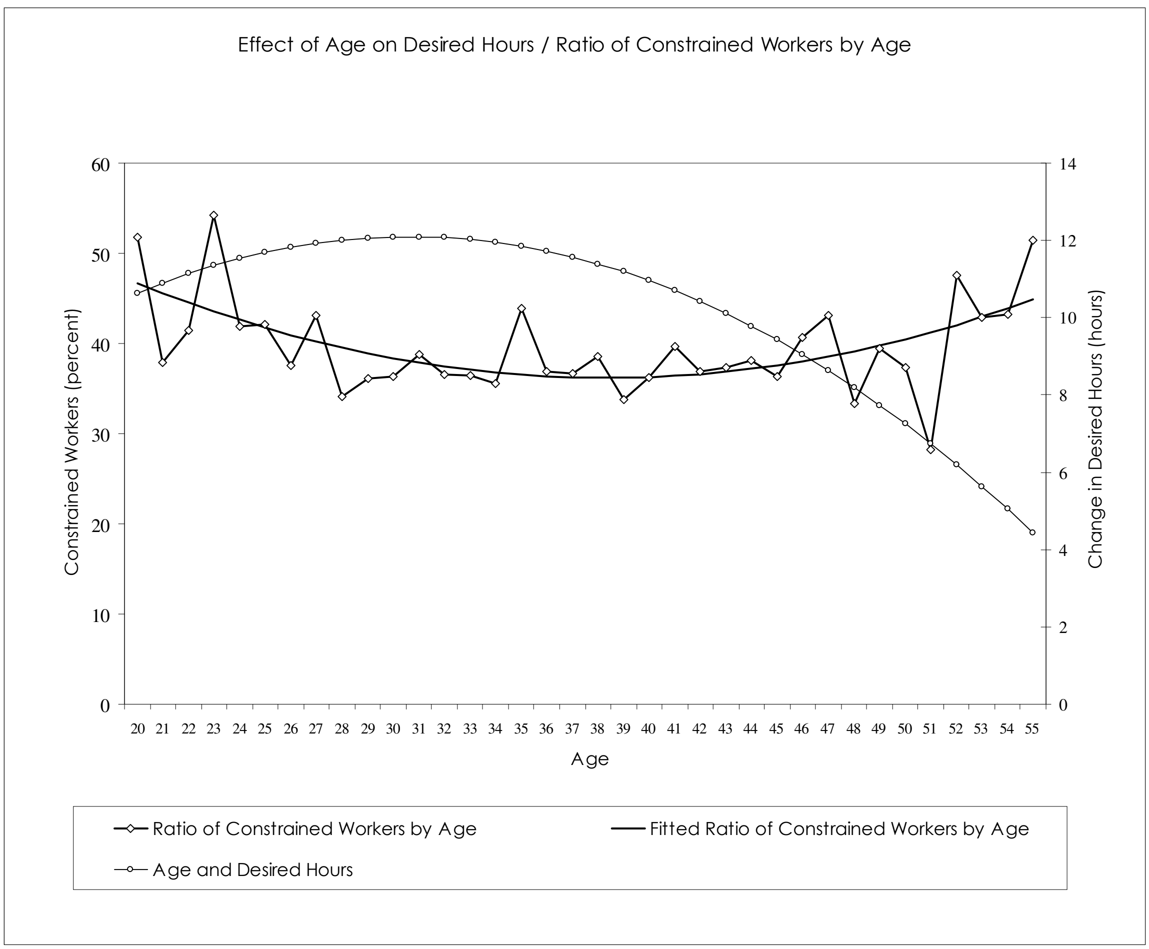

Figure 4

The estimate for α_1 seems to be small, suggesting that a dollar increase in the wage would increase the desired hours by 5 hours given the range of wage estimates. For the average worker, one extra dollar per hour was equal to about a two-hundred-percent increase in hourly wages. This is in line with the findings of several papers on Turkish female labor market activity. Tunali (1997), for example, finds that the wage elasticity of hours supplied is almost zero among Turkish women.

The fixed employment cost is estimated to be about 5.40 dollars. As mentioned before, an average worker works 40 hours per week and makes about 0.54 dollars per hour. In this case, 5.40 dollars corresponds to about 25 percent of the worker's weekly earnings. About 31 percent of all labor costs in Turkey (in 1990) were nonwage payments[12].

5.2.1 Participation Regions

The estimated participation rate from the model is 8.87 percent. Table 7 summarizes the participation probabilities associated with the regions in Figure 3. According to these estimates, 80 percent of all women are restricted in the sense that they want to supply positive hours of work but either are not desired as workers or are constrained by a high number of required minimum hours. Conditional on being a nonparticipant, about 25 percent of women wanted to work and are welcomed into the market but asked to work more hours than they are willing to supply. About 60 percent of women are not offered any job.

Table 7: Participation Regions

Event	Definition	Probability
$h > 0$	participation	0.09
$h = h^*$	working desired hours - Region I	0.04
$h = h^{min}$	working required minimum - Region II	0.05
$w^{min} < \pi$, $h^* > 0$, $h = 0$	required minimum too high - Region III.	0.25
$w^{min} < \pi$, $h^* < 0$, $h = 0$	not want to work - Region IV	0.04
$w^{min} > \pi$	no job offer - Region V	0.62

5.2.2 Fitting the Hours Distribution

Table 8 reports the distribution of the estimated hours. In the simulated data, the average workweek totaled about 41 hours. For the women working their required minimum hours, the mean workweek was 47 hours long, and for women working their desired hours the mean workweek was 35 hours.

Table 8: Distribution of Hours

	mean	st.dev.	min	max
estimated	40.61	13.52	8.54	89.67
$h = h_0$	46.81	15.31	13.64	89.67
$h = h^*$	34.88	8.19	8.54	61.34

[12] TISK (Turkish Employer's Unions Confederation) Website. www.tisk.org.tr

Figure 5 graphs the simulated hours distribution and also shows the distributions for the restricted and unrestricted workers. The relatively high concentration of workweeks at around 30 to 45 hours can be considered a possible explanation for the concentration of the hours distribution around 40 hours in the data.

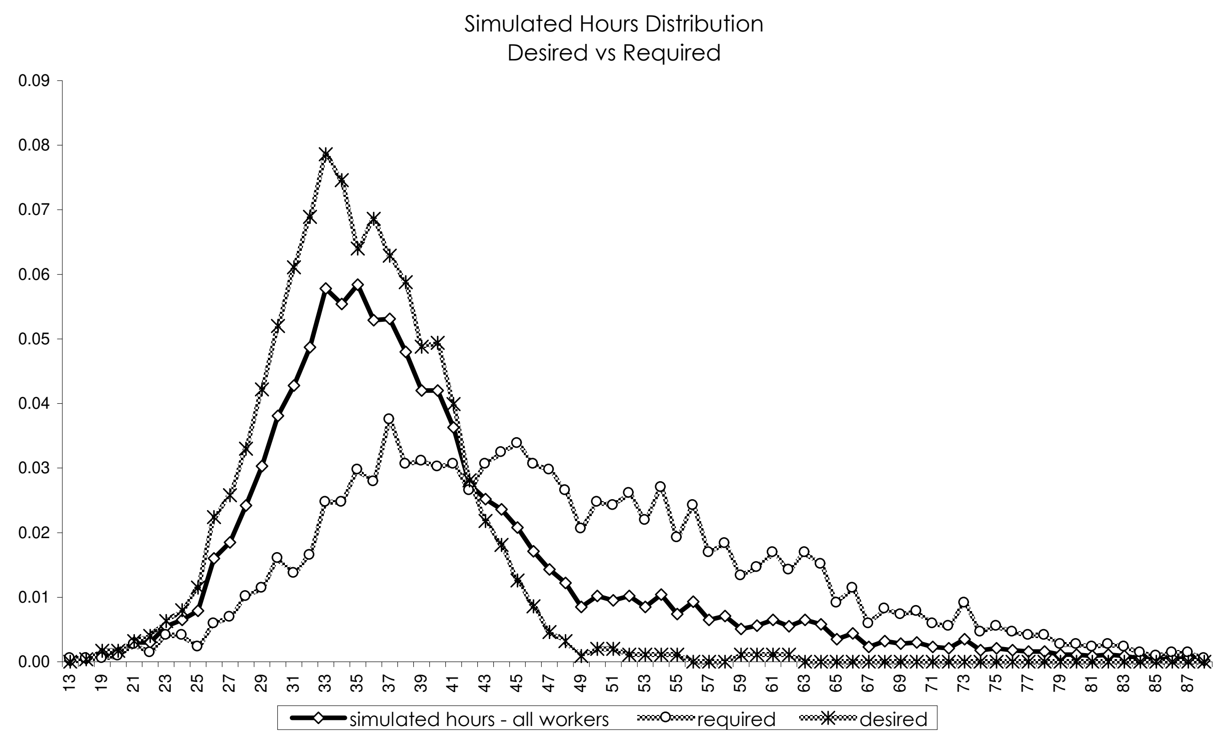

Figure 5

6 Counterfactuals

Given the estimates and the data, I am able to simulate the participation and hours choices under different minimum-wage policies. Moreover, I am able to see how the participation and hours choices would have changed with the same minimum wage in a different economic environment, in this case, a labor market with no employment costs. Based on the estimates, I simulate several counterfactual scenarios and analyze the transitions across labor-market groups under these alternative policies. Table 9 contains the participation probabilities generated via the simulations for these counterfactuals.

Table 9:	Participation Regions under Counterfactuals	
	$f = f_{estimate}$, $w^{min} = 0$	
$h > 0$	participation	0.48
$w^{min} < \pi$, $h^* < 0$, $h = 0$	does not want to work	0.09
	$f = 0.5 * f_{estimate}$, $w^{min} = w^{min}_{data}$	
$h > 0$	participation	0.15
$w^{min} < \pi$, $h^* > 0$, $h = 0$	required minimum too high	0.19
$w^{min} < \pi$, $h^* < 0$, $h = 0$	does not want to work	0.04
$w^{min} > \pi$	no job offer	0.62
	$f = 0.5 * f_{estimate}$, $w^{min} = 0$	
$h > 0$	participation	0.75
$w^{min} < \pi$, $h^* < 0$, $h = 0$	does not want to work	0.09

In the simulation, when the minimum wage is set to zero (in the presence of fixed costs), the amount of women working increases to 48 percent, whereas only 9 percent of women are not working. The fixed cost in this model represents not only technological burdens but also policy-implied costs of employment. Thus, although it is not reasonable to think of an environment without any fixed employment costs, we can think of an environment without the institutional costs imposed by the regulations, taxes, and so forth. The simulation model suggests that 15 percent of women would participate in the labor market if fixed costs were 50 percent lower. If there were no constraints in the market, the simulations show that about 60 percent of currently nonworking women would obtain jobs. This would raise the total female labor force participation to 75 percent, about 9 times the current estimated rate. A simulation without fixed costs indicates that the minimum wage alone explains 42 percent of this total increase. Similarly, a simulation including fixed costs but no minimum wage shows that fixed costs accounted for only 7 percent of the change. Thus, the interaction of the minimum wage with fixed employment costs accounts for most of the difference.

These changes also affect the distribution of working hours. Table 10 shows that the mean, minimum, and maximum hours worked are lower in the counterfactual simulation, indicating more women are working at the low end of the hours distribution. This supports the claim that if there had been more part-time jobs available in the market, participation would have been higher.

Table 10: Counterfactual Distribution of Hours				
	mean	st.dev.	min	max
f=$f_{estimate}$,w^{min}=0	31.91	7.78	10.28	68.62
f=f=0.5*$f_{estimate}$,w^{min}=w^{min}_{data}	36.08	12.05	5.99	89.72
f=f=0.5*$f_{estimate}$,w^{min}=0	28.76	8.56	5.14	68.54

7 Conclusion

In this paper, I show that the interaction of minimum wages and fixed costs of employment limits the availability of short workweeks for women, and as a result can cause a shortage of part-time jobs. Thus, for sufficiently high employment costs, the institution of a minimum wage affects employment among all workers who prefer flexibility in terms of hours, regardless of the level of productivity. I estimated the model with Turkish data. My estimates indicate that about 80 percent of all women in Turkey are restricted; they wish to supply positive hours of work but either have lower than minimum-wage productivity and thus are not desired as workers or are constrained by the required minimum hours in the market. The key parameter in the model is the fixed cost of employment, which is estimated to be about 5 dollars per week for each employee. The average worker in the sample worked 40 hours per week and made about 54 cents per hour. The 5-dollar fixed cost thus corresponded to about 25 percent of average weekly earnings. Given that, on average, 30 percent of all labor costs in Turkey represent nonwage expenses[13] , this estimate appears to be a good approximation of labor costs for the present sample.

With counterfactual simulations I show that with no constraints in the market, total female labor force participation would increase nine fold. About 65 percent of these new participants would hold part-time jobs. A simulation without fixed costs indicates that the minimum wage alone explains 42 percent of this total increase, and a simulation including fixed costs but no minimum wage reveals that fixed costs accounts for only 7 percent of the change. These results support the claim that the impact of the minimum wage is strongest when it is imposed in inflexible market conditions.

There are several assumptions in the model that may be considered restrictive. For example, in the current functional specification of the model, there is no place for a nonmonotonic relationship between hours supplied and fixed costs. Moreover, there is no room for nonlinear responses to wages. Implications of the model for employment decisions do not change if the technology is modified in order to allow alternative constraints and wage structures. For example, an S-shaped hours-productivity relationship (Barzel, 1973; Moffitt, 1984), which is considered a more realistic approach, would lead to both lower

[13] SIS statistic

and upper bounds for the length of workweeks acceptable to the employers. This would strengthen the impact of the minimum wage on the level of employment, even without the fixed costs. In the data, the distribution of hourly wages by workweek is weakly concave, which rejects the idea of a full-time wage premium. I take this as a sign that the present model is a good choice for the studied environment. It implies that part-time jobs will be in short supply and high-productivity workers will occupy the existing jobs. Low-productivity workers will be constrained by having to work more hours. Thus, in this environment, the part-time job market may have higher hourly wages on average than the full-time job market. This is quite different from the markets that are explained with S-shaped budget constraints.

Allowing constraints only on the minimum number of hours workers can work may also seem limiting. However, an upper limit on working hours does not seem to be an issue in the data. Moreover, unlike some other studies in the literature, I chose not to discretize the choice set of hours because the main concern is not fitting the distribution of observed hours (mainly the spikes at certain lengths of workweeks, such as 40 hours) but understanding how important these constraints are in explaining the concepts of voluntary and involuntary unemployment. I cannot capture the spikes of observed hours distribution with these estimates. However, the model successfully fits the external margins of participation. I also ignore the possible heterogeneity of fixed costs due to the lack of variables needed to identify such variation across workers.

This paper offers a stylized model of employment costs. The model restricts the use of information on employers because this information does not exist for nonworkers and thus cannot be used to approximate the latent indices created for each individual. Estimating the model only on workers can improve this aspect of the estimates. However, workers constitute a minority in this dataset, which reduces the power of estimation. Thus, the next step is to estimate the model with a dataset in which employment rates are higher, such as the Current Population Survey. In the meantime, the dataset can be enriched by the inclusion of single females and perhaps males. Married women make nonparticipation decisions more easily than men and single women because they usually have a higher nonlabor income on which to rely. It would be interesting to use the household as the unit of analysis and estimate the impact that the minimum wage and market inflexibilities have on the intrahousehold division of labor. Like their wives, married Turkish men also work long hours (on average 52 hours in my data). This is very high compared to many other countries.

In this model productivity is perfectly observed by employers, and wages are based on productivity. This kind of model of the labor market has been used before to consider minimum-wage impacts, dating back to Stigler (1946). The approach has been criticized before because it does not account for the spike in the wage distribution at the minimum wage (Card and Krueger, 1994). The model introduced in this paper does not suffer from this criticism. One implication of my model is that, despite being based on a Stiglerian view of the labor market, the model still ends up with a spike at the minimum wage, without raising anyone's wages (e.g., an impressive 43 percent of all registered workers are reported to be working for minimum wage in the Turkish data). This model also can be used to explain the high rates of minimum-wage noncompliance—if the alternative is being unable to work, many workers would not complain if they are being paid below the minimum wage for a job with flexible hours.

APPENDIXES

I. UTILITY FUNCTION AND WORK DECISION

The following two graphs show the relationship between work hours and utility, holding everything else constant for two different individuals. Both individuals have the same characteristics, except for the number of young children. The x-axis crosses the y-axis at U(h = 0), that is, at the utility level of not working.

This first figure illustrates the utility function of an individual for whom not working is superior to working at any h. This individual is not going to work at h* because this local maximum implies a lower utility level than what he receives at h=0 .

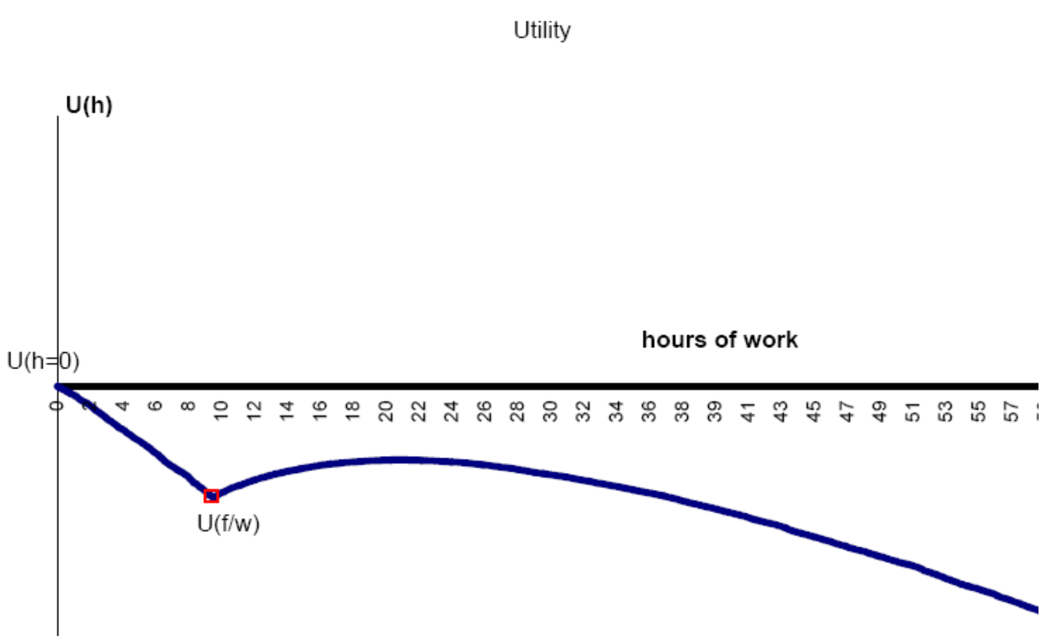

Figure A-1

The following individual has the same characteristics as the above individual except for the number of young children. As you can see, the absolute required minimum is the same for both individuals because only the productivity variables affect the location of this minimum. Unlike the case above, there is a positive h for this individual where her utility is maximized. She will work h^* (point C) if the required minimum number of hours is between points B and C. She will work her required minimum hours if the minimum is between C and D (note that for these points utility is higher than what it is at h=0). If the required minimum is more than D, she will not work because in that situation not working yields a higher utility compared to working at h^{min}.

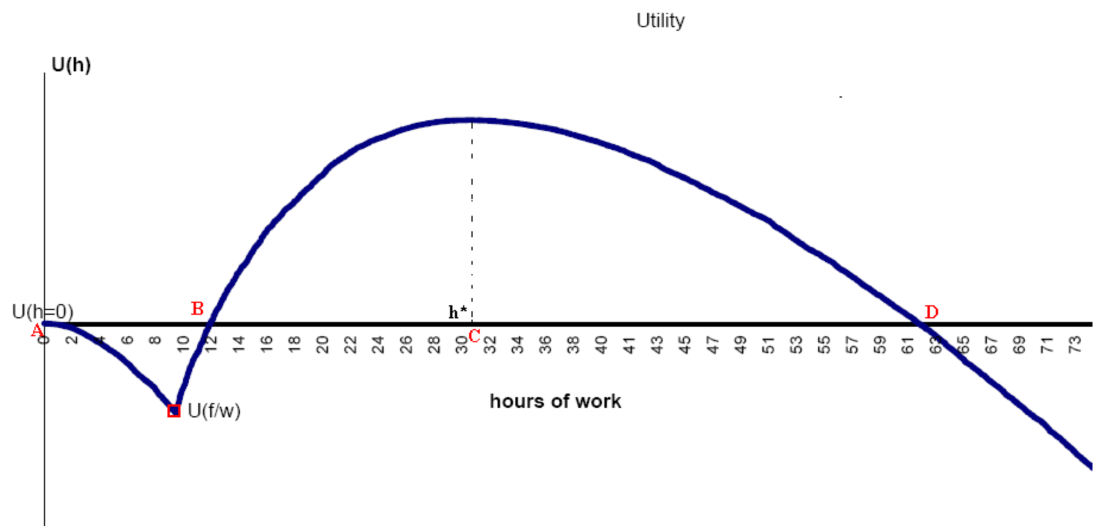

Figure A-2

II. DERIVATION OF THE LIKELIHOOD FUNCTION

The individual's problem is to maximize

$$\begin{aligned} U &= U(C_i, L_i;\ A_i, \epsilon_i) \\ &= \left(\frac{\alpha_2(T-Li)-\alpha_1}{\alpha_2^2}\right)\exp\left(\frac{\alpha_2\left(\alpha_{0+}\alpha_2 C_i+\alpha_3 A_i+\epsilon_{1i}\right)-\alpha_1}{\alpha_2 h_i-\alpha_1}\right) \ , \end{aligned}$$

which is subject to the following set of constraints:

$$C_i \leq M_i + \gamma(\pi_i h_i - f)$$
$$L_i + h_i \leqslant T \quad ,$$

where A_i is a vector of demographic characteristics, M_i is nonlabor income, C_i is the composite good (the numeraire), L_i is leisure, and T is the fixed weekly time endowment that can be divided between leisure and work. γ is a dummy that is equal to 1 if the individual works and 0 otherwise. The solution to this optimization problem gives

$$h_i^* = T - L_i^* = \alpha_0 + \alpha_1\pi_i + \alpha_2(M_i - f) + \alpha_3 A_i + \epsilon_{i1}$$

as the desired hours equation. This model has two more latent indexes:

$$\pi_i = X_i\beta + \epsilon_{i2}$$

$$h_{ij}^{\min} = \frac{f}{\pi_i - w_j^{\min}}.$$

Then for a worker

$h_i = h_i^*$ (works desired hours) if

$$h_i^* > h_{ij}^{\min} \text{ and } \pi_i > w_j^{\min} \ ;$$

$h_i = h_{ij}^{\min}$ (works required minimum hours) if

$$0 < h_i^* < h_{ij}^{\min} \text{ and } \ U(h_i = h_{ij}^{\min}) > U(h_i = 0) \ \ ;$$

$h_i = 0$ (desires to work but is restricted) if

$$0 < h_i^* < h_{ij}^{\min} \quad \text{and} \quad U(h_i = h_{ij}^{\min}) < U(h_i = 0) \ ;$$

$h_i = 0$ (does not want to work but is offered a job) if

$$h_i^* \leq 0 \quad \text{and} \quad \pi_i > w_j^{\min} \ ;$$

and

$h_i = 0$ (can not work-no job is offered) if

$$\pi_i < w_j^{\min} \ .$$

Then the log-likelihood function is:

$$\log L = \sum_{h>0} \log Q + \sum_{h=0} \log q,$$

where

$$Q = \left(\begin{array}{c} \left(\begin{array}{c} k(h| \ Region \ \ I \ , \ X_i, \ A_i, \ \sigma_1, \ \sigma_2, \ w_j^{\min}, \ M_i) \\ \Pr(\ Region \ \ I \mid X_i, \ A_i, \ \sigma_1, \ \sigma_2, \ w_j^{\min}, \ M_i) \end{array} \right) \\ + \\ \left(\begin{array}{c} k(h| \ Region \ II, \ X_i, \ A_i, \ \sigma_1, \ \sigma_2, \ w_j^{\min}, \ M_i) \\ \Pr(\ Region \ \ II \mid X_i, \ A_i, \ \sigma_1, \ \sigma_2, \ w_j^{\min}, \ M_i) \end{array} \right) \end{array} \right)$$

and

$$q = \left(\begin{array}{c} \Pr(Region \ III \mid X_i, \ A_i, \ \sigma_1, \ \sigma_2, \ w_j^{\min}, \ M_i) \\ + \Pr(Region \ IV \mid X_i, A_i, \sigma_1, \sigma_2, w_j^{\min}, M_i) \\ + \Pr(Region \ V \mid X_i, \ A_i, \ \sigma_1, \ \sigma_2, \ w_j^{\min}, \ M_i) \end{array} \right).$$

$k(.)$ is the conditional probability density function of the hours-of-work variable given dependent variables, nonlabor income, minimum-wage levels, and the unobserved preference and productivity shocks.

Furthermore,

$$k(h|Region \ I, .) = \frac{\Phi \left[\frac{(h_i - f) X_i \beta - w_j^{\min} h_i}{\sqrt{(f-h_i)^2 \ \sigma_2^2}} \right] \phi \left[\frac{h_i - \alpha_0 - (\alpha_1 - \alpha_2 f) X_i \beta - \alpha_2 M_i - \alpha_3 A_i}{\sqrt{(\alpha_1 - \alpha_2 f)^2 \ \sigma_2^2 + \sigma_1^2}} \right] \frac{1}{\sqrt{(\alpha_1 - \alpha_2 f)^2 \ \sigma_2^2 + \sigma_1^2}}}{\Pr(0 < h_{ij}^{\min} < h^*, U(h = h_{ij}^{\min}) \ > U(h=0) \mid X_i, A_i, \sigma_1, \sigma_2, w_j^{\min}, M_i)} \ ,$$

$$k(h|Region \ II, .) = \frac{[\Phi(Z_1) \ - \ \Phi(Z_2)] \ (\frac{w_j^{\min} f}{(h_i - f)^2 \sigma_2}) \ \phi \ (\frac{w_j^{\min} \frac{h_i}{h_i - f} \ - \ X_i \beta}{\sigma_2})}{\Pr(0 < h_i^* < h_{ij}^{\min}, \ U(h_i = h_{ij}^{\min}) \ > U(h_i = 0) \mid X_i, A_i, \sigma_1, \sigma_2, w_j^{\min}, M_i)},$$

where

$$Z_1 = \frac{\log\left(\frac{\alpha_1 - \alpha_2 h_i}{\alpha_1}\right)[(\alpha_1 - \alpha_2 h_i)\ (\alpha_1)] - \alpha_2^2\alpha_0 h_i - \alpha_2^3 h_i M_i - \alpha_2^2\alpha_3 A_i h_i + \alpha_2\alpha_1 h_i - \alpha_2^2\alpha_1 w_j^{\min} h_i}{\alpha_2^2 h_i \sigma_1};$$

and

$$Z_1 = \frac{h_i - \alpha_0 - (\alpha_1 - \alpha_2 f)X_i\beta - \alpha_2 M_i - \alpha_3 A_i - (\alpha_1 - \alpha_2 f)\left[w_j^{\min}\dfrac{h_i}{h_i - f} - X_i\beta\right]}{\sigma_1};$$

and

$$q = \left(\begin{array}{c} \Pr\left(\begin{array}{c} \left[\begin{array}{c} \left(\alpha_2 h_{ij}^{\min} - \alpha_1\right)\exp\left(\frac{\alpha_2\left(\alpha_0 + \alpha_2 M_i + \alpha_2 h_{ij}^{\min} w_j^{\min} + \alpha_3 A_i + \epsilon_{1i}\right) - \alpha_1}{\alpha_2 h_{ij}^{\min} - \alpha_1}\right) \\ < \\ (-\alpha_1)\exp\left(\frac{\alpha_2(\alpha_0 + \alpha_2 M_i + \alpha_3 A_i + \epsilon_{1i}) - \alpha_1}{-\alpha_1}\right) \end{array} \right] \\ ,\ h_i^* > 0, \\ \pi > w_j^{\min} \mid X_i, A_i, \sigma_1, \sigma_2, w_j^{\min}, M_i \end{array} \right) \\ + \Pr\left[h_i^* < 0,\ \pi > w_j^{\min}\ \mid\ X_i, A_i, \sigma_1, \sigma_2, w_j^{\min}, m_i\right] \\ + \Pr\left[\pi < w_j^{\min}\ \mid\ X_i, A_i, \sigma_1, \sigma_2, w_j^{\min}, M_i\right] \end{array} \right)$$

$$= \left(\begin{array}{c} \Pr\left(\begin{array}{c} \left[\begin{array}{c} \left(\alpha_2 h_{ij}^{\min} - \alpha_1\right)\exp\left(\frac{\alpha_2\left(\alpha_0 + \alpha_2 m + \alpha_2 h_{ij}^{\min} w_j^{\min} + \alpha_3 A_i + \epsilon_{1i}\right) - \alpha_1}{\alpha_2 h_{ij}^{\min} - \alpha_1}\right) \\ < \\ (-\alpha_1)\exp\left(\frac{\alpha_2(\alpha_0 + \alpha_2 M_i + \alpha_3 A_i + \epsilon_{1i}) - \alpha_1}{-\alpha_1}\right) \end{array} \right] \\ ,\ X_i\hat{\beta} - w_j^{\min} > -\epsilon_{2i}, \\ \alpha_0 + (\alpha_1 - \alpha_2 f)X_i\hat{\beta} +\ \alpha_2 M_i + \alpha_3 A_i > \epsilon_{1i} + \epsilon_{2i}(\alpha_1 - \alpha_2 f) \end{array} \right) \\ + \Pr\left[\begin{array}{c} \alpha_0 + \alpha_1\left(X_i\hat{\beta} + \epsilon_{i2}\right)_i + \alpha_2\left(M_i - f(X_i\hat{\beta} + \epsilon_{i2})\right)_i \\ + \alpha_3 A_i + \epsilon_{1i} < 0,\ X_i\hat{\beta} + \epsilon_{i2} > w_j^{\min} \end{array} \right] \\ + \Pr\left[X\hat{\beta} + \epsilon_{i2} < w_j^{\min}\right] \end{array} \right)$$

$$= \left(\begin{array}{c} \Pr\left(\begin{array}{c} \left[\begin{array}{c} \left(\alpha_2 h_{ij}^{\min} - \alpha_1\right)\exp\left(\frac{\alpha_2\left(\alpha_0 + \alpha_2 M_i + \alpha_2 h_{ij}^{\min} w_j^{\min} + \alpha_3 A_i + \epsilon_{1i}\right) - \alpha_1}{\alpha_2 h_{ij}^{\min} - \alpha_1}\right) \\ < \\ (-\alpha_1)\exp\left(\frac{\alpha_2(\alpha_0 + \alpha_2 M_i + \alpha_3 A_i + \epsilon_{1i}) - \alpha_1}{-\alpha_1}\right) \end{array} \right] \\ ,\ X_i\hat{\beta} - w_j^{\min} > -\epsilon_{2i}, \\ \alpha_0 + (\alpha_1 - \alpha_2 f)X_i\hat{\beta} +\ \alpha_2 M_i + \alpha_3 A_i > \epsilon_{1i} + \epsilon_{2i}(\alpha_1 - \alpha_2 f) \end{array} \right) \\ + \Phi\left[\frac{-\left[\alpha_0 + (\alpha_1 - \alpha_2 f)X_i\hat{\beta} + \alpha_2 M_i + \alpha_3 A_i\right]}{\sqrt{\sigma_1^2 + (\alpha_1 - \alpha_2 f)\sigma_2^2}},\ \frac{-X_i\hat{\beta} + w_j^{\min}}{\sigma_2}\right] + \Phi\left[\frac{X_i\hat{\beta} - w_j^{\min}}{\sigma_2}\right] \end{array} \right).$$

III. TABLE 1 - ALL COEFFICIENT ETIMATES

Table 1: Employment and Part-time Probabilities and Hours of Work in Turkey for Urban Females with Log Real Minimum Wage (1988TL)

Dependent Variable	Employment		Part-time		Log Hours
Method of Estimation	Probit		Probit		OLS
	β	mfx	β	mfx	β
Lagged Minimum Wage	-1.018	-0.143	-1.437	-0.230	
	(0.207)**	(0.029)**	(0.539)**	(0.086)**	
Log Lagged Minimum Wage					0.205
					(0.027)**
Married	-0.576	-0.105	0.287	0.045	-0.083
	(0.021)**	(0.005)**	(0.057)**	(0.009)**	(0.008)**
Number of children ages 6-14	0.019	0.003	0.134	0.021	-0.011
	(0.010)	(0.001)	(0.032)**	(0.005)**	(0.005)*
Number of children ages 3-5	-0.143	-0.020	0.158	0.025	-0.022
	(0.022)**	(0.003)**	(0.063)*	(0.010)*	(0.010)*
Number of children ages 0-2	-0.234	-0.033	0.015	0.002	-0.011
	(0.026)**	(0.004)**	(0.075)	(0.012)	(0.012)
Primary School	0.363	0.049	-0.180	-0.027	0.010
	(0.041)**	(0.005)**	(0.197)	(0.027)	(0.025)
Junior High	0.899	0.203	-0.105	-0.016	-0.023
	(0.047)**	(0.014)**	(0.212)	(0.030)	(0.027)
High School	1.413	0.353	0.012	0.002	-0.085
	(0.042)**	(0.014)**	(0.191)	(0.031)	(0.025)**
Post Secondary	2.480	0.756	1.021	0.204	-0.242
	(0.046)**	(0.012)**	(0.188)**	(0.045)**	(0.025)**
Extended Family	0.062	0.009	-0.038	-0.006	0.008
	(0.025)*	(0.004)*	(0.071)	(0.011)	(0.010)
Constant	-1.202		-1.394		2.835
	(0.087)**		(0.275)**		(0.142)**
Observations	45629	45629	5639	5639	5639
R-squared					0.16

Standard errors in parentheses

**: significant at 1% significance level. *: significant at 5% significance level.

REFERENCES

Barzel, Yoram, (1973), "The Determination of Daily Hours and Wages", Quarterly Journal of Economics, 87(2), pp.220-238

Baslevent, Cem.(2001) Essays on Female Labor Supply in Turkey , Ph.D. Thesis, Department of Economics, Bogazici University.

Baslevent, Cem and Insan Tunali (2005) "Female Labor Supply in Turkey" in S.Altug and A. Filiztekin(Eds). The Turkish Economy: The Real Economy, Corporate Governance and Reform and Stabilization Policy, Routledge Curzon Studies in Middle Eastern Economics

Bertola, G. (1990) "Job Security, Employment and Wages" European Economic Review, June '990, 34(4), pp.851-79"

Blanchard, O.J, and Juan Jimeno (1995) "Structural Unemployment: Spain versus Portugal" American Economic Review, (2) pp.212-18

Blanchard, O.J (2005), "European Unemployment: The Evalution of Facts and Ideas", NBER Working Paper #11750

Bulutay, Tuncer and Enver Tasti (2004) "Informal Sector in the Turkish Labor Market", TEA Discussion Paper #2004/22 (http://www.tek.org.tr/dosyalar/informal_in_turkey.pdf)

Card, David, and Alan B. Krueger. 1994. "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania." American Economic Review. Vol. 84, No. 5 (December), pp. 772-93.

Campolieti, Michele, M.Gunderson, and C.Riddell (2006). "Minimum Wage Impacts from a Prespecified Research Design: Canada 1981-1997." Industrial Relations, Vol. 45, No. 2 (April), pp. 195-216.

Dayioglu, M. (1998), "Labor Market Participation of Women in Turkey" in F. Acar and A. Ayata (eds.), Women's Identities and Roles in the Course of Change: Central Asia, East and Central Europe and Turkey, Duke University Press.

Falzone, Joseph (2000) "Labor market decisions of married women: With emphasis on part-time employment" International Advances in Economic Research, Vol. 6, No. 4 (November) pp.662-671

Goldin, Claudia (1995) "The U-Shaped Female Labor Force Function in Economic Development and Economic History." In T. P. Schultz, ed., Investment in Women's Human Capital and Economic Development. Chicago, IL: University of Chicago Press, pp. 61-90.

Hausman, Jerry A. 1985. "The Econometrics of Nonlinear Budget Sets." Econometrica. 53(6): 1255–1282.

Katz, Lawrence F., and Alan B. Krueger. 1992. "The Effect of the Minimum Wage on the Fast Food Industry." Industrial and Labor Relations Review, Vol. 46, No. 1

(October), pp. 6-21.

Kennan, J.(1998) “Minimum Wage Regulation,” The New Palgrave Dictionary of Economics and the Law

Lemos, Sara, (2009). "Minimum wage effects in a developing country," Labour Economics, Vol. 16(2), pp 224-237.

Mincer(1985) Mincer, Jacob. (1985). “Inter-Country Comparisons of Labor-Force Trends and Related Developments: An Overview,” In Jacob Mincer and Richard Layard (eds.), Trends in Womens Labor Force. Journal of Labor Economics (Special Volume) 3(1), part 2.

Moffitt, R. (1982) “The Tobit Model, Hours of Work and Institutional Constraints”, Review of Economics and Statistics, Vol.64 No.3, pp.510-15.

Moffitt, R. (1984) "The Estimation of a Joint Wage-Hours Labor Supply Model" Journal of Labor Economics Vol. 2, No. 4, pp. 550-566

Neumark, David and Wascher, William (January 2007) "Minimum Wages and Employment" IZA Discussion Paper No. 2570. Available at SSRN: http://ssrn.com/abstract=961374

OECD 2000 Country Report, available at OECD Webpage (www.oecd.org)

OECD 1999 Employment Outlook, available at OECD
Webpage (www.oecd.org/dataoecd/9/46/2079974.pdf)

Oi, Walter Y.(1962) "Labor as a Quasi-Fixed Factor," Journal of Political Economy, University of Chicago Press, vol. 70, pages 538.

Ozturk, Orgul D.(2008) "Minimum Wages, Market Inflexibilities, and Female Employment in Select OECD Countries". Available at SSRN: http://ssrn.com/abstract=1238203

Ozar, Ş.(1996), “The Employment Aspects of the Informal Sector” in Tuncer Bulutay (ed.), Informal Sector (II), pp.175-203. Ankara: State Institute of Statistics

Pencavel, J.(1986) “Labor Supply of Men: A Survey,” in O.Ashenfelter and R. Layard (eds.), Handbook of Labor Economics, Vol. 1. North Holland.

Rebitzer, J. and L.Taylor (1995), "The Consequences of Minimum Wage Laws: Some New Theoretical Ideas", Journal of Public Economics, February, pp.245-255

Schultz, T. P. (1990) “Women’s Changing Participation in the Labor Force: A World Perspective”, Economic Development and Cultural Change, 38 (3), pp. 719-42.

Shorter, Fred (1995), “The Crisis of Population Knowledge in Turkey.” New Perspectives on Turkey, no.12 (Spring), pp.1-31.

SIS (State Institute of Statistics) Webpage, HLFS Database

Stigler, G.(1946) The economics of minimum wage legislation. American Economic Review 36: 358-365.

Train, Kenneth (2003), Discrete Choice Methods with Simulation, Cambridge University Press: Cambridge

Tunali, Insan (1997) “To Work or Not to Work: An Examination of Female Labor Force Participation Rates in Urban Turkey” Proceedings of the 4th Annual ERF Conference held in Beirut

TISK Yayinlari Newsletters, www.tisk.org.tr

World Bank(2006) "Turkey Labor Market Study" http://siteresources.worldbank.org/INTTURKEY/Resources/3616 16-1144320150009/Labor_study.pdf