

Why a fixed workweek? *

Antonia Díaz[†]
Universidad Carlos III

Cristina Echevarria
University of Saskatchewan

February 2007

Abstract

The main goal of this article is to explain why the fixed workweek appeared. To this purpose we differentiate between “jobs” and “hours per job”. We consider an economy where hours and number of workers are substitutes in production but in which hiring a worker entails a fixed cost plus a variable cost per hour worked. This fixed cost implies that, for firms, it is not equivalent to hire a worker for eight hours or eight workers for an hour. Therefore, firms would like workers to work as many hours as physically possible. In an unregulated economy, workers work more hours than they would like to at the on-going wage rate. This situation characterizes the economy of today’s industrialized countries in the XIXth century.

Keywords: labor supply, workweek length, employment, unions Muchas.

JEL Classification: E24, J22, K31

*We thank Peter Dooley for the historical references. Echevarria thanks Juan Urrutia who once in the middle of a discussion on the topic in class, when she was an undergraduate and he her professor, told her that she needed to learn to formalize her arguments: she did. Díaz thanks the Dirección General de Investigación, project SEJ2004-00968, for financial support.

[†]Corresponding author: Antonia Díaz, Department of Economics. Universidad Carlos III de Madrid, Calle Madrid, 126, Getafe 28903 Madrid, Spain. E-mail: andiaz@eco.uc3m.es. Ph: +34-91-624-5733.

1 Introduction

The main purpose of this article is to explain why the fixed workweek appeared and it is a feature of almost all industrialized countries. In order to do so, we consider an economy where hours and number of workers are substitutes in production but in which hiring a worker entails a fixed cost plus a variable cost per hour worked. This fixed cost implies that the total cost of hiring a worker for eight hours is not the same as that of hiring eight workers for an hour. Therefore, firms would like workers to work as many hours as physically possible. We show that in an unregulated economy without unemployment insurance, workers work more hours that they would like to at the on-going wage rate. This is so because the hourly wage determines not only the number of hours demanded per body but also the number of bodies demanded, given the workweek. Thus, the hourly wage that guarantees employment to all workers is not necessarily the same that makes number of hours demanded per person equal to number of hours supplied per person.

According to the historical evidence that we have, this result resembles closely the economy of today's industrialized countries in the XIXth century. Because the workers could not fight this situation in an individual fashion, with which they were very dissatisfied, they organized themselves against the long working hours to institute a fixed workweek. In the words of Marx: "The establishment of a norm for the working day presents itself as a struggle over the limits of that day, a struggle between collective capital, i.e. the class of capitalists, and collective labor, i.e., the working class" (p. 344) It was this struggle which, allegedly, gave birth to the labor movement. Its first important battle was against the long workweek and its first victory was to institute a fixed workweek. Consistently with historical evidence, restricting the workweek in our framework leads to higher workers' welfare although it reduces output. Thus, we give a rational for the surge of unions along the XIXth century in currently industrialized countries.

Next we introduce unemployment insurance to study the effect of a reduction in the length of the workweek on the level of employment and output. As in Fitzgerald (1998), Marimón and Zilibotti (2000), Osuna and Ríos-Rull (2003), or Ortega (2003) employment increases if costs associated to creating jobs are not large. Nevertheless in our framework the effect on output is ambiguous, depending on the fixed costs associated to create new jobs.

The rest of the paper is organized as follows: section 2 summarizes some evidence on the historical evolution of labor market institutions in the XIXth and XXth centuries. Section 3 describe the basic framework that we are going to use. In section 4 first, we study the effects of

regulating the length of the workweek in an economy without any previous labor market regulation and, secondly, we turn to study the effect of further reducing the workweek in an economy with a fix workweek and unemployment insurance. Section 5 concludes.

2 Labor relations and fixed workweek

In this section we describe the historical evidence that we have about labor relations and regulation of the workweek.

2.1 Length of the workweek

In pre-industrial times, non-enslaved people in today's industrialized countries generally worked fewer hours per year than they do today, though on a less regular cycle since agriculture demands a variable amount of effort over the course of the year. The industrial revolution made it easier to find work year-round, since labor was not tied to the season, and artificial lighting made work possible for the greater part of the day. Thus, technological advances during early capitalism made it possible to extract upwards of seventy hours per week of working time from a person.¹ Before collective bargaining and worker protection laws, "eighteenth- and nineteenth-century Europe and America (...) witnessed what were probably the longest and more arduous work schedules in the history of humankind", see Schor (1991), p. 6. Records indicate that work schedules as arduous as sixteen hours per day were demanded of wage earners, including children (Brown 1982, p. 66, Marx 1867, p. 356).

The workweek, in most of the industrialized world, dropped steadily, to about forty hours after World War II. In the United States, in the early 1830s the average workweek was 69 hours. At the end of the century was about 59 hours per week (see Table 1). The cause was a decline in daily hours: from 11 hours and 20 minutes in 1832 to just over ten hours in 1880 (see Margo 1998). However, as Brown (1982) argues, the decline of working time since mid-nineteenth century is not a consequence of the market system; on the contrary, it happened because workers joined forces against the market forces since, in an individual fashion, the market determined a long work schedule. Brown (1982) reports (p. 165): "The legislation of the early 1879, like the earlier repeal of the Combination Acts, created a climate conducive to union growth. The spread of unionization,

¹As Schor (1991), a sociologist, states it: "Once capital is invested, its owner has strong financial incentives to see that it is used as intensively as possible" (Schor 1991, p. 59).

especially among previously unorganized groups of workers, was encouraged mainly by the boom conditions which characterized the first half of the decade. (...) The immediate spur seems to have been the long and successful strike conducted in 1871 by north-eastern engineers to secure a nine-hour day. It triggered off an astonishing response.” Thus, Brown (1982) ties the struggle for a shorter day to the spread of unionization and, later on (p. 173), he remarks on the emphasis the trade unions placed on state intervention in regulating work schedules.

2.2 Unions and government regulation in the XIXth century in the United States

According to Margo (1998, p. 231), “In explaining the decline in weekly hours, historians have traditionally emphasized the twin roles of organized labor and the State. According to this view, employers steadfastly resisted a decline in the weekly hours and they could only be convinced by strike or government edict. The union push for shorter hours essentially began in the late 1820s and early 1830s as workers in Philadelphia, Boston and New York clamored for a 10 hour day ... leading to the passage of the first ‘maximum hours’ laws in New Hampshire (1847) and Pennsylvania (1849)”.

President van Buren established a ten hour day for manual labor in 1840. After the American Civil War the vindication of the organized labor changed from the ten hour to the eight hour day. “Strikes for shorter hours became more common, reaching a peak in the mid-1880s.” (Atack, Bateman, and Margo 2003). In fact, as Alesina and Glaeser (2004, p. 124) remind us, “the international workers’ holiday of May 1 commemorates the Chicago Haymarket riot of 1886”. Margo (1998) continues (p. 235): “the first recognizable attempt at a labor movement in the United States occurred in the 1820s”. It took the form of union organizing and great frequency of strikes. It embraced causes such as shorter hours, higher wages, and better working conditions. According to Margo, (1998, p. 236), “despite their limited penetration into the labor force, antebellum labor organizations were far from total failures. Many strikes did raise wages, forestall wage cuts, reduce hours, and improve working conditions”.

Unemployment starts being a problem in the States in the late XIXth century. Since there was no unemployment insurance, workers would rely on savings, odd jobs, the earnings of other family members, relatives, friends, churches, and unions. According to Margo (1998), “in occupations or locations in which unemployment was predictable, wages were higher: unemployment risk com-

manded a wage premium” (p. 242). However, the causality might have been the other way around. What seems relevant is that there was a correlation between unemployment and higher wages.

Summarizing, a stylized chronological sequence of the labor movement in the United States is as follows: labor gets organized pushing for shorter hours at the beginning of the XIXth century. Although formal unionization was never large, unions were successful at organizing labor. By the end of the century unemployment is a fact, probably brought up by higher wages. The unemployed would survive by using their social network, including unions. “The earliest known (trade union) plan was established in 1831... practically all trade unions gave assistance to their unemployed members and many unemployment benefit relief plans sprang up” (Blaustein 1993, p. 108). There were also joint agreement plans between unions and management and some company plans started in 1917, almost at the same time that the first attempts to enact state unemployment insurance. “As the depression of the 1930s deepened, an increasing number of progressive reformers and representatives sensitive to workers interests were elected to governorships and state legislatures.” (Blaustein 1993, p. 107). These voluntary schemes plus the labor movement push through the above mentioned representatives lead to the passage of the Social Security Act in 1935.

3 The environment

Here we describe the environment that will be used in the three economies considered, which will differ in the labor institutions in place.

There are N workers and m entrepreneurs. We take both numbers as exogenously given.²

Workers have preferences on consumption and leisure. We assume that their preferences are represented by the utility function

$$u(c, l) = \frac{c^\rho}{\rho} + \gamma \frac{l^\rho}{\rho}, \quad (3.1)$$

where $\rho \in (0, 1)$. Workers have a maximum amount of available time equal to \bar{h} . Therefore, $0 \leq l \leq \bar{h}$. Thus, hours worked are $h = \bar{h} - l$. We are going to denote as w the compensation (wages plus benefits) per hour worked h . Hereafter we are going to call w wages.

Each entrepreneur has available a technology to produce the consumption good that uses only

²Assuming away capital and taking the number of entrepreneurs as given are two assumptions that go hand in hand if we think of an entrepreneur as being somebody with enough savings (rather than somebody with special skills).

labor. According to this technology, output equals

$$a(n) (nh)^\theta, \quad \theta \in (0, 1), \quad (3.2)$$

where h is hours per worker and n is the number of workers. The factor $a(n)$ is a productivity factor. Thus, we take the stance that productivity at the workplace augments with the size of the workforce. This factor also captures the impact of capital, assumed away.³ For simplicity of exposition we assume that $a(n) = a n^\alpha$, where $\alpha \in (0, 1)$, $\theta \in (0, 1)$ and $\alpha + 2\theta \leq 1$.

Production entails two types of costs. The first one is the cost per hour worked by employee and it corresponds to wages paid, whn . The other type of cost does not vary with hours worked and only depends on the number of employees, $t(n)$. We are going to call this type of cost personnel cost. Since our model is just a one-period model, it encompasses the annual cost of training plus the cost of recruiting and hiring and other fixed costs that need to be incurred every production period.⁴ Finally, for simplicity we assume that personnel costs are linear, $t(n) = tn$.

It will be useful to compare our technology with that assumed in the literature within the neoclassical framework. Notice that our technology can be rewritten as

$$a n^{\alpha+\theta} h^\theta, \quad \theta \in (0, 1), \quad \alpha \in (0, 1), \quad \alpha + 2\theta \leq 1. \quad (3.3)$$

Fitzgerald (1998) and Osuna and Ríos-Rull (2003) used a technology very close to Hornstein and Prescott (1993) and assume that a firm (actually, a plant in their theory) produces final output with the technology

$$y = h^\xi k^{1-\phi} n^\phi, \quad \phi \in (0, 1). \quad (3.4)$$

In this setup, n is the number of workers and k is the stock of capital. That is, $k^{1-\phi} n^\phi$ is the production per hour and h is the number of hours the plant is operated. If we take the stock of capital as given, and call it $a = k^{1-\phi}$ the technology becomes $y = ah^\xi n^\phi$, which is equivalent to ours, shown in (3.3). Hornstein and Prescott (1993) and Fitzgerald (1998) assume that $\xi = 1$. This is the case called “team production” in the literature—production per hour worked does not change with the length of the workweek. Osuna and Ríos-Rull (2003) calibrate their economy so that $\xi < 1$,

³Behind this assumption we have in mind a question of timing: the investment decision is taken prior to the hiring decision; thus, in a one-period model, labor is the only variable factor of production. We could also think that there are human capital externalities so that productivity increases with the number of workers.

⁴That would be the total cost prorated among the years in which the benefits of training accrue.

rationalized as “fatigue”, and assume $\xi + \phi > 1$. That is, in either case, there are increasing returns to scale in hours and bodies. On the contrary, we assume that there are decreasing returns to scale, $\xi + \phi < 1$; that is, there is “severe fatigue”. Although both frameworks may seem equivalent, they are conceptually different. In the Hornstein and Prescott’s framework, productivity at the plant depends on the workweek, whereas in our framework it depends on the number of workers. This is why in the Hornstein and Prescott’s framework it is assumed that $\xi > \phi$, whereas we assume that $\xi < \phi$. The issue is, then, quantitative: since there are no reliable estimates for ξ and ϕ separately, we do not have a way of discriminating between both theories of production.

4 Labor market institutions, employment, and workweek length

In this section we present three model economies which differ in the labor market institutions in place. In the first one, called the *laissez-faire* economy, there is no regulation about the workweek length—the number of hours worked per worker—nor there is any unemployment insurance mechanism. In the second one the length of the workweek is fixed but there is no unemployment insurance mechanism. In the third one, which is meant to resemble the current situation, the length of the workweek is fixed and there is unemployment insurance. We will compare the resulting equilibria in the two first economies to give a rationale to the regulation of the workweek length. Secondly, we will use the third economy to study the effects of changing the length of the workweek on the level of employment.

4.1 The *laissez-faire* economy

This economy is meant to capture two main features of the situation during the XIXth century: there was no regulation of the workweek, no unemployment insurance and workers were not organized in labor unions.

Entrepreneur’s and worker’s problem

Entrepreneurs choose the number of workers n and the number of hours per worker h that maximize profits

$$a n^{\alpha+\theta} h^\theta - w h n - t n, \tag{4.1}$$

Notice that we assume that entrepreneurs are aware of the productivity effect of increasing the number of their employees. The solution to this problem is given by the demand functions

$$n^d(w) = a^{\frac{1}{1-\alpha-\theta}} \left(\frac{\alpha}{t}\right)^{\frac{1-\theta}{1-\alpha-\theta}} \left(\frac{\theta}{w}\right)^{\frac{\theta}{1-\alpha-\theta}}, \quad (4.2)$$

and

$$h^d(w) = \frac{\theta t}{\alpha w}. \quad (4.3)$$

On their turn, workers solve the problem

$$\begin{aligned} \max_{c, h} \quad & \frac{c^\rho}{\rho} + \gamma \frac{(\bar{h}-h)^\rho}{\rho} \\ \text{s.t.} \quad & c \leq w h. \end{aligned} \quad (4.4)$$

As a result, the individual labor supply is

$$h^s(w) = \frac{\gamma^{\frac{1}{\rho-1}} \bar{h}}{w^{\frac{\rho}{\rho-1}} + \gamma^{\frac{1}{\rho-1}}}. \quad (4.5)$$

Notice that, since there is no unemployment insurance, workers always want to work and labor supply is an increasing function of the wage, $h^s \xrightarrow{w \rightarrow \infty} \bar{h}$, given the assumption $\rho \in (0, 1)$.

Equilibrium

Here we state some properties of the equilibrium allocation. Notice that there are two markets, the market for hours and the market for bodies, and only one price to clear them both. That is, there is a market incompleteness. This is the key of our results shown in Propositions 1 and 2.

Proposition 1. *In equilibrium, the wage is such that $n^d(w) m = N$.*

Proof. Let us denote as w_{lf} the wage at which the aggregate demand for bodies equals aggregate supply, $n^d(w) m = N$. The market wage cannot be below w_{lf} because in that case entrepreneurs would be rationed and they would have incentives to offer a higher wage. Let us think of the case $w > w_{lf}$. In this case, the demand would be lower than the number of workers willing to work (remember that they always want to work). Thus, unemployed workers would have incentives to supply hours at a lower wage. Hence, in equilibrium $w = w_{lf}$. \square

Thus, the wage that clears the market for bodies is

$$w_{lf} = a^{1/\theta} \left(\frac{\alpha}{t}\right)^{\frac{1-\theta}{\theta}} \theta \left(\frac{m}{N}\right)^{\frac{1-\alpha-\theta}{\theta}}. \quad (4.6)$$

Clearly, this wage is lower the larger the number of workers relative to the number of entrepreneurs. The following proposition establishes the number of hours worked in equilibrium.

Proposition 2. *Let $h_{lf} = h^d(w_{lf})$ be the number of hours demanded at the wage w_{lf} and $h^s(w_{lf})$ be the number of hours that maximizes worker's utility at that wage. If $h_{lf} \leq h^s(w_{lf})$, the equilibrium number of hours worked per worker is h_{lf} . If $h_{lf} > h^s(w_{lf})$ then $h = \min\{h_{lf}, \bar{h}\}$.*

Proof. The first part of the proposition says that, given the wage w_{lf} , hours worked in equilibrium cannot be higher than hours demanded at that wage. The second part says that hours worked cannot be lower than hours demanded. This is so because, if $h_{lf} > h^s(w_{lf})$ and hours worked in equilibrium were equal to $h^s(w_{lf})$, competition among entrepreneurs would drive the wage above w_{lf} . In that case, not all workers would be employed, which would drive the wage down again. \square

We are going to concentrate our attention on the equilibrium in which workers work more hours than desired. In this type of equilibrium, the larger the labor force relative to the number of entrepreneurs, N/m , the longer the workweek of workers. For historical reasons, we can think of the XIXth century as characterized by such a large ratio—a large labor force. The equilibrium would explain the struggles of the XIXth century labor force for shorter workweeks (see Marimón and Zilibotti 2000) as arising from a situation in which workers feel compelled to work too many hours, given the wage rate. Notice also that we obtain this result without imposing any kind of monopolistic practices in the labor market.

In this type of equilibrium we obtain hours worked substituting w_{lf} in (4.3),

$$h_{lf} = \left(\frac{1}{a}\right)^{1/\theta} \left(\frac{t}{\alpha}\right)^{\frac{1}{\theta}} \left(\frac{N}{m}\right)^{\frac{1-\alpha-\theta}{\theta}}. \quad (4.7)$$

Notice that the amount of hours worked increases with personnel costs. This is so because the larger t the less substitutable are bodies and hours.

Final output in this economy is gross output minus personnel costs,

$$Y_{lf} = m a \left(\frac{N}{m}\right)^{\alpha+\theta} \left(h^{lf}\right)^\theta - t N = \frac{1-\alpha}{\alpha} t N. \quad (4.8)$$

The total wage bill, $w_{lf} h_{lf} N$, is the fraction $\theta/(1 - \alpha)$ of final output and aggregate profits are the fraction $(1 - \alpha - \theta)/(1 - \alpha)$.⁵

One may argue that this type of equilibrium, one in which hours demanded are higher than hours that maximize workers' utility, is very rare. This objection has a quantitative nature. Thus we have conducted a quantitative exercise where we have calibrated our model economy along the following lines: $\theta/(1 - \alpha)$ equals $2/3$, since that is a typical value for the share of labor in GDP. The value of ρ is set equal to 0.5 , the elasticity of utility with respect to utility is $\gamma = 0.75$ and the total available time \bar{h} is normalized to one. We assume that entrepreneurs comprise 15 percent of the total population; that is, $m = 0.15$ whereas $N = 1 - m$. Figure 1 shows hours demanded and the number of hours that maximize workers utility (labeled as supply) given that the market of bodies has cleared. That is, assuming that the wage is given by expression (4.6). Notice that if personnel costs are sufficiently large hours demanded are higher than the amount that maximizes workers' utility. Thus, we think that is not unreasonable to focus on this type of equilibria.

4.2 The regulated economy

In this section we want to present a model economy which is meant to reproduce the point in history when workers have already achieved their vindications of a shorter workweek. This is captured by the following assumption:

Assumption 1. *Workers work more hours than desired in the laissez-faire economy, $h_{lf} > h^s(w_{lf})$.*

Another way of stating this assumption is that, in the laissez-faire economy, the marginal rate of substitution of consumption for leisure is greater than the wage in equilibrium,

$$\gamma \frac{(\bar{h} - h_{lf})^{\rho-1}}{(w_{lf} h_{lf})^{\rho-1}} > w_{lf}. \quad (4.9)$$

Assumption 2. *The length of the workweek is lower than in the laissez-faire economy, $h_r < h_{lf}$.*

Equilibrium

Entrepreneurs choose the number of workers that maximize profits given the number of hours

⁵Remember that profits in this context are returns to capital in actuality.

per worker, h_r . The solution to this problem is the inverse demand function for workers,

$$w^d(n, h_r) = (\alpha + \theta) a n^{\alpha+\theta-1} h_r^{\theta-1} - t h_r^{-1}. \quad (4.10)$$

The problem of workers is trivial: they must work at the market wage. Hence, the wage must clear the market for bodies,

$$w_r(h_r) = w^d\left(\frac{N}{m}, h_r\right), \quad (4.11)$$

where we see that the wage increases with length of the workweek, h_r , if and only if

$$t > (1 - \theta)(\alpha + \theta) a \left(\frac{N}{m}\right)^{\alpha+\theta-1} h_r^\theta. \quad (4.12)$$

In other words, if personnel costs are important, an increase in the length of the workweek increases the wage per worker and hour worked because a longer workweek allows entrepreneurs to better recoup the personnel spending on each individual worker. On the other hand, if personnel costs are not large, a longer workweek means that entrepreneurs can easily substitute people by hours per worker to obtain a total number of hours; in such a case, a longer workweek decreases the wage.

Comparison of both economies

Under assumptions 1 and 2, the laissez-faire economy and the regulated economy only differ in the length of the workweek. Therefore, final output,

$$Y_r(h_r) = m^{1-\alpha-\theta} a N^{\alpha+\theta} h_r^\theta - t N, \quad (4.13)$$

is lower than in the laissez faire economy. This is also true for aggregate profits and the wage bill, $w_r h_r N$. Nevertheless, the factor distribution of income is different in both economies. Specifically, the share of aggregate profits in net output is lower than $(1 - \alpha - \theta) / (1 - \alpha)$, the profit share in the laissez faire economy, and it is increasing in the length of the workweek for any $h_r \leq h_{lf}$. Conversely, the labor share is higher in the regulated economy and decreases with the length of the workweek.

The reduction in the absolute level of the wage bill implies that consumption per worker is smaller in the regulated economy. However, since the previous leisure/consumption allocation was not optimal on the workers' eyes, that does not mean that workers' are worse off in this case. To see

under which conditions workers are better off with a shorter workweek, we differentiate their utility with respect to hours worked. For them to be better off with a shorter workweek the following condition,

$$\frac{du(w_r(h)h, \bar{h} - h)}{dh} = \frac{\partial u(w_r(h)h, \bar{h} - h)}{\partial c} \left(\frac{dw_r(h)}{dh} h + w_r(h) \right) - \frac{\partial u(w_r(h)h, \bar{h} - h)}{\partial l} < 0, \quad (4.14)$$

is needed. In other words, the marginal rate of substitution of consumption for leisure, *MRS*, must be larger than the variation in consumption due to a change in the length of the workweek,

$$\frac{dw_r(h)}{dh} h + w_r(h) < MRS. \quad (4.15)$$

The marginal rate of substitution is greater than the wage when workers are working more hours than desired at the going wage rate, as in the laissez faire economy (remember assumption 1). Thus, a sufficient condition for inequality (4.15) to be met is that $dw_r(h)/dh$ is negative. This is the case whenever personnel costs are not too high (inequality 4.12 is reversed),

$$t \leq (1 - \theta)(\alpha + \theta) a \left(\frac{N}{m} \right)^{\alpha + \theta - 1} h_r^\theta, \quad (4.16)$$

which can be rewritten as

$$h_r \geq \left(\frac{\alpha}{(1 - \theta)(\alpha + \theta)} \right)^{\frac{1}{\theta}} a^{\frac{-1}{\theta}} \left(\frac{m}{N} \right)^{1 - \alpha - \theta} \left(\frac{t}{\alpha} \right)^{\frac{1}{\theta}}. \quad (4.17)$$

where the right hand side of this inequality is the fraction $(\alpha/(1 - \theta)(\alpha + \theta))^{\frac{1}{\theta}}$ of the workweek in the laissez-faire economy. That is, we can ensure that workers are better off in the regulated economy if the workweek is lower than the laissez-faire workweek but not too much. Nevertheless, even if personnel costs are high, so that condition (4.12) holds, workers would be better off with a shorter workweek as long as condition (4.15) is satisfied. The only difference is that the wage would fall after a reduction of the workweek, instead of rising.

This result is very similar to that found by Marimón and Zilibotti (2000). In a neighborhood of the laissez-faire equilibrium reducing working time increases workers' welfare although it decreases output. Nevertheless, our laissez-faire economy is very different from theirs. In their case, workers have finite marginal utility of consumption when the wage is zero. That is, implicitly there is unemployment insurance whereas in our case there is not. This difference leads to different results. In our laissez-faire economy each worker is working more hours than desired regardless other workers'

workweek. In Marimón and Zilibotti (2000) all workers are better off in the regulated economy but, individually, would like to deviate from the collusive agreement and work longer hours. Thus, our setup suggests that collective action surged as a response to individual dissatisfaction with the length of the workweek.

4.3 The economy with insurance contracts

To say something meaningful about the effect of the length of the workweek on employment we need a variation of the model in which unemployment exists. We assume in this section the existence of a labor movement; i.e., that workers act in a coordinated fashion, as a union.

As we saw in section 2, workers do not need to be formally unionized to act in a coordinated fashion. As Blanchard and Summers (1986) argue, the union model can be interpreted as describing the behavior of workers when they act as a group, even if they are not formally unionized. The usual union models propose unions demanding wages above equilibrium, knowing that this will generate unemployment and, therefore, establishing an unemployment insurance fund.⁶ In this model we change the control variable of the union with similar results: the union restricts the offer of labor to keep wages higher and institutes an employment insurance fund to this effect: they open an insurance market where π denotes the probability of working. The problem faced by entrepreneurs does not change. Since the wage rate is determined by the clearing market condition in the market for bodies, by effectively restricting the amount of workers offering their services, the union can push wages up. The union decides which proportion of the labor force will work (by the law of large numbers, this is the individual probability of being employed) to maximize workers' expected utility given the labor market structure. To this purpose, it establishes an insurance employment fund. Workers are then randomly assigned to jobs.

Equilibrium

The union's problem is

$$\begin{aligned} \max_{c, \pi} \quad & \frac{c^\rho}{\rho} + \pi \gamma \frac{(\bar{h} - h_r)^\rho}{\rho} + (1 - \pi) \gamma \frac{\bar{h}^\rho}{\rho} \\ \text{s.t.} \quad & c \leq w h_r \pi, \end{aligned} \tag{4.18}$$

⁶As described in section 2, unemployment insurance was not originally provided by the state but by unions and other workers' or workers' oriented groups. Later on, the labor movement induced the state to introduce an unemployment insurance scheme.

where π is the probability of working. The solution of this problem is the inverse supply function

$$w^s(\pi, h_r) = \left(\frac{\gamma}{\rho}\right)^{\frac{1}{\rho}} h_r^{-1} \left[\bar{h}^\rho - (\bar{h} - h_r)^\rho\right]^{\frac{1}{\rho}} \pi^{\frac{1-\rho}{\rho}}. \quad (4.19)$$

Since the firm's problem is exactly the same that in the regulated economy, the inverse labor demand function is shown in expression (4.10). Using the law of large numbers, the fraction of workers that actually work in equilibrium is $\pi_{ru}(h_r)$, and it equates

$$w^s(\pi_{ru}(h_r), h_r) = w^d\left(\frac{\pi_{ru}(h_r) N}{m}, h_r\right). \quad (4.20)$$

Notice that, given the length of the workweek, creating an unemployment insurance scheme implies that employment is reduced, $\pi_{ru}(h_r) \leq 1$ and workers' welfare is higher than in the regulated economy. Net output is

$$Y_{ru}(h_r) = m^{1-\alpha-\theta} a (\pi_{ru}(h_r) N)^{\alpha+\theta} h_r^\theta - t \pi_{ru}(h_r) N. \quad (4.21)$$

It is easy to check that net output falls and that the share of profits decrease, too, with respect to the equilibrium in the regulated economy.

The effect of shortening the length of the workweek

To analyze the effect of shortening the workweek on employment we only need to differentiate expression (4.20) in both sides with respect to h_r . We obtain

$$\frac{d\pi_{ru}}{dh_r} = \frac{\frac{\partial w^d}{\partial h_r} - \frac{\partial w^s}{\partial h_r}}{\frac{\partial w^s}{\partial \pi} - \frac{\partial w^d}{\partial \pi}}. \quad (4.22)$$

The denominator of his expression is positive since $\partial w^s/\partial \pi$ is positive and $\partial w^d/\partial \pi$ is negative. Likewise, $\partial w^s/\partial h_r$ is positive. Thus if $\partial w^d/\partial h_r$ is negative we find that employment increases after shortening the workweek. This is exactly the case whenever

$$t \leq (1 - \theta)(\alpha + \theta) a \left(\frac{\pi_{ru}(h_r) N}{m}\right)^{\alpha+\theta-1} h_r^\theta. \quad (4.23)$$

That is, whenever personnel costs are low, employment increases after shortening the workweek. Even in the case in which inequality (4.23) is reversed, it could be the case that employment increases after shortening the workweek, as long as $\partial w^d/\partial h_r - \partial w^s/\partial h_r$ is negative.

Thus, for low and moderate personnel costs, a reduction in the workweek implies an increase in employment. This is so because lower personnel costs induce a higher degree of substitutability between bodies and hours. The implication of this result is that the impact of shortening the length of the workweek may vary across industries depending on the fixed costs associated to employing a worker. For instance, in industries where building specific human capital is important personnel costs might be high. In those industries a reduction of the workweek may reduce employment. The reverse would be true in industries where specific human capital is not important.

The effect of decreasing the workweek on net output is ambiguous. The derivative of net output with respect to the workweek can be written as

$$\frac{dY_{ru}}{dh_r} = \theta m^{1-\alpha-\theta} a (\pi_{ru}(h_r) N)^{\alpha+\theta} h_r^{\theta-1} + \frac{d\pi_{ru}}{dh_r} w^d \left(\frac{\pi_{ru}(h_r) N}{m}, h_r \right) h_r N. \quad (4.24)$$

If employment falls, $d\pi_{ru}/dh_r > 0$, which may happen if personnel costs are sufficiently high), net output decreases. However, it also may fall even if employment increases, due to the fall in the production per worker.

Our results are line with the results found, for instance, by Fitzgerald (1998), Marimón and Zilibotti (2000), Osuna and Ríos-Rull (2003), or Ortega (2003), who find that a shortening of the workweek length may augment employment but reduces output. The main difference with Fitzgerald (1998) and Osuna and Ríos-Rull (2003) (aside from the fact that theirs are dynamic model economies) is that they assume that working entails commuting costs for workers, which play similar role to our personnel costs, whereas we assume that personnel costs are borne by entrepreneurs. Our personnel costs are similar to the fixed cost of creating vacancies assumed by Marimón and Zilibotti (2000) and Ortega (2003) in their economy with search-matching frictions.

5 Final comments

This paper gives a rational to the regulated workweek that prevails in most industrialized countries. Here we propose that such a measure was intended to rise workers' welfare since workers, in an unregulated economy, work more hours than desired. The reason for this outcome in a competitive economy is that there is only one price, the wage, and two markets, the market for bodies and the market for hours. As we have seen, the number of hours is determined by the firms. The workers' only choice is whether to work or not. Without any unemployment insurance or safety net, all

workers supply the required hours in the market. Thus, a suitable reduction in the workweek increases workers' welfare although it decreases output, aggregate profits and the total wage bill. It is interesting to note that the labor share increases with the reduction of the workweek length and also the wage if personnel costs are not too high.

The result of this paper is consistent with the historical evidence that we have and legitimizes the arguments of the labor movement in industrialized countries. One could ask why the first goal of unions was to regulate the workweek instead of the creation of an unemployment insurance scheme (this was the observed timing, according to the historical evidence we have, see section 2). In order to answer this question we present in the Appendix an alternative economy where the workweek is unregulated and there is unemployment insurance. We can see there that, even in that case, because of competition among firms to hire workers, the workweek is set by the firms whereas workers get to set the wage (alternatively, the probability of working, which amounts to the employment rate). Thus, the key issue is that in an unregulated economy firms set the work schedule, which may or may not be the schedule preferred by workers.⁷ Thus, it seems reasonable that workers organized first to fight for a regulated (and shorter) workweek and, later on, created the first private unemployment insurance systems.

Given the existence of a fixed workweek, the existence of unemployment, propitiated by the existence of unemployment insurance, decreases total output and the share of profits. Once we accept the existence of unemployment, and personnel costs are not very high a reduction in the workweek implies lower unemployment although the effect on output and profits is ambiguous.

Defining, as we did, an entrepreneur as somebody with enough saving, the number of entrepreneurs is given in a one-period model; in a dynamic model, however, it is a state variable. Since, as explained in 4, the likelihood of workers working more hours than they desire in an unregulated equilibrium depends on the wage rate, which in turn depends on the amount of capital and the level of technology, the need for regulation may weaken with economic prosperity. A dynamic model, our next step, should produce rich across-time and across-country comparisons to this respect as well as allow us to differentiate between two types of costs: the first, an initial cost of training people—a large cost (one and a half years of wages on average, according to some business literature) whose benefits extend over more than one period of time; the second, an on-going personnel cost per worker—a cost not so large but that needs to be incurred on every period of time the worker is employed.

⁷This is also the result found by Fitzgerald (1996) and Fitzgerald (1998), who analyzes an economy where firms offer bundles of wages and hours and there is an unemployment insurance.

We will also like to investigate the mechanism by which the labor movement convinces the state to introduce a fixed workweek.

A A benchmark economy

We can think of this economy as an economy in which there is no regulation about the length of the workweek but there exists employment insurance. The problem faced by entrepreneurs does not change is the same than in the laissez faire economy.

Workers open an insurance market where π denotes the probability of working. The union's problem is

$$\begin{aligned} \max_{c, \pi, h} \quad & \frac{c^\rho}{\rho} + \pi \gamma \frac{(\bar{h} - h)^\rho}{\rho} + (1 - \pi) \gamma \frac{\bar{h}^\rho}{\rho} \\ \text{s.t.} \quad & c \leq w h \pi, \end{aligned} \tag{A.1}$$

where π is the probability of working. The solution of this problem is the inverse supply function for the probability of working

$$w^s(\pi, h) = \left(\frac{\gamma}{\rho} \right)^{\frac{1}{\rho}} h^{-1} \left[\bar{h}^\rho - (\bar{h} - h)^\rho \right]^{\frac{1}{\rho}} \pi^{\frac{1-\rho}{\rho}}. \tag{A.2}$$

and the supply of hours

$$h^s(w, \pi) = \frac{(\pi \gamma)^{\frac{1}{\rho-1}} \bar{h}}{(\pi w)^{\frac{\rho}{\rho-1}} + (\pi \gamma)^{\frac{1}{\rho-1}}}. \tag{A.3}$$

Proposition 1. *Let us denote as w^* the wage in equilibrium and π^* , the probability of working in equilibrium. Thus, in equilibrium, hours worked, $h^* = h^d(w^*)$, are equal to hours demanded at the wage w^* .*

Proof. Suppose that h^* , is higher than the number of hours demanded at the wage w^* . For entrepreneurs to employ more hours, the wage would have to fall; thus, w^* would not be the equilibrium wage. On the other hand, suppose that h^* is lower than hours demanded. Because of competition among entrepreneurs, the wage would have to rise. \square

The probability of working in equilibrium is given by the inverse of (A.2). That is, all firms will set the same work schedule and will choose the one that gives them higher profits. The union sets the wage or, alternatively, the employment rate, $1 - \pi$.

Table 1: Annual hours over eight centuries

Year	Type of worker	Country	Annual hours
13th century	Adult male peasant	U.K.	1620
14th century	Casual laborer	U.K.	1440
Middle ages	English worker	U.K.	2309
1400-1600	farmer-miner (male)	U.K.	1980
1840	Average worker	U.K.	3105-3588
1850	Average worker	U.S.	3150-3650
1987	Average worker	U.S.	1949
1988	Manufacturing workers	U.K.	1856

Source: Schor (1991), p. 45

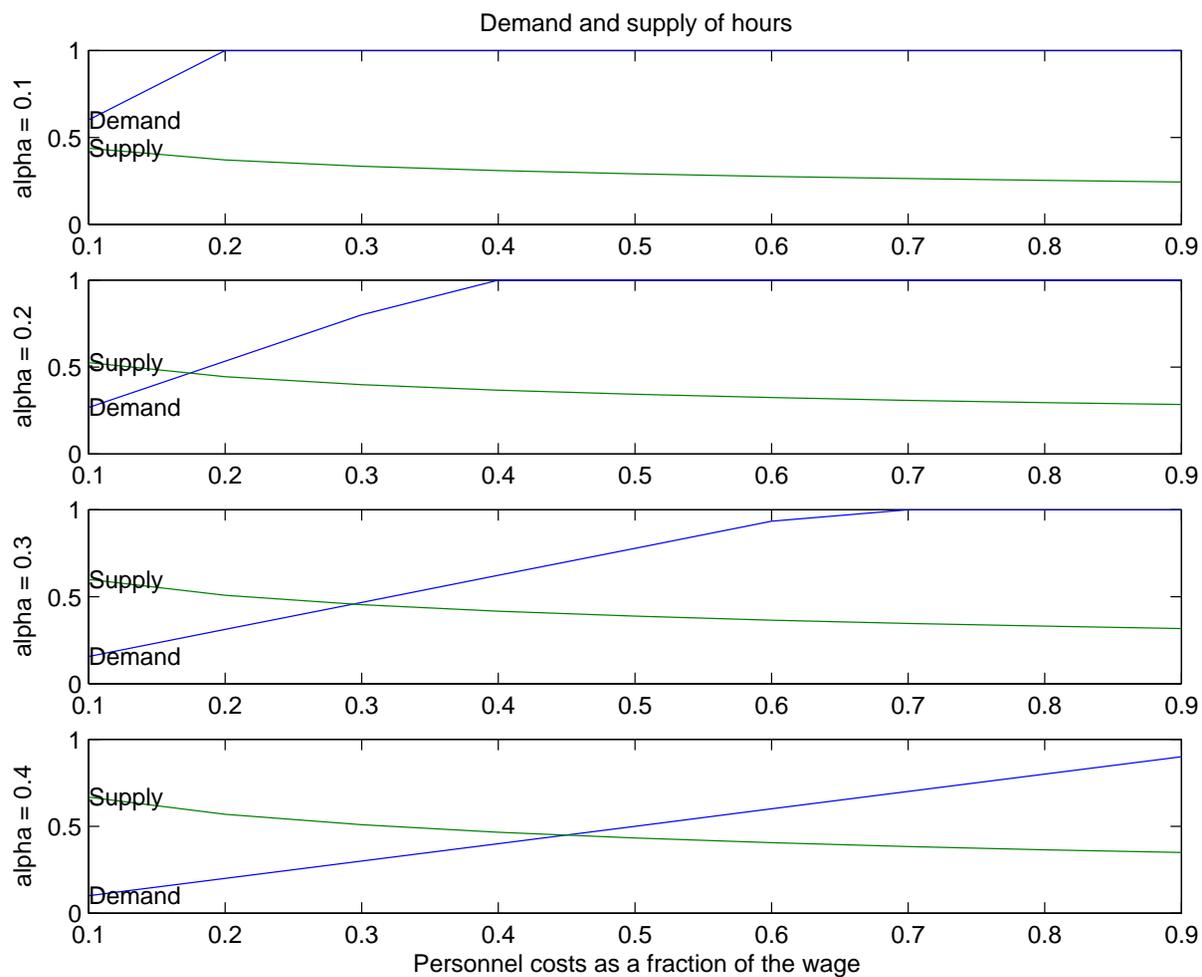


Figure 1: Hours worked and hours that maximize workers' utility as a function of personnel costs for several values of α . The rest of the calibration is $\theta/(1-\alpha) = 2/3$, $\rho = 0.5$, $m = 0.15$, $N = 1 - m$, $\gamma = 0.75$, $\bar{h} = 1$.

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