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Employment and distributional effects of restricting working time

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Abstract

We study the employment and distributional effects of regulating (reducing) working time in a general equilibrium model with search-matching frictions. Job creation entails fixed costs, but existing jobs are subject to diminishing returns. We characterize the equilibrium in the de-regulated economy where firms and individual workers freely negotiate wages and hours. Then, we consider the effects of a legislation restricting the maximum working time, while we let wages respond endogenously. Employment effects are sensitive to the representation of preferences. In our benchmark, small reductions in working time, starting from the laissez-faire equilibrium solution, always result in a small increase in the equilibrium employment, while larger reductions reduce employment. The regulation benefits workers, both unemployed and employed (even if wages decrease and even in cases where employment falls), but reduces profits and output. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

The conventional economists' wisdom is that labor market regulations in the form of benefits, minimum wages, job protection, etc., are the main source for unemployment. The difficulty to reform these institutions, especially in Continental Europe, does not necessarily reflect a lack of understanding of their effectiveness. Labor market reforms have redistributional effects – typically favorable to firms and adverse to workers (or, at least, to some of them) – and compensating losing parties might be costly, noncredible or, in general, politically unfeasible. The appeal of the proposal of reducing working time as an employment policy with the public opinion lies in its promise to reduce unemployment without touching the Welfare State, namely, without harming the workers' interests. Most economists, following their wisdom, regard this proposal with skepticism.[1]

In this paper we present a theory that rationalizes the debate on the working time regulation as arising from an objective conflict of interest between workers and firms. In particular, with the aid of a general equilibrium search-matching model with fixed hiring costs and endogenous wage adjustment (Nash bargaining), we address two separate, although interlinked, questions regarding a policy of reducing working time: (i) Can it increase employment? (ii) What are its redistributional effects?

As concerns the first question, (i), our analysis provides little ground for optimism. While regulating (restricting) the number of working hours may have positive effects on employment, our quantitative analysis suggests that these effects are, at best, very small. The major effect of reducing working hours is a decrease in output and the total number of hours worked. Our predictions are in line with the existing empirical evidence for experiments with working time reduction in Germany in the 1980s (see Section 2). For example, we compute that a reduction from 40 to 35 hours, results in an increase in employment of less than a quarter of a percentage point, while output falls by nine percent. As concerns the second question, (ii), however, we show that the call for a reduction in working time can be rationalized as a call for imposing a redistributional policy. The difference between the workers' most preferred regulation and the laissez-faire equilibrium outcome can be quite substantial, even though workers anticipate the wage reduction associated with shorter working hours.

[1] For example, Saint-Paul (1999) captures precisely the opinion of many economists when he argues that 'part of the popularity of this recipe hinges on utopia (a free lunch), misunderstanding and ideology .... If it is the case that people want to work shorter hours because they consider that the workweek is too long given the hourly wage, that is, they would prefer to work less in exchange for an equiproportionate reduction in earnings, then this is up to each individual's decision and there is no reason why the government should step in and impose a mandatory reduction in hours worked ...'.

We also analyze the impact of the policy on global efficiency, i.e., whether the total surplus to be distributed between the different parties increases or decreases after the reduction. The results depend on the (exogenous) bargaining power of the workers. More precisely, we show that reducing working time can improve efficiency in economies where workers have a significant bargaining power, and, consequently, unemployment is high, while resulting in efficiency losses in economies where workers have low bargaining power, including the benchmark case where the Hosios–Pissarides efficiency condition holds. A different, but related question is how, in efficiency terms, working time regulation compares with other *labor market policies* which can achieve redistributional goals. To this aim we compare, in the context of a calibrated economy, a policy of unemployment benefits provision financed through taxes on firms' profits with that of restricting working time. In the economy analyzed, the policy of benefits provision which achieves the same welfare improvements for employed workers as the most preferred working time regulation, turns out to increase the welfare for unemployed workers and, overall, to be less distortionary (i.e., reduces less output), although it generates higher unemployment.

We also show that both the employment and the distributional effects tend to vanish if the workers' collusive action – say, by the implementation of working time regulations – cannot affect the marginal product of labor, forcing a reduction in the returns accruing to capitalists. This is the case, for example, when there are no firm-specific fixed factors of production, and capital can freely adjust, its return being determined by the international rate in a small open economy framework. Finally, we show that, unless properly taxed, allowing for overtime may undo the effects of setting statutory hours.

The model is characterized by an interplay of opposite forces, which make the general equilibrium employment and distribution effects of working time reduction *a priori* ambiguous. On the one hand, the aggregate technology exhibit decreasing returns to labor, and the services provided by newly hired workers are perfect substitutes for the hours worked by those already employed. This effect stimulates job creation. But, on the other hand, job creation is subject to hiring costs which increase with the number of employees, but not with the number of hours worked by each of them. Moreover, wages are (individually) bargained in a Nash fashion between workers and firms, and hourly wages endogenously increase when hours are cut. As a result, our economies do not feature the elementary version of the 'lump of work' argument ('less hours for the employed, more for the unemployed, one-to-one'), although, in equilibrium, the employment effects of reducing working time *may* be positive.

We take *laissez faire* economies, where wages and hours are freely negotiated as our benchmark. Then, we study the behavior of alternative economies where the maximum working hours are exogenously reduced from the laissez faire level and workers and firms only bargain for wages. A result is that workers and capitalists have, endogenously, diverging preferences on working time in economies which are not too far from the laissez-faire equilibrium. Workers prefer a reduction in working time in order to increase the marginal product of labor, in a similar fashion that, when facing a downward sloping demand, oligopolist firms can increase their profits by colluding to reduce output. As in the oligopolistic competition example, individual workers would like to deviate from the collusive agreement and work longer hours. In fact, once the marginal product of labor is set above its *laissez faire* value, individual workers would like to work even longer hours than in the absence of any regulation. This explains why workers may want to pass enforceable legislation restricting working hours while, at the same time, being willing, individually, to work more. It also explains why workers would like to have such legislation to be as encompassing as possible (i.e., making it more difficult for capital to adjust). As in the oligopolistic competition example, the other side of the market, i.e., the capitalists capturing residual rents, is hurt by a policy of restricting labor supply.

This partial equilibrium effect is only part of the story, though, and our model accounts for various general equilibrium effects. Depending on how bargained wages react to working time regulations (which, in turn, depends on the structure of workers' preferences for consumption and leisure), the policy may or may not generate additional employment. This feeds back to workers' preference for regulations. If, for instance, working time reduction increases the duration of unemployment, this will hurt workers as each of them anticipates the possibility of becoming unemployed in future. The model allows us to show how the trade-off between these different effects is resolved in equilibrium. In particular, it turns out that the redistributional effect tends to dominate, even when the employment effects are practically nil or even negative.

Although the search aspect of the model is not crucial for the main argument of the paper, we find the flow approach of search-matching models a la Pissarides (1990) useful for the objective of our analysis. In particular, we view the advantage of this approach as (i) being analytically tractable while general equilibrium in nature; (ii) usefully distinguishing how many people are matched-and-employed from how many hours are worked; (iii) being parsimonious in terms of the number of parameters to be calibrated in the numerical analysis; (iv) allowing for an explicit characterization of the distributional conflict.

We are, by no means, the first to analyze the effects of working time regulations. Most of the existing literature already cautions that government action in reducing working hours may not lead to a reduction of unemployment. Calmfors (1985) studies how the reduction in working hours affects wages and employment in a static model where wages are set by a monopoly union. He finds that the employment effects of reducing working time are, in general, ambiguous, and that unions will never find it optimal to accept a working time and wage reduction in response to a negative supply shock. More recent theoretical research includes d'Autume and Cahuc (1997), Hart (1987), Cahuc and Granier (1997), Booth and Schiantarelli (1987), Calmfors and Hoel (1988, 1989), Contensou and Vranceanu (1998), Fitzgerald (1998), Hoel (1986), Hoel and Vale (1986), Moselle (1996) and Rocheteau (1999).[2] Most of these papers are methodologically different from our search-matching general equilibrium approach. Some predict substantial employment effects (Fitzgerald, 1998), while others, closer to our findings, predict a non-monotonic relationship between a reduction in hours and employment (Moselle, 1999). The main feature which distinguishes our contribution from this related literature is the focus on the political economy aspect. Some of these papers (e.g., Booth and Schiantarelli (1987), and, again, Moselle (1996)) imply in fact that workers are hurt by working time reduction and that unions should not lobby for such policies, whereas our analysis provides a rationale to their observed behavior.

We proceed as follows. In Section 2, we report some motivating empirical evidence. In Section 3, we describe our model. In Section 4, we characterize equilibrium under different assumptions about preferences and technologies, and interpret our results. In Section 5, we analyze the quantitative effects with the aid of calibrated economies. In Section 6, we extend the analysis to allow for overtime. Section 7 concludes.

2. A perspective on working time

There has been a secular trend towards the reduction in working time. Fig. 1 reports Maddison's (1991) estimates of the secular evolution of the average yearly number of hours of labor activity per worker in seven industrialized countries, showing a significant decrease for all countries sampled. Although these figures, to a large extent, reflect the result of institutional changes (e.g., increasing female participation, the development of part-time work, etc.), it is clear that working time has decreased substantially over the last 150 years, while reductions in the retirement age have curtailed the gains from longer life expectancies. In 1815, the working week in textile mills was 76 standard hours, with about 9–10 days off per year (Bienefeld, 1972), and it was even longer in France (Rigudiat, 1996). In the middle of the 19th Century, a law of a 60 hours working week (from 6 am to 6 pm, six days a week) was passed in England under the pressure of the union movement, whereas the 60 hours legislation was only introduced in France in 1904. Contrary to what is commonly perceived, the legislation about working time is not an 'European issue'. In fact, the US led the trend of working time reduction in the first half of this century – from 58 weekly hours in 1901 to 42 weekly hours in 1948 (Owen, 1979,1988) – and for a long

[2] Methodologically closer to our model, but less developed in scope, are Burdett (1979) and Pissarides (1990, in particular, Chapter 6).

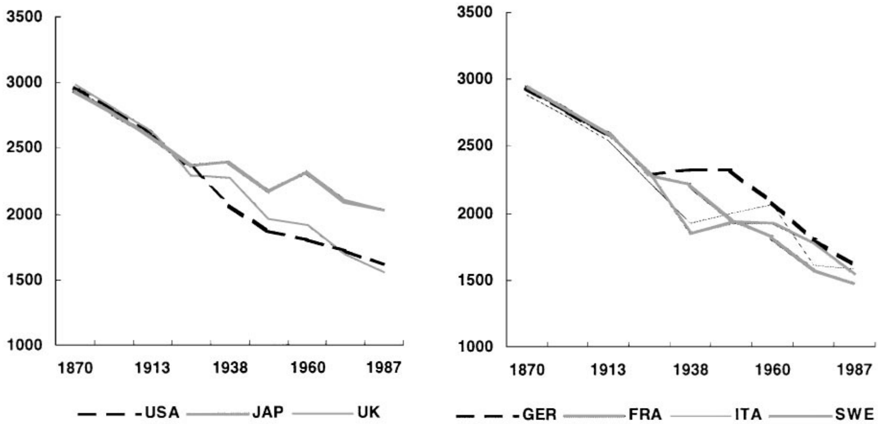

Fig. 1. Annual working hours per worker (1870–1987). *Source:* Maddison (1991).

time the regulation has been tighter in the New than in the Old Continent (the situation was only reversed in the period 1960–85; for more recent evidence, see Bosch et al. (1994), European Commission (1994) and Hoffmann et al. (1993)).

The progressive reduction in working time is far from being the history of a process of smooth change in the set of contractual relationships to accommodate an increase in the demand for leisure. Rather, it is the history of acrimonious industrial disputes, culminating in legislative interventions and/or direct agreements between workers and firms, where the outcome typically depended on the general political strength of the two parties in conflict. For instance, French workers obtained, in 1848, an act of 60 hours, which was soon abolished as the fortune of the labor movement was reversed.

As in the past, the regulation of working time remains a controversial issue, and the social groups supporting and opposing further reductions today are the same as in the early days of the Industrial Revolution.[3] There is, however, an important novelty in the current call for the 35 hours working week. What was

[3] Unions support worktime reduction in most European countries (see, for example, the general resolution of the Munich Congress of the European Trade Union Confederation of May 1979), and, in some cases, also in the US. Business and employee organizations, instead, typically oppose such policies. There are, of course, some partial exceptions. For example, there are many case studies where working time reductions correspond to better working arrangements (new shifts, etc.) and the increases in productivity are welcomed by employers (see, for example, White (1981) or Richardson and Rubin (1997)). Nevertheless, such managerial optimism seems, however, to be a relative rare event (see Bienefeld (1972) and also Hart (1984)). For example, in the hot political debate which accompanied the recent approval of the Aubry Law in France, Jean Gandois, the leader of the main French employers' association, resigned in protest against the 35 hours legislation, denouncing 'a triumph of ideology over reasons' (Economist, 3 April 1999).

a call for alleviating the poor conditions of the employed workers a century ago, in order to defend them from the monopsonistic practices of the employers has, in the last decades, become a call for alleviating the European unemployment problem, for *work sharing*, i.e., a larger number of people being employed, each person working less.[4] But do workers back this call from unions and political organizations? Although there is no hard evidence, some recent surveys show that a significant share of workers – especially blue-collar workers – would like to work less hours at the given *hourly* wage, while only a small share would like to work more hours (see Robbins, 1980; Stewart and Swaffield, 1997).[5] Interestingly, a significant proportion of the British workers who would like to work less hours state that they often work overtime.

Concerning the employment effects of shorter working hours, the results are rather mixed. A number of studies during the 1980s based on time series evidence (Wadhwani, 1987; Brunello, 1989) find positive and large employment effects from reducing working time, although their methodology may well capture the existence of common trends, rather than causal relationships. More recent work on two episodes of reduction in working time in the 1980s finds significantly smaller employment effects. Between 1985 and 1989, under the pressure of the Metal Working Industry Union, Germany experienced a series of negotiated reductions in the average weekly hours to 37 hours, where unions accepted – as a counterpart – extended flexibility in the organization of the working time. Contrary to earlier optimistic findings based on surveys run by employers and unions (Bosch, 1990), some recent microeconometric work finds the employment effects to be fairly small. In particular, Hunt (1999) uses data for 30 manufacturing industries from the German Socio-Economic Panel and estimates the employment effects from the industry-level variation in hours reduction. According to her estimates, employment on average rose by 1.3% in response to one standard hour reduction. The precision of the estimate is, however, low, and the coefficient is not statistically significant. Moreover, the magnitude and even the sign of the effects vary substantially depending on the specification, split by gender and level of aggregation used. While the employment effects are ambiguous, the negative effects on the total number of hours worked are large (2.4% fall per hour reduction) and highly significant.

[4] For example, according to K. Marx, the reduction of working time was a necessary condition for freedom (Mark, 1956, Capital, Book III, III, Section VII, Chapter XXVIII).

[5] Stewart and Swaffield (1997) report that in 1991 one-third of male manual workers in UK would prefer to work fewer hours at the prevailing wage. They also estimate that, on average, desired hours per week are 4.3 hours lower than actual hours. Note that there are important differences between the attitudes of European and North American workers. Bell and Freeman (1994) report that while in Germany, as in Britain, there are more workers surveyed who would rather work less hours at the current hourly wage than workers who would rather do the opposite. This pattern is reversed in the United States. And the response of Canadian workers is similar to those of the US workers (see Kahn and Lang, 1995).

Unlike in Germany, in France it was the government which, in 1982, introduced a generalized reduction of statutory working time to 39 hours, intended to be the first step towards 35 hours. The experiment raised substantial controversy, and was abandoned shortly afterwards. A study by INSEE based on survey evidence finds relatively low employment effects, quantitatively similar to those estimated by Hunt (1999) for Germany, although Cette and Taddei (1994) report more optimistic figures.[6]

3. The model

3.1. Technology

A unique consumption good is produced by a measure one of competitive final good firms. The representative final good firm's technology is given by

$$Y_i = \tilde{A}(X_i)^{\alpha} K_i^{1-\alpha},$$

where $\alpha \le 1$, $\tilde{A}$ is a parameter, and X_i denotes firm i's intermediate input. K_i is a firm-specific productive factor which firm i is endowed with, and its supply is fixed. For instance, K_i can be interpreted as firm-specific human capital, managerial capability, etc., which cannot be used productively in other activities. In Section 4.1.4, we modify the interpretation of K_i to general capital, whose quantity can be adjusted by firms.

We assume that all firms in the economy have an identical endowment of the fixed factor, i.e., $K_i = K$. Then, we will write the production function as

$$Y_i = A(X_i)^{\alpha},$$

where $A \equiv \tilde{A}K^{1-\alpha}$. Intermediate firms use labor as their only input. Thus, we can interpret the intermediate input industry as the indirect provider of labor services to the final good industry. In particular, we assume that each intermediate firm can hire one worker only, and that its output increases linearly with the number of hours worked by its employees. More formally, $x_j = l_j$, where x_j denotes firm j's output. We denote by n the number of active intermediate firms. Clearly, n will also denote total employment in the economy.

[6] In the United Kingdom, the only European country with virtually no regulation of working time, two important industrial disputes exploded in 1979 and 1989, both involving manual engineering workers, where the workers' main request was the reduction of the working week. The former started with the demand of 35 hours and ended with an agreement based on 39 hours. The latter led to a further cut in the working week to 37 hours. While the first episode had very marginal effects, since firms mainly replaced normal hours with overtime (Roche et al., 1996), some authors argue favorably about the consequences of the second episode (see Richardson and Rubin, 1997).

The market for intermediate goods is competitive, and the equilibrium price of a unit of intermediate good is given by

$$p = \alpha A(X)^{\alpha - 1} = \alpha A(nl)^{\alpha - 1}, \tag{1}$$

since, in a symmetric equilibrium, $X = nl$. The profits (rents) accruing to final good producers and, more in general, to all firms in this economy, equal

$$\Pi = (1 - \alpha)A(nl)^{\alpha}. \tag{2}$$

The labor market is characterized by search frictions (Pissarides, 1990). We assume a standard isoelastic constant returns to scale matching function, $m/v = \theta^{-\zeta}$, where m denotes matches, v denotes vacancies and $\theta \equiv v/u$ is the tightness of the labor market, u being the mass of unemployed agents (thus, $u = 1 - n$). We assume that an intermediate firm must pay a flow cost of c units of output in order to hold an open vacancy. Jobs are terminated at the exogenous rate s. Then, the net employment flow is given by

$$\dot{n} = \theta^{-\zeta} v - sn \tag{3}$$

where v denotes the number of vacancies, and θ is the tightness of the labor market (thus, $\theta^{-\zeta}$ is the rate at which firms fill vacancies). In steady-state, recalling that $u = 1 - n$,

$$n = \frac{\theta^{1-\zeta}}{s + \theta^{1-\zeta}}. \tag{4}$$

This environment is quasi-isomorphic to one where the final good firms hire labor services directly, rather than embodied in intermediate goods. The only difference is that, in the alternative environment, the firms' employment decisions would interact with the bargaining between workers and firms in a more complex fashion, due to the presence of decreasing returns to labor. In particular, firms would strategically 'over-hire' workers in order to increase their bargaining power against the workers (see Stole and Zwiebel (1996) for a detailed analysis of the problem). This issue, which is orthogonal to the main point of our analysis, would complicate the analysis substantially. Thus, for simplicity, we adopt this more decentralized set-up.

We denote by J the value of an intermediate firm with a filled vacancy. In steady-state

$$(r + s)J = pl - w. \tag{5}$$

Instead, let J_v denote the value of holding an open vacancy. Free-entry implies that, in equilibrium, $J_v = 0$. Thus,

$$\theta^{-\zeta} J = c, \tag{6}$$

i.e., vacancies will remain open until the point where the cost of holding a vacant position, c, equals the expected value of a filled vacancy (recall that $\theta^{-\zeta}$ is the instantaneous probability of a vacancy giving rise to a match). Eqs. (5) and (6) jointly imply that

$$pl - w = c(r+s)\theta^{\zeta} \tag{7}$$

which will be referred to as the labor demand equation.

We normalize hours such that each worker has a unit time endowment. Workers' preferences are defined over consumption and leisure $(1-l)$. Throughout our analysis, we will assume that workers can neither save nor borrow, thus w will denote both the current wage and consumption. We will denote by $\tilde{u}(w,(1-l))$ the instantaneous utility function of a representative worker, and assume that the rate of time preferences is equal to the interest rate, r. The value of employment for a worker is

$$(r+s)W = \tilde{u}(w,(1-l)) + sU, \tag{8}$$

where U is the value of being unemployed. U, in turn, is given by

$$rU = \tilde{u}(0,1) + \theta^{1-\zeta}(W-U), \tag{9}$$

where $\tilde{u}(0,1)$ is the instantaneous utility of an unemployed agent earning no wage and does not work ($w = l = 0$). From Eqs. (8) and (9) it follows that

$$(r+s+\theta^{1-\zeta})(W-U) = \tilde{u}(w,(1-l)) - \tilde{u}(0,1). \tag{10}$$

We assume that each worker bargains individually over his wage and (in some cases) over his hours with the firm with which he is matched, and that these are determined by the Nash solution.[7] The Nash solution is given by the following program:

$$\max_{\{w,l\}} \ (W-U)^{\beta}(J-J_v)^{1-\beta}, \tag{11}$$

where β is the bargaining strength of the workers, and J_v is the value of a vacancy. Free entry implies that, in equilibrium, $J_v = 0$. The first-order conditions can be written, after rearranging terms, as

$$\frac{\beta}{\tilde{u}(w,(1-l)) - \tilde{u}(0,1)}\tilde{u}_w = \frac{1-\beta}{(pl - w + c\theta)}, \tag{12}$$

$$-\frac{\beta}{\tilde{u}(w,(1-l)) - \tilde{u}(0,1)}\tilde{u}_l = \frac{1-\beta}{(pl - w + c\theta)}p, \tag{13}$$

[7] See the working paper version of this paper (Marimon and Zilibotti, 1999) for an analysis of collective bargaining with a slightly different model.

which, jointly, imply that $p = -\tilde{u}_l/\tilde{u}_w$, thus yielding an implicit relationship between wages and the hours worked.

We will also study the case where the number hours is fixed by legal regulation, and workers and firms only bargain on wages.[8] In this case, the bargaining problem is equivalent to (11), except that the maximization is now defined over w only. The resulting First Order Condition is (12), with the restriction that $l = l_r$, where l_r denotes the statutory working time.

The steady-state laissez-faire equilibrium will be determined by Eqs. (1), (4), (7), (12) and (13), the endogenous variables being n, θ, l, p, w. In contrast, when working time is determined by legislation, the steady-state equilibrium will be determined by Eqs. (1), (4), (7) and (12), the endogenous variables being n, θ, p, w, while l_r will be exogenous.

3.2. Preferences

We will consider two parameterized classes of preferences. Our benchmark preferences are a generalized version of quasi-linear utility, which was first introduced in the macro-RBC literature by Greenwood et al. (1988), where consumption and leisure are additively separable within each period. Formally

$$\tilde{u}(w,(1-l)) = v(w - l^{\chi}/\chi)^{1/v}, \tag{14}$$

where we assume that $\chi > 1$ and $v > 1$. The value of $1/\chi$ corresponds to what is known in the literature as the intertemporal elasticity of substitution in labor supply, while $(v-1)/v$ is the coefficient of relative risk aversion. Note that in the risk-neutrality case ($v = 1$), they reduce to the quasi-linear utility specification.[9]

The restriction $v > 1$ means that one is the upper bound to relative risk aversion. With relative risk aversion equal or larger than one, the outcome of the bargaining process always gives the workers their reservation utility. Since the only effect of risk aversion is to reduce the workers' bargaining power, and

[8] For simplicity, we assume that the number of hours are set by the policy authority and are perfectly enforced. Thus, workers and firms cannot agree to work either more or less hours. Alternatively, we could more realistically think that the authorities set a ceiling, and restrict attention to cases in which the ceiling is binding.

[9] A drawback of GHH preferences is the prediction that technical progress – which is not explicitly introduced in our model – induces workers to increase continuously the number of hours supplied. This contradicts the evidence of a secular trend towards a reduction in working time discussed in the Section 2. As Correia et al. (1995) noted, however, a simple modification to the utility function (14) would rule out this counterfactual feature. In particular, it must be assumed that as labor productivity grows, so does the value of not working (i.e., due to ongoing technical progress in home production). Formally, the modified utility function would be: $\tilde{u}(w,(1-l)) = v(w - X_t(l^{\chi}/\chi))^{1/v}$, where X_t grows at the same rate of labor productivity. With this modification, Eq. (14) becomes consistent with the absence of positive trends in working time.

we allow, as a limit case (i.e., when $v \to \infty$), for unit relative risk aversion, this assumption entails no loss of generality.

Some of the results will be sensitive to this assumption of linear separability. In particular, with GHH preferences, endowing workers with more leisure has no effect on their marginal evaluation of consumption. When consumption and leisure are complements – e.g., with preferences exhibiting Constant Elasticity of Substitution (CES) between consumption and leisure – workers bargain more aggressively when their leisure is increased by restricting working time. Thus, hourly wages increase more than in the GHH case. To analyze the sensitivity of the results, we extend our analysis to CES preferences. Formally

$$\tilde{u}(w,(1-l)) = \begin{cases} \left(\dfrac{w^{\xi}}{2} + \dfrac{(1-l)^{\xi}}{2}\right)^{1/\xi} & \text{if} -\infty < \xi \le 1 \text{ and } \xi \neq 0, \\ \sqrt{w(1-l)} & \text{if } \xi = 0, \end{cases} \tag{15}$$

where $1/(1-\xi)$ is the elasticity of substitution between labor and leisure. Note that this specification encompasses Cobb–Douglas preferences, $\tilde{u} = \sqrt{w(1-l)}$, as the limit of $(w^{\xi}/2 + (1-l)^{\xi}/2)^{1/\xi}$ when ξ tends to zero.[10]

4. Analysis

4.1. GHH preferences

4.1.1. Laissez-faire equilibrium

The first-order conditions for the laissez-faire economy, Eqs. (12) and (13), are

$$\frac{\beta}{v(w-(1/\chi)l^{\chi})} = \frac{1-\beta}{pl - w + c\theta}, \tag{16}$$

$$\frac{\beta l^{\chi-1}}{v(w-(1/\chi)l^{\chi})} = \frac{(1-\beta)p}{pl - w + c\theta}, \tag{17}$$

[10] Some technical remarks are in order, in this respect. First, the utility function (15) is not well-defined at $(0,1)$ when $\xi < 0$. However, it is easily proved that, in this case, $\lim_{\{w \to 0, l \to 1\}} \tilde{u}(w, 1-l) = 0$. Using this fact, throughout the analysis, we will omit limits and, with some abuse of notation, write that $\tilde{u}(0,1) = 0$ when $\xi \le 0$. Second, observe that under the CES representation (15), $\tilde{u}(0,1) = \frac{1}{2}$ when $\xi > 0$. Since the utility of consumption–leisure during unemployment determines the workers' outside option when bargaining with firms over wages and employment conditions, this discontinuous behavior will create some technical complications, which will be discussed as we proceed.

which, after rearranging terms, give the following laissez-faire (*unrestricted*) solutions:

$$l_u = p^{1/(\chi - 1)}, \tag{18}$$

$$w_u = \gamma\left[\left(\frac{(1-\beta)v}{\chi} + \beta\right)p^{\chi/(\chi-1)} + \beta c\theta\right], \tag{19}$$

where $\gamma \equiv [(1-\beta)v + \beta]^{-1} \leq 1$. Two features of Eqs. (18) and (19) are worth noting:

1. Working time only depends on the marginal product of labor and the disutility of labor (and not on the workers' risk aversion, nor on their bargaining strength). In particular, Eq. (18) implies that the marginal cost of foregone leisure equals the marginal product of labor. In other terms, given p, hours are set so as to maximize the size of the surplus, and the wage is used to split this surplus between workers and firms.
2. Wages decrease with risk aversion. In particular, as $v \to \infty$ (unit RRA), then $w_u \to l^\chi/\chi$, namely workers are paid their reservation wage, whereas, when $v = 1$ (risk neutrality) then $w_u = l^\chi/\chi + \beta(pl + c\theta - l^\chi/\chi)$, namely workers receive their reservation wage plus a share β of the surplus generated by the match.

To find employment, substitute the equilibrium values of l_u and w_u as given by Eqs. (18) and (19) into Eq. (7):

$$\gamma v(1-\beta)\,\frac{\chi - 1}{\chi}\,p^{\chi/(\chi-1)} - c[(r+s)\theta^\zeta + \beta\gamma\theta] = 0. \tag{20}$$

Next, substitute n and l as given by Eqs. (4) and (18), respectively, into the expression of the marginal product of labor, (1):

$$p = ((\alpha A)^{1/(1-\alpha)}(1 + s\theta^{\zeta - 1}))^{(1-\alpha)(\chi-1)/(\chi-\alpha)}. \tag{21}$$

Eqs. (20) and (21) jointly determine the equilibrium solution in the endogenous variables p, θ. Once p and θ are determined, Eqs. (4) and (18) yield the equilibrium employment and hours. The system (20)–(21) identify two loci in the plane (p, θ) which are, respectively, positively and negatively sloped, and whose intersection yields the unique equilibrium, (p_u, θ_u) – see Fig. 2. Recall that, from (18), a higher p implies a higher l, whereas, from (4), a higher θ implies a higher n. The comparative statics are standard. Unemployment, for instance, depends positively on β and c, and negatively on v.

4.1.2. Equilibrium with hours regulation

We now characterize equilibrium when agents bargain on wages only, and hours are exogenous. The first-order condition, (12), yields

$$w = (1 - \gamma\beta)l_r + \gamma\beta(p^{\chi/(\chi-1)} + c\theta), \tag{22}$$

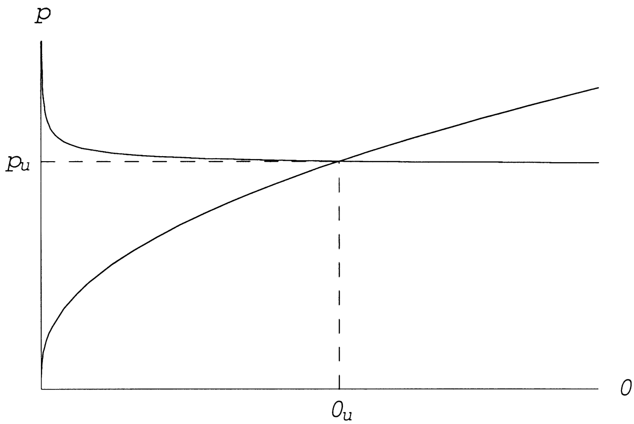

Fig. 2. Laissez-faire equilibrium.

which can be substituted into Eq. (7) to obtain the following demand condition:

$$(1-\beta\gamma)\left(pl_r - \frac{l_r^\chi}{\chi}\right) = c[\beta\gamma\theta + (r+s)\theta^\zeta]. \tag{23}$$

Next, using Eqs. (1) and (4) sequentially to eliminate p and n we obtain

$$\tau(\theta, l_r) \equiv (1-\beta\gamma)\left(\alpha A(s\theta^{\zeta-1}+1)^{1-\alpha} l_r^\alpha - \frac{l_r^\chi}{\chi}\right) - c[\beta\gamma\theta + (r+s)\theta^\zeta] = 0, \tag{24}$$

which is a key equation for studying the employment effect of a change in the regulation of working time. By the implicit function theorem, we have that $\theta'(l_r) \equiv \mathrm{d}\theta/\mathrm{d}l_r = -\tau_{l_r}(\theta, l_r)/\tau_\theta(\theta, l_r)$. On the one hand, $\tau_\theta(\theta, l_r)$ is unambiguously negative. On the other hand, some simple algebra establishes that $\tau_{l_r}(\theta, l_r) \gtreqless 0 \Leftrightarrow \alpha p - l_r^{\chi-1} \gtreqless 0$. Thus

$$\theta'(l_r) \gtreqless 0 \;\Leftrightarrow\; \alpha p - l_r^{\chi-1} \gtreqless 0, \tag{25}$$

i.e., small reductions in working time increase employment as long as $\alpha p < l_r^{\chi-1}$. But we know that, in a laissez-faire equilibrium, the value of the marginal product of labor services, p, equals the marginal cost of leisure, $l_u^{\chi-1}$. Thus, reducing working time necessarily increases employment in the neighborhood of a laissez-faire equilibrium, provided that $\alpha < 1$. This result is summarized by the following proposition:

Proposition 1. (A) *If* $\alpha < 1$ (*decreasing returns to labor services*), *then, in the neighborhood of a laissez-faire equilibrium, reducing working time increases employment.*

(B) *If* $\alpha = 1$ (*constant returns to labor services*), *in the neighborhood of a laissez faire equilibrium, reducing working time reduces employment.*

Proof. By condition (25), $\theta'(l_r) < 0 \Leftrightarrow l_r^{\alpha-1} > \alpha p$. But, from (18) $l_u = p^{1/(\alpha-1)}$. Then, if $\alpha < 1$, in a neighborhood of l_u, it must be that $\theta'(l_r) < 0$, and (A) is proved. When $\alpha = 1$, then $\tau_{l_r} = 0$ and changing hours has no first-order effects. However, the analysis of second-order effects establishes that $\theta''(l_r) = -\tau_{l_r l_r}(\theta, l_r) > 0/\tau_{\theta\theta}(\theta, l_r) > 0$. Thus, (B) follows. □

Proposition 1 establishes that, generically, the laissez-faire solution fails to maximize employment. While, under laissez-faire, $l = p^{1/(\alpha-1)}$, employment is maximized when $l = (\alpha p)^{1/(\alpha-1)}$. The two conditions only coincide under constant returns to labor (or labor-intensive intermediate inputs), while if returns to labor are diminishing, unfettered bargaining will yield overwork and under-employment.

The result of Proposition 1 is illustrated by Fig. 3, which geometrically represents the implicit function given by Eq. (24). When $\alpha < 1$ (Case A), the laissez-faire solution (l_u) lies to the right of the employment maximizing working time. Note that the result has a local nature. While *small* reductions in working time increase employment, large reductions may have the opposite effects. Finally, when $\alpha = 1$, $l = l_u$ maximizes employment (Case B), and no regulation in working time might reduce unemployment.

Using (7) and the result of Proposition 1, it is also straightforward to establish that restricting hours reduces wages per employee.

Next, we analyze the welfare implications of policies reducing working time. For simplicity, we restrict attention to steady-state analysis. Although a formal

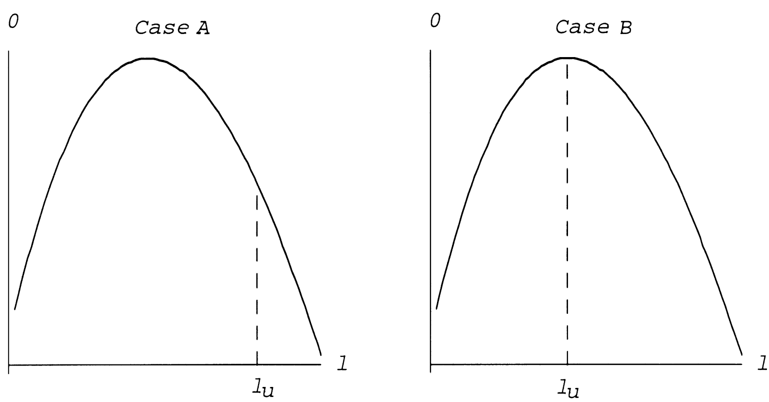

Fig. 3. Relationship between θ (tightness of the labor market) and l_r (hours). Case A: $\alpha < 1$. Case B: $\alpha = 1$.

characterization of the transitional dynamics is beyond the scope of our analysis, it seems safe to conjecture that the model exhibits monotonous convergence in employment. After a reduction in working time in the neighborhood of a laissez-faire equilibrium, the price of intermediate inputs would jump up, triggering an increase in wages and in the rate of vacancy creation. As new jobs are created, the supply of intermediate inputs increases, and their price falls. Thus, the rate of job creation would steadily decline back to the steady-state level. This means that the short-run gains for the workers would be larger than the corresponding steady-state gains, while final good firms lose more in the short than in the long run.

Proposition 2. (A) *In a neighborhood of the laissez-faire equilibrium where reducing working time increases employment* (*see Proposition 1*), *reducing working time increases the welfare of both the employed* (W) *and unemployed* (U) *worker.*

(B) *Reducing working time*, *instead*, *decreases firms' profits.*

Proof. From Eqs. (8)–(10) and (22), and given that $\tilde{u}(0,1)=0$, it follows that

$$W = \frac{r+\theta^{1-\zeta}}{r(r+s+\theta^{1-\zeta})}\left(w-\frac{l^{\chi}}{\chi}\right)^{v}$$
$$= \frac{r+\theta^{1-\zeta}}{r(r+s+\theta^{1-\zeta})}(\beta\gamma)^{v}\left(pl+c\theta-\frac{l^{\chi}}{\chi}\right)^{v} \equiv W\left(\theta(l), pl-\frac{l^{\chi}}{\chi}\right) \tag{26}$$

and

$$U = \frac{\theta^{1-\zeta}}{r(r+s+\theta^{1-\zeta})}\left(w-\frac{l^{\chi}}{\chi}\right)^{v}$$
$$= \frac{\theta^{1-\zeta}}{r(r+s+\theta^{1-\zeta})}(\beta\gamma)^{v}\left(pl+c\theta-\frac{l^{\chi}}{\chi}\right)^{v} \equiv U\left(\theta(l), pl-\frac{l^{\chi}}{\chi}\right) \tag{27}$$

where both $W(.)$ and $U(.)$ are increasing in both arguments. But Eq. (23) implies that $\theta'(l) \gtreqless 0$ if and only if

$$\frac{\mathrm{d}}{\mathrm{d}l}(pl - l^{\chi}/\chi) \gtreqless 0.$$

Thus, the first part of the proposition follows.

To prove the second part of the proposition, recall, first, that in steady-state the set of intermediate firms make, altogether, zero profits, thus only final good firms make pure profits. These profits are equal to $\Pi = (1-\alpha)A(nl)^{\alpha}$, as from (2). Proving that profits decrease, therefore, amounts to proving that the total labor input in the economy decreases, or, equivalently, that p increases due to the reduction of working time. We start by implicitly differentiating

Eq. (23) with respect to l, and evaluating the resulting expression at the laissez-faire equilibrium ($p = l_r^{\chi-1}$):

$$\theta'(l) = \frac{(1-\beta\gamma)(p + (\mathrm{d}p/\mathrm{d}l)l - l_r^{\chi-1})}{c[\beta\gamma + \zeta(r+s)\theta^{\zeta-1}]} = \frac{(1-\beta\gamma)(\mathrm{d}p/\mathrm{d}l)l}{c[\beta\gamma + \zeta(r+s)\theta^{\zeta-1}]}.$$

Now, assume, in contradiction with the proposition, that $\mathrm{d}p/\mathrm{d}l \geq 0$ (implying that p does not increase nor does Π fall after a reduction in working time). Then, in a neighborhood of the laissez-faire solution, $\mathrm{d}\theta/\mathrm{d}l \geq 0$. But this contradicts Proposition 1. Thus, in such a neighborhood, $\mathrm{d}p/\mathrm{d}l < 0$ and profits fall after a reduction in working time. □

Proposition 2 establishes that, starting from a laissez-faire equilibrium, all workers, both employed and unemployed, benefit from the reduction in working time when $\alpha < 1$. Firms lose, however. While the value of intermediate firms holding filled positions increases, the value of final good firms (Π), i.e., the rents associated with the fixed factor K, falls.

So far, we have discussed the employment and distributional effect of working time regulation. It seems natural to ask what the effects on efficiency are. For simplicity, we address this issue by restricting attention to the case where agents are risk neutral ($v = 1$). In this case, aggregate welfare can be defined as the value of final output net of the effort cost suffered by employed agents and of job creation costs. More formally

$$\omega(l) = A(nl)^{\alpha} - n(l^{\chi}/\chi) - c\theta(1-n). \tag{28}$$

Choosing l so as to maximize $\omega(l)$ subject to the market constraints (3)–(25) is equivalent to solving a standard constrained social planner solution in the limit case where agents do not discount future ($r \to 0$). This restriction simply avoids complications associated with transitional dynamics, and the problem can be generalized to allow for positive r. We can establish the following proposition.

Proposition 3. Consider an economy which is, initially, in a laissez-faire equilibrium. Reducing working time increases (reduces) total welfare as defined in Eq. (28) if and only if $\beta > (\leq)\zeta$.

Proof. Differentiating (28) using the chain rule, yields

$$\frac{\mathrm{d}\omega}{\mathrm{d}l} = n(p - l^{\chi-1}) + \left[\left(pl - \frac{l^{\chi}}{\chi} + c\theta\right)\frac{\mathrm{d}n}{\mathrm{d}\theta} - (1-n)c\right]\frac{\mathrm{d}\theta}{\mathrm{d}l}. \tag{29}$$

Since, under laissez-faire, $p = l^{\chi-1}$, then, using (3) to replace $\mathrm{d}n/\mathrm{d}\theta$ and $(1-n)$, we rewrite (29) as

$$\frac{\mathrm{d}\omega}{\mathrm{d}l} = \frac{s}{s+\theta^{1-\zeta}}\left[\left(pl - \frac{l^{\chi}}{\chi} + c\theta\right)\frac{(1-\zeta)\theta^{-\zeta}}{s+\theta^{1-\zeta}} - c\right]\frac{\mathrm{d}\theta}{\mathrm{d}l}. \tag{30}$$

Furthermore, we know from Proposition 1 that, for an economy which is initially in a laissez-faire equilibrium, $\mathrm{d}\theta/\mathrm{d}l < 0$. Thus

$$\operatorname{sign}\left\{\frac{\mathrm{d}\omega}{\mathrm{d}l}\right\} = \operatorname{sign}\left\{-(1-\zeta)\left(pl - \frac{l^{\chi}}{\chi}\right) + c(\zeta\theta + s\theta^{\zeta})\right\}. \tag{31}$$

Next, from (23), while letting $r = 0$, we have

$$-(1-\zeta)\left(pl - \frac{l^{\chi}}{\chi}\right) + c(\zeta\theta + s\theta^{\zeta}) \gtreqless 0 \iff \zeta \gtreqless \beta.$$

Thus, $\mathrm{d}\omega/\mathrm{d}l \gtreqless 0 \Leftrightarrow \zeta \gtreqless \beta$, and the result is established. □

Note that, in the knife-edge case where $\beta = \zeta$, the laissez-faire choice of working time maximizes welfare. This extends the Hosios–Pissarides condition (Pissarides, 1990) to the choice of working time. Interestingly enough, restricting working time has positive effects on total welfare when the workers' bargaining power is large (high β) relative to the elasticity of the matching function. In this case, employment is suboptimally low, and reducing working time improves the aggregate welfare by increasing the number of employed workers, and avoiding that those employed overwork. The opposite occurs in economies where workers have a low bargaining power and there is overemployment. In this case, the positive effect on employment from cutting working time is detrimental to welfare.

4.1.3. Interpretation of the results

In this model, workers' preferences are determined by two elements:

1. the utility flow accruing to a worker when employed ($w - l^{\chi}/\chi$).
2. the tightness of the labor market (θ) which determines both the expected duration of unemployment (recall that all workers contemplate becoming unemployed, sooner or later) and the equilibrium wage, due to the outside option effect in Nash bargaining.

The first reason why workers like regulations setting working time somewhat below the laissez-faire level is because it provides a commitment device to collectively reduce the aggregate labor supply in a world where the demand for labor services is downward sloping. As discussed in the introduction, this is a standard issue of collusive behavior (*oligopoly* effect). All workers gain by restricting their labor supply, since it increases the market value (marginal product) of labor services, but, individually, every worker has, ex post, the temptation to deviate and overwork making collusion non-sustainable.

To see the point more clearly, consider a simpler version of our model with no search frictions nor unemployment, where workers are paid a competitive wage equal to their marginal product, i.e., $w = pl$. Here, workers would maximize utility, by setting l so as to maximize $pl - l^{\chi}/\chi = \alpha A l^{\alpha} - l^{\chi}/\chi$, namely by working

$l_r = \alpha^2 A^{\chi-\alpha}$ hours ($n = 1$, since there is no unemployment). In a laissez-faire economy, however, they would work $l_u = \alpha A^{\chi-\alpha}$ and their welfare would be lower. The two expressions are only identical when $\alpha = 1$. Clearly, the absence of unemployment makes this model rather unrealistic and uninteresting. But it shows the point that the direct effect is independent of both search frictions and Nash bargaining.

The second effect, instead, relates to the presence of search frictions and unemployment in the labor market. In particular, the creation of new vacancies (employment) increases with the profit flow of intermediate firms, i.e., with $pl - w$. A particular feature of GHH preferences – and of the wage behavior implied by these – is that the flow $pl - w$ increases uniformly with the gap between the value of intermediate services produced by each worker and the cost of leisure, i.e., $pl - l^{\chi}/\chi$. Thus, in equilibrium, the tightness of the labor market and the utility flow of the employed agent co-move perfectly, both being driven by $pl - l^{\chi}/\chi$. The general equilibrium employment effect, therefore, always reinforces the oligopoly effect. To put it differently, under GHH preferences, the preferences of workers and intermediate firms with a filled vacancy are perfectly aligned.

It is important to stress that this alignment of interests is not a robust feature of the model. We will see in the next section, for instance, that it breaks down under CES preferences, since the oligopoly and employment effects, possibly, go in opposite directions. For instance, in the Cobb–Douglas case, the equilibrium tightness of the labor market (employment) increases with pl rather than with $pl - l^{\chi}/\chi$, and restricting hours increases the utility flow $w - l^{\chi}/\chi$, but reduces employment. In this case, workers may face a trade off between the oligopoly and the employment effect when contemplating policies of working time reduction.

We conclude this subsection with two remarks. First, from the results of the previous section, it might seem as if there were no insider–outsider conflict in the model. This is not true by assumption, though. Although both employed and unemployed workers care about the same two objectives (high $w - l^{\chi}/\chi$, high θ), they weight them differently. In particular, the unemployed care relatively more than the employed about the duration of unemployment (θ). This has no effect under GHH preferences, but can cause (at least, potentially) a divergence of interests when working time restrictions have opposite effects on the two variables.

Second, our assumptions imply that newly hired workers are perfect substitutes of hours in the aggregate technology. This is not very realistic, and potentially important elements such as start up costs and fatigue are ignored. If we restrict ourselves to simple technological specifications, however, it is easy to see that the qualitative results just discussed are fairly robust to changing this assumption. Imagine, for instance, that each worker produces l^{κ} units of services where $0 \leq \kappa \leq \chi - \alpha$ but is, possibly, larger than unity. Thus, the aggregate technology would be $Y = An^{\alpha}l^{\alpha+\kappa}$, and workers and hours would be imperfect substitutes. It is straightforward to see that the qualitative results of the previous section carries on unchanged to this extension. Thus, the results are robust to simple generalizations introducing imperfect substitutability between newly hired workers and hours.

4.1.4. Capital adjustments

As we have seen (Proposition 1, part B), under constant returns to labor, reducing working time below the laissez-faire equilibrium results in lower employment. The same result holds if K is interpreted as adjustable capital, even though returns to labor alone are diminishing. To analyze this case, we recover the original formulation $Y_i = \tilde{A}(N_i l_i)^{\alpha} K_i^{1-\alpha}$ and, for simplicity, consider a small open economy with perfectly mobile capital and no capital adjustment costs. Then, the representative firm's optimal capital–labor ratio satisfies

$$\frac{K}{nl} = \left(\frac{r}{(1-\alpha)\tilde{A}}\right)^{1/\alpha}. \tag{32}$$

In this case, the marginal product of labor is uniquely determined by the interest rate, i.e.,

$$p = p(r) \equiv \alpha\tilde{A}\left(\frac{r}{(1-\alpha)\tilde{A}}\right)^{(1-\alpha)/\alpha}.$$

Therefore, equilibrium condition (20) becomes

$$(\gamma v)\,\frac{\chi-1}{\chi}\,(1-\beta)(p(r))^{\chi/(\chi-1)} - c[(r+s)\theta^{\zeta} + \beta\theta] = 0, \tag{33}$$

and the interest rate, r, uniquely determines the *laissez-faire* market tightness: $\theta_u = \theta(r)$.

Proposition 4. If $Y = \tilde{A}(Nl)^{\alpha}K^{1-\alpha}$ where $\alpha < 1$, and firms can costlessly adjust capital, then, in the neighborhood of a laissez faire equilibrium, reducing working time reduces employment, employed and unemployed workers' welfare, and firm's profits.

The proof is an immediate extension of the proof of Propositions 1 and 2 and is, therefore, omitted. The employment effects of reducing working time are negative when capital is perfectly mobile, and there is no fixed factor of production, thus, no pure rents accrue to the firms. Additionally, workers do not benefit from working time regulation. This finding suggests that at least part of the positive employment and welfare effects which may materialize in the short run are likely to vanish as firms adjust their productive capacity.

4.2. Constant elasticity of substitution

4.2.1. Laissez-faire equilibrium

Under CES utility, the First Order Conditions of the bargaining problem Eqs. (12) and (13), can be written as

$$\Gamma(w,l,\xi)\,\frac{\beta w^{\xi}}{w(w^{\xi}+(1-l)^{\xi})}=\frac{(1-\beta)}{pl-w+c\theta}, \tag{34}$$

$$\Gamma(w,l,\xi)\,\frac{\beta(1-l)^{\xi}}{(1-l)\,(w^{\xi}+(1-l)^{\xi})}=\frac{(1-\beta)p}{pl-w+c\theta}, \tag{35}$$

where

$$\Gamma(w,l,\xi)\equiv\begin{cases}\dfrac{\left(\dfrac{w^{\xi}}{2}+\dfrac{(1-l)^{\xi}}{2}\right)^{1/\xi}}{\left(\dfrac{w^{\xi}}{2}+\dfrac{(1-l)^{\xi}}{2}\right)^{1/\xi}-\dfrac{1}{2}} & \text{if } \xi>0,\\[2ex] 1 & \text{if } \xi\le 0.\end{cases}$$

The two conditions jointly imply that $w=p^{1/(1-\xi)}(1-l)$. Unfortunately, it is impossible to characterize analytically the solutions for wages and hours worked when the elasticity of substitution between consumption and leisure is larger than one ($\xi>0$). Quasi closed-form solutions can instead be derived when $\xi\le 0$.[11] In this case, the expressions for consumption and leisure are

$$l_u=1-\frac{\beta(p+c\theta)}{p(1+p^{\xi/(1-\xi)})}, \tag{36}$$

$$w_u=\frac{\beta(p+c\theta)}{1+p^{-\xi/(1-\xi)}}. \tag{37}$$

To find the equilibrium employment level in this economy, plug in l_u and w_u into (7) and rearrange terms to obtain

$$p(1-\beta)-c[(r+s)\theta^{\zeta}+\beta\theta]=0. \tag{38}$$

Next, substitute n and l as given by Eqs. (4) and (36), respectively, into the expression of the marginal product of labor, (1), to get

$$p=\alpha A\left(\frac{(1+p^{\xi/(\xi-1)})(1+s\theta^{\zeta-1})}{1+p^{\xi/(\xi-1)}(1-\beta)-p^{1/(\xi-1)}c\beta\theta}\right)^{1-\alpha}. \tag{39}$$

[11] The source of complication is the term $\Gamma(w,l,\xi)$. The case $\xi>0$ can be dealt with only numerically (see Section 5).

Eqs. (38) and (39) jointly determine the equilibrium solution with respect to the endogenous variables p, θ. Once p and θ are determined, Eqs. (4), (36) and (37) can be used to obtain solutions for the equilibrium employment, hours worked and wages.

4.2.2. Equilibrium with hours regulation

Let us turn, now, to the bargaining problem with exogenous working time. The unique First Order Condition is given by (34), with the restriction that $l = l_r$. Using (7) to substitute away $(pl_r - w)$, we can rewrite (34) as follows:

$$\mu(w, l_r) \equiv \frac{(1-\beta)}{\beta} \frac{w^{\xi} + (1-l_r)^{\xi}}{\Gamma(w, l, \xi)} w^{1-\xi} = c\theta + (r+s)c\theta^{\zeta}. \tag{40}$$

Standard differentiation shows that, irrespective of the parameters, $\mu_w > 0$, while the sign of the partial derivative μ_l depends on the elasticity of substitution between consumption and leisure. In particular, it can be shown that $\xi \gtreqless 0 \Leftrightarrow \mu_l \lesseqgtr 0$.

Next, we use Eqs. (1) and (4) to substitute away p and n, respectively, and rewrite the steady-state employment demand condition, (7), as

$$w = \alpha A l_r^{\alpha}(s\theta^{\zeta-1} + 1)^{1-\alpha} - (r+s)c\theta^{\zeta}. \tag{41}$$

The equilibrium is characterized by the pair of equations (40) and (41), where w and θ are the endogenous variables. Fig. 4 provides a geometrical representation of the equilibrium in the plane (w, θ). Eq. (40) is described by the upward sloping curve WW, while Eq. (41) is described by the downward sloping curve DD. Consider now the effect of a reduction in the hours worked per employee, l_r. The decrease in l_r shifts the DD curve to the left, while its effect on the WW

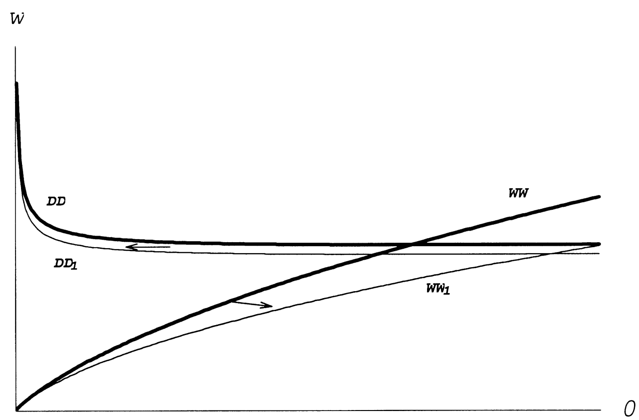

Fig. 4. Equilibrium under CES function ($\xi > 0$): effect of hours reduction.

curve depends on the sign of ξ. In particular, if $\xi < 0$ (implying $\mu_{l_r} > 0$), the WW curve shifts to the left. If $\xi > 0$, however (implying $\mu_{l_r} < 0$), the WW curve shifts to the right (as in Fig. 4). In the case of unit elasticity ($\xi = 0$), the WW curve does not move. This simple geometrical argument establishes the following proposition.

Proposition 5. If $\xi \leq 0$, *then reducing working time necessarily decreases the steady-state employment level. If* $\xi > 0$, *then reducing working time necessarily decreases the steady-state wage.*

Under CES, this model yields the following prediction: if consumption and leisure are more complementary than Cobb–Douglas preferences, reducing working time increases steady-state unemployment. Note that when $\xi \leq 0$, the effect of a reduction in hours on the total wage is ambiguous. If, however, $\xi > 0$, reducing hours certainly decreases wages and, *possibly*, unemployment. As the inspection of the equilibrium conditions (40)–(41) suggests, the range of parameters for which work-sharing has positive employment effects, given $\xi > 0$, increases with smaller α's (the shift to the right of the DD curve after a reduction in l_r tends to be dominated by the shift to the right of the WW).

The intuition for the result is the following. The more complementary are consumption and leisure, the more the marginal valuation of consumption to the workers increases with leisure. Thus, the lower is ξ, the more agresively workers negotiate their wages when working time is reduced. As a result, when $\xi \leq 0$, $pl - w$, namely, the share of the surplus accruing to intermediate firms goes down. In this case, the steady-state tightness of the labor market decreases when working time is reduced, irrespective of the initial working time. When $\xi > 0$, instead, workers are more prepared to substitute leisure for consumption, and wages fall more substantially. Note that, as ξ tends to one, the economy tends to behave as in the case of GHH, where the marginal utility of consumption is independent of leisure.

It is not possible to analytically sort the welfare implications of reducing hours under CES utility, as the oligopoly and employment effect now have an opposite sign, and the resulting expressions are involved. Nevertheless, our calibrations in Section 5 will show that, in a neighborhood of the laissez-faire equilibrium, workers typically gain from policies restricting working time. Thus, the distributional implications are the same under both GHH and CES preferences.

5. Calibration

In this section we provide the results of some numerical simulations, the aim of which is to provide a quantitative assessment of the importance of the effects identified in Sections 4.1 and 4.2.

We calibrate the parameters as follows. We interpret a time period of unit length to be one quarter, and set the annual interest rate at 4.5%. The separation rate is fixed at $s = 0.04$, implying an average duration of a match of about six years. The bargaining strength parameter is set equal to $\beta = 0.5$ (symmetric Nash solution), and the elasticity of the matching function is $\zeta = 0.5$. Note that $\beta = \zeta$ is the standard Hosios–Pissarides condition. The elasticity of output to labor, α, is set equal to 0.65, a standard value in both the growth and business cycle literature, where the output elasticity of labor is the competitive labor share. The calibration of r, s and α are rather standard, while the choice of $\beta = \zeta$ reflects the intent to focus on economies where changing working time around the laissez-faire triggers no large global welfare effects. The two remaining parameters, c (the hiring cost) and A (the TFP in the production function), are calibrated so as to keep the steady-state unemployment rate to 8% and $l = 0.55$ in the laissez-faire equilibrium across the different experiments. Moreover, to fix ideas, we assume that the $l = 1$ corresponds to 80 hours per week, implying that the laissez-faire solution yields 44 weekly working hours. Note that the average duration of unemployment implied by these parameters is approximately 9 months. The calibrated economy has, thus, an average duration of unemployment and unemployment rate which are somewhere in between the average in Europe and the US, although closer to the former than to the latter.

5.1. GHH preferences

Following the studies of Greenwood et al. (1988) and Correia et al. (1995), based on micro-evidence, we assume the intertemporal elasticity of substitution in labor supply to be 0.6, i.e., we set $\chi = 1.7$. We present the results for three different risk aversion parameters, ranging between the case of risk-neutrality ($v = 1$) and (almost) unit relative risk aversion ($v = 10{,}000$). As mentioned before, given our extreme assumption about market incompleteness, the latter represents the upper bound to the effects of risk aversion in this model.

The results are summarized in Table 1. For each of the different cases analyzed, we report – together with the parameters used – two series of statistics. The first column (Free) corresponds to the equilibrium solution given unrestricted bargaining between firms over both wages and hours. The second column (Restr) corresponds to the equilibrium solution under the assumption that the government imposes regulations on working time, so as to maximize the welfare of the employed. In the latter case (which will be referred to as a *labor-managed economy*), workers and firms only bargain on wages. For each economy we report the solutions for the steady-state working time (l), unemployment (u), wage (w), total hours ($l \cdot n$) and net GDP ($y - c\theta u$).

The length of the working week maximizing workers' utility is approximately 29 hours, corresponding to about two-thirds of the equilibrium working time under unconstrained bargaining. The size of the differences between a

Table 1
Simulations: GHH preferences

RRA	0 ($v = 1$)		0.8 ($v = 5$)		1.0 ($v = 10^3$)	
Regime	Free	Restr.	Free	Restr.	Free	Restr.
Hours	44	29	44	29	44	29
Un. rate	0.080	0.075	0.080	0.074	0.080	0.071
Wage	0.348	0.261	0.312	0.222	0.213	0.105
Total hours	40.5	26.8	40.5	26.9	40.5	26.9
GDP	0.503	0.382	0.477	0.354	0.406	0.270

laissez-faire and a labor managed economy changes with risk aversion, since this affects the wage response. In all cases, there is less unemployment in the labor managed than in the laissez-faire economy, with the decrease in the unemployment rate ranging between 0.5 and 0.9 points. Small employment effects imply that the total number of working hours in the economy is reduced by almost the full amount of the reduction in hours per worker. GDP (net of recruitment costs) falls by about a fourth.[12]

Fig. 5 plots, respectively, the unemployment rate (u), the welfare of the employed workers (W), the welfare of the unemployed workers (U) and the firms' profits (Π) as functions of the number of hours (l_r), for the case where $v = 5$. The dashed line corresponds to the laissez-faire equilibrium (44 hours). As discussed in Section 4.1, the relationship between employment and working time is non-monotonic (top left panel), with employment being maximized for a working time level below the free-market agreement. Workers' welfare is maximized at $l_r = 29$ (top right panel). Firms' profits, finally, increase monotonically with working time (bottom right panel).

An interesting experiment related to the ongoing policy debate in a number of European countries is to compare two regulated economies, with working weeks of 40 and 35 hours, respectively. We restrict our attention to $v = 1$ and $v = 5$, and retain the same values for A and c used for corresponding experiments in Table 1. As Table 2 shows, the differences in employment are very small. If we

[12] The value of (A, c) used in the different simulations reported in Table 1 are, respectively, $(0.798, 0.58)$, $(0.798, 2.12)$, $(0.798, 6.32)$. Since A and c are chosen to determine u and l_u, recruitment costs are not calibrated to real observations We checked, therefore, whether the relative size of the 'recruitment costs' implied by these experiments is realistic. Under risk neutrality, each firm's expenditure on recruitment turns out to be about 1.9% of the value of its gross GDP. In the other two cases ($v = 5$; $v = 10^3$), this percentage increases to 7% and 21%, respectively. Since recruitment costs in this model are meant to capture a variety of quasi-fixed cost, such as training, etc., we think that both 1.9% and 7% are in the range of 'reasonable' values.

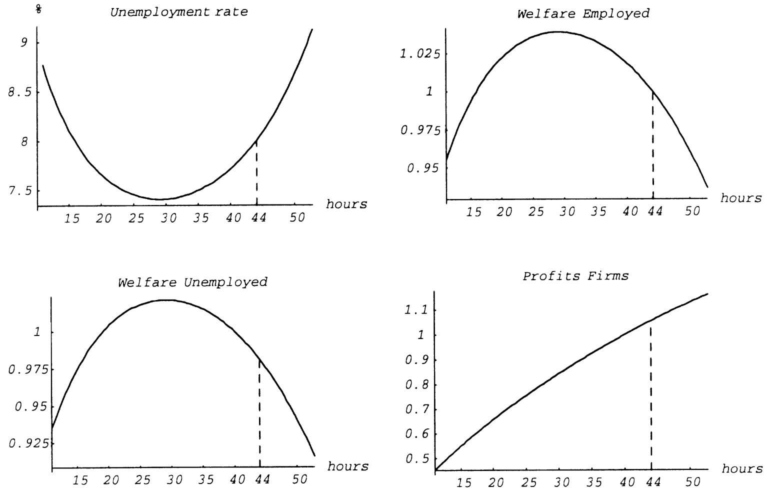

Fig. 5. Equilibrium under alternative worktime regulations.

Table 2
From 40 to 35 hours

RRA	0 ($v = 1$)		0.8 ($v = 5$)	
Hours	40	35	40	35
Un. rate	0.078	0.076	0.077	0.075
Wage	0.326	0.296	0.288	0.257
Total hours	36.9	32.4	36.9	32.4
GDP	0.473	0.431	0.446	0.403

compare the predictions of our model with the empirical estimates of Hunt (1999), we find that one standard hour reduction causes a reduction in total hours of about 2.4%, which is about Hunt's estimate. The employment effects predicted by our model are pretty small, also in line with the ambiguous effects found by Hunt. A reduction in standard hours of 12.5% causes an employment increase of about 0.23%, with an implied elasticity of 0.02. Moreover, steady-state GDP falls by about 9%, a fairly large amount. Fig. 5 shows, however, that workers are better off with 35 than with 40 hours. Note that the results would not change significantly, considering economies with a higher structural unemployment rate. If, for instance, we set the parameters so that the unemployment rate in the 40 hours economy is 11% (about the average unemployment rate in

Continental Western Europe), the unemployment rate of the 35 hours economy would be 10.7%.

5.1.1. *A policy design experiment: Working time reduction vs. unemployment benefits*

In the calibrated economies just analyzed, the government may want to introduce working time regulation in order to achieve a redistributional goal. But are there more efficient ways of achieving the same goal? The answer to this question depends, of course, on the range of policy instruments considered. In this section, we limit attention to a particular alternative labor policy, namely granting benefits to the unemployed to such an extent that employed workers achieve the same utility as in the labor managed economy, with restricted hours. In this model, unemployment benefits are valuable to the workers, even when risk neutral, for two reasons. First, they increase utility during unemployment. Second, they increase the workers' bargaining power by increasing the value of their outside option.

Unemployment benefits are assumed to be financed by taxing final good firms' profits. We restrict our attention to the case of linear utility ($v = 1$), and set $A = 0.798$ and $c = 0.58$, so as to generate a laissez-faire 8% unemployment rate (the same economy as in the first column of Table 1). The results are summarized in Table 3.

In order to make the employed workers' welfare equal to what they would attain in a *labor managed economy*, the government must raise the replacement ratio from zero to about 31%. In the resulting laissez-faire-cum-benefits equilibrium, the unemployed workers are, on the one hand, marginally better off than in the *labor managed economy*. Firms' losses are, on the other hand, much smaller. They suffer a 14% loss compared to the laissez-faire economy, whereas the corresponding loss is of the order of 25%, if redistribution is achieved via

Table 3
Benefits vs. WTR

Regime	Free	Restr.	Free
Repl. ratio	0	0	0.31
Hours	44	29	45
Un. rate	0.080	0.075	0.139
Wage	0.348	0.261	0.373
Total hours	40.5	26.8	38.7
GDP	0.503	0.382	0.490
W/W_{free}	1	1.16	1.16
U/U_{free}	1	1.16	1.17
Π/Π_{free}	1	0.75	0.86

working time reduction. The unemployment rate is, on the other hand, much higher in the laissez-faire-cum-benefits equilibrium (13.9% vs. 7.4%), while output falls considerably less in comparison with the laissez-faire economy. Note that unemployment benefits have, qualitatively, the opposite effect to working time reduction: they reduce the number of employees, whereas those employed are induced to work for longer hours and earn higher wages.

These results should be read with caution, and are only intended to give a broad sense of the order of magnitude of the effects involved. A major limitation is that the provision of benefits is financed through non-distortionary taxation, reducing the deadweight loss associated with this policy. When taxation issues are introduced into the analysis, however, it should be recalled that the output loss caused by working time reduction would generate a reduction in the government tax revenue which must be compensated for by additional distortionary taxation.

5.2. CES preferences

In the CES case, we need to parameterize the elasticity of substitution between consumption and leisure. We consider values of elasticities ranging between 0.2 ($\xi = -4$), and 2 ($\xi = 0.5$). The lower bound corresponds to the time series estimation of Alogoskoufis (1987a) with UK data. Cross-sectional analysis, in particular, finds that individuals earning higher hourly wages work more hours in the market than workers with low wages. This is consistent with consumption and leisure being substitutes rather than complements (as well as being consistent with GHH preferences). The elasticity of working hours to wages is estimated to be around 0.2 by Zabel (1993) using PSID, while earlier studies where direct and participation effects were compounded had found even large estimates of this elasticity. Since the existing evidence is mixed, we consider a wide range of elasticities.

Table 4 summarizes the results.[13] Coherently with the theoretical results of Section 4.2, when $\xi \leq 0$, the unemployment rate is higher in the labor managed than in the laissez-faire economy. The more complementary are consumption and leisure, the more negative are the employment effects of restrictions on working hours. With Cobb–Douglas preferences ($\xi = 0$), for instance, the unemployment rate in the labor-managed economy is 0.7% higher than in the laissez-faire economy, while the difference increases to 3%, when the elasticity is 0.2 ($\xi = -4$). Yet, even when this causes higher unemployment, employed

[13] The parameters (A, c) used in each of the four simulations are, respectively (1.18, 3.80), (1.16, 3.70), (1.2, 3.85) and (1.53, 0.553).

Table 4
Simulations: *CES* preferences

Elast.	0.2 ($\xi = -4$)		0.5 ($\xi = -1$)		1.0 ($\xi = 0$)		2.0 ($\xi = 0.5$)	
Reg.	Free	Restr.	Free	Restr.	Free	Restr.	Free	Restr.
l	44	32.9	44	32.6	44	34	44	30.4
u	0.080	0.110	0.080	0.097	0.080	0.087	0.080	0.076
w	0.447	0.385	0.440	0.365	0.451	0.379	0.682	0.531
y	0.758	0.613	0.746	0.606	0.767	0.649	0.984	0.775

workers' welfare is maximized when a relatively large restriction on working time is imposed (in these calibrations, the welfare of the unemployed is also increased by the corresponding reduction of working time). This shows that the 'oligopoly' effect tends to dominate the general equilibrium 'employment' effect in determining workers' preferences for regulation. Note that, in contrast with the GHH case, a conflict of interests arises now not only between workers and final good firms, but also between workers and intermediate good firms with a filled position, which suffer a reduction in their net cash flow, $pl - w$, when hours are cut (recall that this is the reason why θ and n fall).

The analysis showed that, when $\xi \geq 0$, employment effects are ambiguous. As shown by the last two columns in Table 4, when the elasticity of substitution equals two, the solution resembles that under GHH preference. In particular, it turns out that unemployment is a U-shaped function of working time, decreasing at the laissez-faire solution, l_u. Unemployment is lower in the labor managed than in the laissez-faire economy.

Overall, the patterns described in Fig. 5 generalize to the CES case, except that the schedule in the top left panel is uniformly downward sloping when $\xi \leq 0$. Yet, even in this case where unemployment increases when working time is reduced, the welfare of both employed and unemployed workers is maximized by a regulation imposing working time below laissez-faire.

6. Overtime

So far, we have restricted our attention to an extreme form of regulation, where an employee can only work a given number of hours as set by the legislation. It is common practice, however, to allow overtime, although firms are, in many countries, subject to pecuniary penalties as well as to various types of constraints on their use. In this section, we extend the model to introduce this feature. We assume that firms can employ workers for a longer time than the statutory hours, but must pay an extra-cost proportional to the number of extra hours. Workers and firms bargain on wages and hours subject to such regulations. We define τ as the surcharge paid by the firm on each extra hour of work and $\bar{w}$ as the normal hourly wage. We still denote statutory hours by l_r, but in this case, the actual working time need not be equal to l_r.[14] For simplicity, we only study the case of GHH preferences.

The modified steady-state labor demand equation can be written as follows:

$$pl - (\bar{w} + \tau)l + \tau l_r - c(r + s)\theta^{\zeta} = 0. \tag{42}$$

We first consider a case where the additional costs suffered by firms are transferred to the workers as a premium on the extraordinary hours worked. This implies that the total wage of an individual worker can be decomposed into two parts: $\bar{w}l$, defining the normal compensation, and $\tau(l - l_0)$, defining the premium for extraordinary hours. Workers and firms are assumed to bargain $\bar{w}$ and l, taking τ and l_0 as given. However, since agents, when bargaining, understand that only total payments matter, the following neutrality result follows (proof in Marimon and Zilibotti, 1999):

Proposition 6. If the surcharges paid by firms for overtime are transferred to the workers as additional compensation (*overtime premium*), *then the equilibrium solution is identical to the laissez-faire equilibrium*, *irrespective of* τ *and* l_r.

In many countries – see the recent proposal for a 35 hours working week in Italy, for instance – surcharges for overtime have the nature of sunk costs which are not transferred to the workers (e.g., higher taxes). In this case, regulations have real effects, as will now be shown. When workers only receive the normal wage, although firms must pay surcharges on extra hours, the FOC's of the bargaining problem (cf. (16)–(17)) become – restricting attention to interior solutions with a positive number of extraordinary hours worked:

$$\frac{\beta}{v(\bar{w}l - (1/\chi)l^{\chi})} = \frac{(1-\beta)}{pl - \bar{w}l - \tau(l - l_r) + c\theta}, \tag{43}$$

$$\frac{\beta}{v(\bar{w}l - (1/\chi)l^{\chi})}\,(\bar{w} - l^{\chi-1}) = \frac{1-\beta}{pl - \bar{w}l - \tau(l - l_r) + c\theta}\,(p - \bar{w} - \tau). \tag{44}$$

[14] The choice of modeling the extra cost as an absolute fee, τ, on each extraordinary hour worked, rather than, more realistically, as a percentage of the normal hourly wage is motivated by tractability. No major result would change in the alternative set-up, but it becomes impossible to obtain closed-form solutions. The choice of having hourly rather than total wages is instead purely expositional. The results would be identical if we let agents bargain on total instead of hourly normal wages.

Hence,

$$l^* = \mathrm{Max}[(p-\tau)^{1/(\chi-1)}, l_r], \tag{45}$$

$$w^* = \bar{w}^* l^* = \begin{cases} \gamma\left[\left(\dfrac{(1-\beta)v}{\chi} + \beta\right)(p-\tau)^{\chi/(\chi-1)} + \beta(c\theta + \tau l_r)\right] & \text{if } l^* > l_r, \\ \gamma\left[(1-\beta)v\dfrac{l_r^\chi}{\chi} + \beta(pl_r + c\theta)\right] & \text{if } l^* = l_r, \end{cases} \tag{46}$$

where γ is as defined as in Section 4.1. Consider the range of interior solutions, where $l^* > l_r$. Substituting the values of l^* and $\bar{w}^*$ into (42), and rearranging terms, we obtain

$$\Lambda(p,\theta,l_r,\tau) \equiv \gamma v(1-\beta)\left[\frac{\chi-1}{\chi}(p-\tau)^{\chi/(\chi-1)} + \tau l_r\right] - c[(r+s)\theta^\zeta + \beta\gamma\theta] = 0, \tag{47}$$

where standard differentiation shows that $\Lambda_p > 0$, $\Lambda_\theta < 0$, $\Lambda_{l_r} > 0$ and $\Lambda_\tau \leq 0$. In particular, note that $\Lambda_\tau = -\gamma v(1-\beta)(l-l_r)$.

Next, substitute n and l as given by (4) and (45) into the expression of the marginal product of labor, (1) (in the case when $l^* > l_r$) to obtain

$$\Gamma(p,\theta,\tau) = p - \alpha A(1 + s\theta^{\zeta-1})^{1-\alpha}(p-\tau)^{(\alpha-1)/(\chi-1)} = 0, \tag{48}$$

where $\Gamma_p > 0$, $\Gamma_\theta > 0$, $\Gamma_\tau < 0$. Eqs. (47) and (48) determine the equilibrium solution with respect to the endogenous variables p, θ. The effects of legal restrictions on hours can be seen by studying Fig. 6. The positively sloped curve, BB, represents Eq. (47), while the negatively sloped curve, AA, represents Eq. (48). Consider the (steady-state) effect of increasing statutory hours, while keeping τ fixed. Since $\Lambda_{l_r} > 0$ (while Γ is independent of l_r), increasing l_r shifts the BB curve to the right, while the AA curve remains unchanged. Thus, it increases θ and decreases p. Therefore, an increase in statutory hours – when overtime is allowed and in the range where it is used – always increases employment. Reducing statutory hours, on the other hand, reduces employment in the same case.

Consider, now, the effect of changes in τ. Since $\Gamma_\tau < 0$ and $\Lambda_\tau \leq 0$, increasing τ shifts the BB curve to the left and the AA curve to the right, with ambiguous

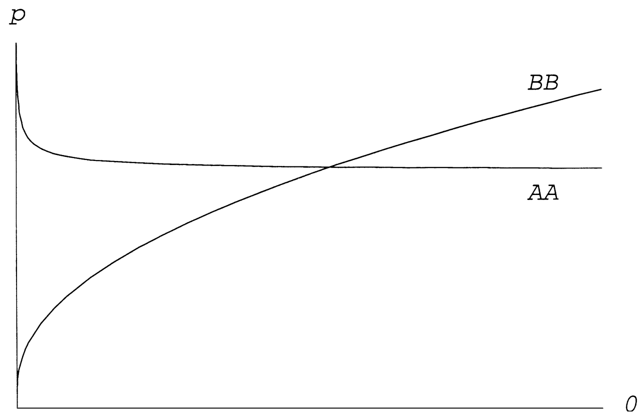

Fig. 6. Equilibrium with overtime.

effects on θ and employment. Nevertheless, an interesting *local* result can be established. Consider an economy where – for given l_r – surcharges are sufficiently high to deter firms from using extra hours, i.e., $l^* = l_r$. Then, decrease τ progressively to the level where firms start using overtime. At this level of taxes, we know that $l^* = l_r$, hence $\Lambda_\tau = -\gamma v(1-\beta)(l-l_r) = 0$. Therefore, the BB curve does not move, while the AA curve shifts to the left, causing a fall in θ. More in general, starting from sufficiently large values of τ, increases in the price of overtime increase employment.

The main results of this section are summarized by the following proposition.

Proposition 7. Assume that, given the initial tax on overtime, τ^0, and the statutory number of hours, l_r^0, there is overtime in equilibrium (i.e., $l^* > l_r^0$). Then,

(A) *if τ^0 is kept constant, reducing statutory working time decreases employment, i.e.,* $\mathrm{d}n/\mathrm{d}l_r > 0$.

(B) (*at least*) *for sufficiently large values of τ^0, employment can be increased by levying higher taxes on overtime* (*more formally,* $\exists \hat{\tau} < \infty$ *such that,* $\forall \tau > \hat{\tau}$, $\mathrm{d}n/\mathrm{d}\tau \geq 0$, *with* $>$ *for some* $\tau > \hat{\tau}$).

The intuition for the first result is the following. When overtime is used in equilibrium, the number of statutory hours can be regarded as the number of inframarginal hours which is 'subsided', namely, on which the government renounces to levy taxes which are, instead, levied on the marginal hour worked. Thus, the scheme is equivalent to one in which the government taxes hours (or value added) at the flat rate τ and rebates lump sum to each firm the amount τl_0. Since this rebate is in terms of per employee, it plays the role of a 'hiring' subsidy. Reducing l_0 amounts to reducing this subsidy, and makes overtime in existing firms more profitable than posting new hirings. Increasing the tax rate on overtime, τ, has, instead, the opposite effect.

Proposition 7 has interesting normative implications. If the government wants to restrict working time with the objective of promoting employment, it should discourage the use of extraordinary hours either by legislation or by enforcing severe surcharges, but not by decreasing the number of statutory hours while keeping penalties on the use of extra hours moderate.

7. Conclusions

Our work suggests that there need not be any irrationality behind the fact that, when the balance of political equilibrium shifts in favor of the workers (as seems to have been the case in several European countries in the late 1990s), the old call for reducing working time by decree emerges again. It is a different matter, however, to assess whether this policy will mitigate the European unemployment problem. To this respect, our paper broadly agrees with the past literature, both theoretical (Calmfors, 1985; etc.) and empirical (Hunt, 1999), in *calling for caution*. The conditions for obtaining even small employment effects are rather restrictive. In particular, productive factors which complement labor – such as capital in our model – should not be able to adjust to the policy intervention. This might explain why some proponents would like these policies to be implemented at the largest scale possible, e.g., the EU. Moreover, the output loss which this policy would cause may be quite large. Although we have not addressed this issue explicitly, reducing working time is likely to have a negative impact on the government budget of the countries which choose to adopt this policy (even more when, as now in France, they are accompanied by subsidies not directed at job creation).

Our theory suggests that the historical reduction from 80 to 40 (perhaps, soon, 35) hours together with the reduction in the retirement age might be the result of the increasing organizational strength and political influence of the workers in capitalist societies. Given the results of our paper, one may wonder how this can have been consistent with steady growth of GDP per worker. On the one hand, technical progress might have been fast enough to more than offset the effects of working time reduction. On the other hand, our analysis does not analyze an important point, which is that technologies may adapt to the new working time regulations in the long run. When this is taken into account, the output effects of working time restrictions may be substantially less dramatic than implied by our calibration.

Several important aspects and extensions are left open for future research. For example, we have only considered steady states without getting into the interesting issues about transitional dynamics. We have ignored the possible role of nominal rigidities, implying that total wages adjust with delay to the reduction of hours. We have restricted our attention to wage setting through bargaining, although we believe our results to be quite robust along this dimension. Similarly, we have not considered other mechanisms that may rationalize 'working time regulations'.[15] Our model does not consider possible 'social coordination' problems, nor the possibility that workers like restrictions on working time to avoid that employers exploit some type of yardstick competition mechanism to induce them to overwork. Finally, one might want to introduce heterogeneity among workers (where some of them might gain and other lose from the policy), as well as among employers' organizations (some industries may benefit more than others from agreements exchanging hours for flexibility) or trade unions. Although important for a more accurate quantitative assessment of the policy, most of these generalizations are unlikely to substantially change our main findings.

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[15] Drèze (1987, 1991), for instance, argues that the substitution of hours/employee with newly hired workers is also beneficial from the standpoint of social efficiency, as employers typically do not properly internalize the social effect of hiring a new worker and have an inefficient bias for asking current employees to work longer hours.

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