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On the Effect of Parental Leave Duration on Unemployment and Wages

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Abstract

We introduce parental leave policies in a labour search and matching model and study the effect of leave duration on unemployment and wages. We show that the effects are ambiguous and depend on whether the ratio of wage bargaining power of employer relative to worker is higher or lower than the ratio of the net value of the leave for employer relative to worker. Our theoretical results suggest that simulated labour market outcomes in search and matching models may be sensitive to the calibration of key parameters that we identify.

Keywords: parental leave, search and matching

JEL Classification: E24, J38

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1 Introduction

Maternal and parental leaves are a fundamental component of family policy in most OECD countries (Thévenon and Solaz, 2013). However, leave policies differ significantly across countries. In this note we explore the effect of parental leave duration, one of the aspects that is found to differ the most, on wages and unemployment.

We consider a labour search and matching model in which a worker can be unemployed, working or on job protected leave. While the worker is on leave the firm incurs a productivity loss but also saves the cost of opening a vacancy as the worker is expected to return to the job. Similarly, the worker enjoys a benefit (e.g. the value of leisure and payment, if any) that needs to be compared with the benefit of the best alternative to the leave if not working (i.e. unemployment). Firms decide whether to open a vacancy under a free entry condition and, when firms and workers are matched, wages are determined through Nash bargaining.

We show that the effects of leave duration on wages and unemployment are ambiguous and depend on whether the ratio of wage bargaining power, of employer relative to worker, is higher or lower than the ratio of the net value of the leave, for employer relative to worker. If the leave yields a net benefit to workers and a net cost to firms, an increase in leave duration has a negative effect on wages but an ambiguous effect on unemployment. If the leave yields a net cost to workers (i.e. unemployment is more attractive) and a net benefit to firms, then leave duration increases unemployment but has an ambiguous effect on wages.

Our paper is related to Erosa et al. (2010). They were the first to develop a general equilibrium model of fertility and labor market decisions within a search and matching framework. They consider three types of workers - males, non-fertile women and fertile women - who decide whether to have children and take leave. Parental leave policies affect equilibrium allocations through three channels: (i) a bargaining channel in which females have the option of taking a parental leave; (ii) a redistributive channel where paid parental leaves redistribute resources from taxpayers to mothers on leave and; (iii) a job creation channel that reduces the value of posting vacancies which, in turn, reduces the job finding rate and increases the unemployment rate. Their model is comprehensive, but also relatively complex, and they resort to calibrations to evaluate the welfare effects of leave policies on fertility, leave take-up and employment.

Our simpler model focuses on the job creation channel and provides empirically testable theoretical results. In addition, our results suggest that simulated labour market outcomes in search and matching models may be sensitive to the calibration of key parameters that we identify.

2 The model

This economy consists of a measure 1 of risk-neutral, infinitely-lived workers and risk-neutral, infinitely-lived firms. Workers and firms discount future payoffs at a common rate r and capital markets are perfect. Time is continuous.

There is a time-consuming and costly process of matching unemployed workers and job vacancies, which is captured by a standard constant-return-to-scale matching function:

$$g(u, v) = g_o u^{\alpha} v^{(1-\alpha)}, \tag{1}$$

where u denotes the number of unemployed workers, v is the number of vacancies, and α and g_o are the matching function parameters. Hence, the aggregate rate at which unemployed workers find jobs, $p(\theta) = \frac{g(u,v)}{u}$, and vacancies are filled, $q(\theta) = \frac{g(u,v)}{v}$, depends on the vacancy-unemployment ratio θ, also known as market tightness, where $p(\theta) = \theta q(\theta)$ and $p'(\theta) > 0$, $q'(\theta) < 0$.

A job can be either filled or not. If the position is not filled, the firm incurs a flow cost c. A vacancy is filled at the endogenous rate $q(\theta)$, yielding a positive value $J - V$, where J and V stand for the value that the firm attributes to a filled and vacant position, respectively.

Each firm has a constant-returns-to-scale production technology with labor as the unique production factor, which generates an instantaneous profit equal to the difference between the constant labor productivity A and the labor cost w. Filled positions can be either destroyed at hazard rate s or interrupted at hazard rate σ if the worker moves to the status of parental leave. The capital loss is represented by $J - V$ when the position is destroyed and $J - X$ when the worker is on parental leave, where X stands for the value that the firm attributes to the parental leave. While the worker is on leave the firm incurs a net productivity loss ψ per period until the individual returns to his job at hazard rate γ. The values V, J and X are given by the following expressions:

$$rV = -c + q(\theta)(J - V), \tag{2}$$

$$rJ = A - w - \sigma(J - X) - s(J - V), \tag{3}$$

$$rX = -\psi + \gamma(J - X). \tag{4}$$

An unemployed individual gets value b and with probability $p(\theta)$ finds a job that yields net value $W - U$, where W and U stand for the value that the worker attributes to employment and unemployment, respectively. Employed workers earn the endogenous wage w, and can either lose their jobs at rate s or move to the status of parental leave at rate σ. A worker on parental leave enjoys value z and returns to the job position at rate γ. This generates a net gain $W - L$, where L stands for the value that the worker attributes to being on parental leave.[1] The inverse of γ represents the average duration of the parental leave. The values associated with the different worker status - unemployed (U), employed (W) and on parental leave (L) - are given by the following expressions:

$$rU = b + p(\theta)(W - U), \tag{5}$$

$$rW = w - s(W - U) - \sigma(W - L), \tag{6}$$

$$rL = z + \gamma(W - L). \tag{7}$$

To close the model, we invoke two standard assumptions: free entry condition for vacancies and bilateral Nash bargaining over wages. The free entry condition for vacancies, whereby firms open vacancies until the expected value of doing so becomes zero, implies

$$V = 0. \tag{8}$$

Since neither workers nor employers can instantaneously find an alternative match partner in the labor market, and since hiring decisions are costly, a match surplus exists: $S = J + W - U$. To divide this surplus between the firm and the worker, we assume wages are the result of bilateral Nash bargaining. The Nash solution is the wage that maximizes the weighted product of the worker's and the firm's net return from the job match. The first-order condition yields the following equation:

$$(1 - \beta)(W - U) = \beta J, \tag{9}$$

[1] Both b and z may include transfers or income support when unemployed or on leave, respectively.

where β and $1-\beta$ represent the bargaining power of the worker and the firm, respectively.

3 The equilibrium

Dynamics of unemployment

Given the state-contingent ratio of vacancies to unemployment θ, unemployment u and employment e evolve according to the following backward-looking differential equations:

$$\dot{u} = se - p(\theta)u, \tag{10}$$

$$\dot{e} = -se + p(\theta)u. \tag{11}$$

At equilibrium, $\dot{u} = 0$. Then, using (10) and the fact that individuals are either employed or unemployed:[2]

$$1 = e + u, \tag{12}$$

we get the equilibrium unemployment level:

$$u = \frac{s}{s + p(\theta)}. \tag{13}$$

The unemployment rate is $u = s/\left(s + p(\theta)\right)$.

Job creation by firms

(2) and (8) imply that the expected value to the firm of filling a position must equal at equilibrium the cost of opening the vacancy:

$$J = \frac{c}{q(\theta)}. \tag{14}$$

A second condition for J can be derived using (3) and (4):

$$J = \frac{(r+\gamma)(A-w) - \sigma\psi}{r(r+\sigma+s) + \gamma(s+r)}. \tag{15}$$

Equilibrium wage

To find the equilibrium wage, we first calculate $W - U$, using (5) to (7), and then substitute the result, together with (15), in (9). After some manipulation, we get:[3]

$$w = b - \frac{\sigma\left(z-b\right)}{r+\gamma} + \beta\left[A - b + \frac{\sigma\left(z-b-\psi\right)}{r+\gamma} + \frac{c}{q(\theta)}\left(\frac{p(\theta)\left(r+\sigma+\gamma\right)+\sigma r}{r+\gamma}\right)\right]. \tag{16}$$

[2] Note that individuals on leave are employed.
[3] See Appendix A for details.

(16) expresses the wage as the sum of the value to the worker outside the match and the fraction of the surplus that accrues to the worker.

4 Effect of leave duration on unemployment and wages

In this section we analyze the effect of leave duration on unemployment and wages. To do that we use the system of two equations that determines market tightness θ and wages w at equilibrium:

$$\frac{(r+\gamma)(A-w)-\sigma\psi}{r(r+\sigma+s)+\gamma(s+r)}-\frac{c}{q(\theta)}=0 \text{ and}$$

$$w-b+\frac{\sigma\,(z-b)}{r+\gamma}-\beta\left[A-b+\frac{\sigma\,(z-b-\psi)}{r+\gamma}+\frac{c}{q(\theta)}\left(\frac{p(\theta)\,(r+\sigma+\gamma)+\sigma r}{r+\gamma}\right)\right]=0,$$

and apply Cramer's rule.[4] It can be shown that the effect of γ on θ and w hinges on whether

$$\frac{1-\beta}{\beta}\lesseqgtr\frac{\frac{c\,(p(\theta)+r)}{q(\theta)}-\psi}{z-b}, \tag{17}$$

i.e. on whether the ratio of the bargaining power $(1-\beta)/\beta$ is larger or smaller than the ratio of the net value of the leave for the firm relative to the worker. As mentioned before the parental leave involves both costs and benefits to the firm: even though the firm incurs a productivity loss ψ while the worker is on leave it saves the cost of opening a vacancy for a regular position, represented by $c\,(p(\theta)+r)\,/q(\theta)$ in (17). Similarly, the worker's benefit when on leave z needs to be compared with the benefit of the best alternative to the leave if not working, i.e. benefit when unemployed b.

Proposition 1. *Let* $C=\frac{c\,(p(\theta)+r)}{q(\theta)}$.

1. *If* $(1-\beta)\,(z-b)>\beta\,(C-\psi\;)$, *then* $\frac{dw}{d\gamma}>0$*: An increase in leave duration (decrease in* γ*) reduces the equilibrium wage but has an ambiguous effect on market tightness and unemployment.*

2. *If* $(1-\beta)\,(z-b)<\beta\,(C-\psi\;)$, *then* $\frac{d\theta}{d\gamma}>0$ *and* $\frac{du}{d\gamma}<0$:[5] *An increase in leave duration (decrease in* γ*) decreases the market tightness and increases unemployment but has an ambiguous effect on the equilibrium wage.*

[4] See Appendix B for details.

[5] Note that $\frac{du}{d\gamma}=\frac{-sp'(\theta)\frac{d\theta}{d\gamma}}{s+p(\theta)}$.

If leave policies yield a net benefit to workers and a net cost to firms, which corresponds to the first case, increasing the leave duration would then likely have a negative effect on wages but an ambiguous effect on market tightness and unemployment.

Recent evidence emphasizes gender differences in wage bargaining. In particular, the literature points out that women are less likely both to bargain on starting wages and to ask for pay raises than men. This implies that they have relatively lower wage bargaining power β and helps to explain part of the gender wage gap (Card et al., 2015). Interestingly, Proposition 1 has the following Corollary:

Corollary 1. If $\beta = 0$, an increase in leave duration (decrease in γ) reduces the equilibrium wage and has an ambiguous effect on unemployment when $z > b$ (the opposite happens when $z < b$).

5 Concluding remarks

In this paper we have considered a single type of worker. This could correspond to a benchmark situation in which all workers - men and women - are treated the same, or alternatively to a situation with segmented markets in which only women are entitled to take a leave. In reality, men and women often compete for the same jobs. Firms will take this into consideration when determining the value of posting a vacancy. Then, although leave entitlements are mainly enjoyed by females in OECD countries (from 54.4% in Iceland to 99.5% in Australia of total users of paid parental leave - see OECD, 2016), they can also affect male outcomes. We plan to extend the model to two types of workers to be able to analyze the effects of type-specific parental leave policies on both males and females.

References

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A Equilibrium wage

The equilibrium wage is the solution to the Nash bargaining problem:

$$w = \arg\max [W(w) - U]^{\beta} [J(w)]^{1\text{-}\beta}.$$

The first order condition yields equation (9):

$$(1-\beta)(W-U) = \beta J.$$

To obtain J we rewrite equations (3) and (4) as:

$$J = \frac{A - w + \sigma X}{r + \sigma + s}, \tag{A.1}$$

$$X = \frac{-\psi + \gamma J}{r + \gamma}. \tag{A.2}$$

We then plug (A.2) into (A.1) to obtain (15).

To obtain $W - U$, we substract rU from both sides of (6) and rearrange:

$$W - U = \frac{w - \sigma(W - L) - rU}{r + s} \tag{A.3}$$

To obtain $W - L$, we use (6) and (7) and rearrange:

$$W - L = \frac{w - z - s(W - U)}{r + \sigma + \gamma}. \tag{A.4}$$

Plugging (A.4) and (5) into (A.3), and rearranging, we get:

$$W - U = \frac{(r+\gamma)(w-b) + \sigma(z-b)}{(r+p(\theta))(r+\sigma+\gamma) + (r+\gamma)s}. \tag{A.5}$$

Plugging (15) and (A.5) into (9), we get:

$$(1-\beta)\left(\frac{(r+\gamma)(w-b) + \sigma(z-b)}{(r+p(\theta))(r+\sigma+\gamma) + (r+\gamma)s}\right) = \beta\frac{(r+\gamma)(A-w) - \sigma\psi}{r(r+\sigma+s) + \gamma(s+r)}. \tag{A.5}$$

We solve for w:

$$w = b - \frac{\sigma\,(z-b)}{(r+\gamma)} + \beta\left[A - b + \left(\frac{(A-w)(r+\gamma)-\sigma\psi}{r+\gamma}\right)\frac{p(\theta)\,(r+\sigma+\gamma)+\sigma r}{r(r+\sigma+s)+\gamma(s+r)} + \frac{\sigma\,(z-b-\psi)}{(r+\gamma)}\right]. \tag{A.6}$$

Plugging (15) into equation (14) we get:

$$\frac{(r+\gamma)(A-w)-\sigma\psi}{r(r+s)+(\sigma+\gamma)\,r+\gamma s} = \frac{c}{q(\theta)}. \tag{A.7}$$

We use (A.7) to rewrite (A.6) as (16).

B Comparative statics

To analyze the effect of leave duration on unemployment and wages we use the system of two equations that determines the vacancy-unemployment ratio, or market tightness, θ, and the wage w (equations (A.7) and (16), which we denote Y and Z in this section for notational simplicity):

$$Y : \frac{(A-w)(r+\gamma)-\sigma\psi}{r(r+s)+(\sigma+\gamma)\,r+\gamma s} - \frac{c}{q(\theta)} = 0$$

and

$$Z : w - b + \frac{\sigma\,(z-b)}{r+\gamma} - \beta\left[A - b + \frac{\sigma\,(z-b-\psi)}{r+\gamma} + \frac{c}{q(\theta)}\left(\frac{p(\theta)\,(r+\sigma+\gamma)+\sigma r}{r+\gamma}\right)\right] = 0.$$

In order to apply Cramer's rule we first calculate and, where possible, sign, all the relevant derivatives. For equation Y:

$$\frac{\partial Y}{\partial \theta} = \frac{q'(\theta)c}{q(\theta)^2} < 0, \tag{B.1}$$

$$\frac{\partial Y}{\partial w} = \frac{-(r+\gamma)}{r(r+s)+(\sigma+\gamma)\,r+\gamma s} < 0, \tag{B.2}$$

$$\frac{\partial Y}{\partial \gamma} = \frac{\sigma r(A-w)+\sigma\psi\,(r+s)}{(r(r+s)+(\sigma+\gamma)\,r+\gamma s)^2} > 0, \tag{B.3}$$

$$\frac{\partial Y}{\partial z} = 0. \tag{B.4}$$

For equation Z:

$$\frac{\partial Z}{\partial \theta} = -\beta c\left(\frac{p'(\theta)\,(r+\sigma+\gamma)}{q(\theta)\,(r+\gamma)} - \frac{(p(\theta)\,(r+\sigma+\gamma)+\sigma r)\,q'(\theta)\,(r+\gamma)}{(q(\theta)\,(r+\gamma))^2}\right) < 0, \tag{B.5}$$

$$\frac{\partial Z}{\partial w} = 1, \tag{B.6}$$

$$\frac{\partial Z}{\partial \gamma} = \frac{\sigma}{(r+\gamma)^2}\left((1-\beta)\,(b-z) + \beta\left(\frac{c\,(p(\theta)+r)}{q(\theta)} - \psi\right)\right) \gtrless 0, \tag{B.7}$$

$$\frac{\partial Z}{\partial z} = (1-\beta)\,\frac{\sigma}{r+\gamma} > 0. \tag{B.8}$$

We write the system in matrix form and apply Cramer's rule.

Recall that $1/\gamma$ represents the duration of the parental leave. To determine the effect of leave duration on market tightness θ and equilibrium wage w we compute, respectively:

$$\frac{d\theta}{d\gamma} = \frac{\begin{vmatrix} -\frac{\partial Y}{\partial \gamma} & \frac{\partial Y}{\partial w} \\ -\frac{\partial Z}{\partial \gamma} & \frac{\partial Z}{\partial w} \end{vmatrix}}{\begin{vmatrix} \frac{\partial Y}{\partial \theta} & \frac{\partial Y}{\partial w} \\ \frac{\partial Z}{\partial \theta} & \frac{\partial Z}{\partial w} \end{vmatrix}}, \tag{B.9}$$

$$\frac{dw}{d\gamma} = \frac{\begin{vmatrix} \frac{\partial Y}{\partial \theta} & -\frac{\partial Y}{\partial \gamma} \\ \frac{\partial Z}{\partial \theta} & -\frac{\partial Z}{\partial \gamma} \end{vmatrix}}{\begin{vmatrix} \frac{\partial Y}{\partial \theta} & \frac{\partial Y}{\partial w} \\ \frac{\partial Z}{\partial \theta} & \frac{\partial Z}{\partial w} \end{vmatrix}}. \tag{B.10}$$

Note also that, since the unemployment rate is given by equation (10):

$$\frac{du}{d\gamma} = \frac{-sp'(\theta)\frac{d\theta}{d\gamma}}{s+p(\theta)}. \tag{B.11}$$

The determinant in the denominator of both equations (B.9) and (B.10) has a negative sign. Hence:

$$sign\left(\frac{d\theta}{d\gamma}\right) = sign\left(\overset{+}{\frac{\partial Y}{\partial \gamma}}\overset{+}{\frac{\partial Z}{\partial w}} - \overset{?}{\frac{\partial Z}{\partial \gamma}}\overset{-}{\frac{\partial Y}{\partial w}}\right),$$

$$sign\left(\frac{dw}{d\gamma}\right) = sign\left(\overset{-}{\frac{\partial Y}{\partial \theta}}\overset{?}{\frac{\partial Z}{\partial \gamma}} - \overset{-}{\frac{\partial Z}{\partial \theta}}\overset{+}{\frac{\partial Y}{\partial \gamma}}\right).$$

The signs of both $d\theta/d\gamma$ and $dw/d\gamma$ are ambiguous and depend on the sign of $\partial Z/\partial\gamma$, where:

$$\frac{\partial Z}{\partial \gamma} \gtrless 0 \Leftrightarrow (1-\beta)(b\ -z\ ) + \beta\left(\frac{c\,(p(\theta)+r)}{q(\theta)} - \psi\ \right) \gtrless 0. \tag{B.12}$$

The condition can be rewritten in terms of the ratio of bargaining power (of employer relative to worker) and ratio of net value of the leave (to employer relative to worker):

$$\frac{1-\beta}{\beta} \quad \text{and} \quad \frac{\frac{c\,(p(\theta)+r)}{q(\theta)} - \psi}{z-b},$$

respectively, yielding condition (17). We discuss the two cases in turn below.

Case 1. If $\partial Z/\partial\gamma < 0$, that is if

$$\beta\left(\frac{c\,(p(\theta)+r)}{q(\theta)} - \psi\ \right) < (1-\beta)\,(z-b)\,,$$

we have that $dw/d\gamma > 0$. The sign of $d\theta/d\gamma$, and hence $du/d\gamma$, remains ambiguous.

Case 2. If $\partial Z/\partial\gamma > 0$, that is if

$$\beta\left(\frac{c\,(p(\theta)+r)}{q(\theta)} - \psi\right) > (1-\beta)\,(z-b)\,,$$

we have that $d\theta/d\gamma > 0$, and hence $du/d\gamma < 0$. The sign of $dw/d\gamma$ remains ambiguous.