

Labor Market Effects of Reducing the Gender Gap in Parental Leave Entitlements

Elena Del Rey*, Maria Racionero[†] and Jose I. Silva[‡]

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Abstract

We explore the effect of parental leave entitlements for mothers and fathers on wages and unemployment. To do so we extend the labour search and matching model in Del Rey, Racionero and Silva (2017) to include two types of workers, males and females, who compete for the same jobs. We show that an increase in leave duration has an ambiguous effect on job creation and wages. We identify analytically and graphically the mechanisms underlying the ambiguous effects. Given the variety of possible cases we calibrate the model for selected countries (Denmark, France, Italy and Portugal) and simulate policy changes. In all countries considered an increase in the duration of either type-specific leave negatively affects job creation and the wage of the targeted worker. In equilibrium both wages fall and unemployment rates increase. Finally, we explore the effect of closing the gender gap in leave duration and show that, since fathers tend to take the leave less often, increasing the duration of the male-specific leave is less effective in closing the wage and unemployment gaps than decreasing the female-specific one.

Keywords: parental leave, search and matching, labor market gaps

JEL Classification: E24, J13, J18

*Corresponding Author: Economics Department, Universitat de Girona.

[†]Research School of Economics, H.W. Arndt Building 25A, Australian National University, ACT 2601 Canberra, Australia. Email: maria.macionero@anu.edu.au

[‡]Economics Department, Universitat de Girona, and University of Kent.

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1 Introduction

Despite convergence over time, substantial gender earnings and wage gaps persist in most countries. A large portion of the gender earnings and wage gaps has been attributed to the presence of children, e.g.: Bertrand, Goldin and Katz (2010), Chung, Downs, Sandler and Sienkiewicz (2017) and Kleven, Landais, and Sogaard (2018). We argue that, if the presence of children plays a key role in explaining gender earnings and wage gaps, family policies become potentially relevant tools to address them. In this paper we explore the role of parental leave regulations.

Parental leave regulations are indeed a central element of family policies in most OECD countries. They have expanded over time from narrow maternity leave entitlements to broader parental leave entitlements designed to support both working parents. Maternity and paternity leave is available to mothers and fathers, respectively, around the time of child-birth or adoption. Parental leave covers longer employment-protected periods. Parental leave can be either an individual right or a family entitlement. In an attempt to encourage the take-up of parental leave by fathers some countries reserve a portion of the leave to be taken exclusively by fathers. We refer to father-specific leave to encompass the paternity leave and the portion of the parental leave reserved for fathers. Similarly for mother-specific leave.

Mother-specific leave entitlements seek to encourage female labor supply by allowing mothers to remain attached to the labor market after birth. However, prolonged periods of absence from the workplace can lead to loss of human capital and weaker labour market outcomes. The empirical literature on the effect of parental leave programs on female labour market outcomes is as yet inconclusive. Olivetti and Petrongolo (2017) identify two main difficulties in the empirical analysis - the complexity of family legislation and the likely endogeneity of family policy interventions – and distinguish two main strands of the empirical literature - cross-country and micro-level studies. Ruhm (1998), a seminal cross-country contribution, finds that leave duration plays a critical role: short periods of leave entitlements of less than three months are associated with small increases in female employment and no discernible effect on wages, while longer leave entitlements are associated with significant negative effects on female wages.¹ Olivetti and Petrongolo (2017) extend Ruhm’s approach. They exploit the

¹Leave duration also seems to play a key role in the micro-level studies. For instance, Lalive and Zweimüller (2009) and Lalive, Schlosser, Steinhauer and Zweimüller (2014) show that extended leave delays return to work with significant negative effects on female employment and earnings, particularly during the first three years after birth.

evolution of family policies over time in high-income countries, using data on 30 OECD countries over 45 years, and consider several aspects of parental leave entitlements, such as duration, percentage of total leave that is paid and average payment rate, alongside other family policies, such as subsidised childcare and workplace flexibility. They conclude that moderate job-protected leave entitlements, up to about one year, are associated with higher female employment but longer and more generously paid entitlements seem instead detrimental for female employment. In addition, for college-educated women longer entitlements seem to be associated with wider gender earnings and wage gaps. They argue that returns to job-specific experience is possibly higher for skilled women, who accordingly stand to lose more. Because the study reports effects on gender gaps, it takes into account the effects, if any, of the mother-specific leave entitlements considered on male labor outcomes. Most high-income countries have in place leave provisions for fathers but their recent introduction and their limited take-up has not yet allowed proper evaluation of their effects.

Despite the public policy debate and the empirical interest on the effects of parental leave programs, there are however surprisingly few theoretical contributions. Bastani, Blumkin and Micheletto (2019) explore the efficiency enhancing role of mandatory parental leaves when workers can be career oriented or family oriented and firms are not allowed to offer differentiated contracts due to anti-discrimination legislation. They show that, in this context, a mandatory parental leave can be part of the socially optimal policy. In contrast, in a model where social norms concerning childcare activities arise endogenously from the most frequent behavior in the previous generation, Barigozzi, Cremer and Roeder (2017) show that parental leave can reduce social welfare. Most fathers choose the career path and most mothers choose childcare, which generates a social norm externality on the future generation. In this context, the presence of parental leaves can intensify the externality and reduce social welfare.

Erosa, Fuster and Restuccia (2010) and Del Rey, Racionero and Silva (2017) explore the effects of parental leave provisions in the presence of search and matching frictions. Erosa, Fuster and Restuccia (2010) include fertility and labor market decisions within a relatively comprehensive model. They consider three - bargaining, redistribution and job creation - channels for parental leave effects and explore, using simulations, the effects of leave policies on fertility, leave take-up and employment.

Del Rey, Racionero and Silva (2017) focus on the job creation channel and identify the mechanisms behind the ambiguous effects of leave duration on wages and unemployment. Increasing the duration of the leave has a negative direct effect on job creation because the benefit of opening a vacancy

decreases. This yields higher unemployment. This direct effect on unemployment can however be reduced, even reverted, if coupled with a fall in wages. Wages can fall if workers attach a high net value to the leave and have low bargaining power. The negative direct effect of leave duration on job creation can however be strengthened if wages increase, which can happen if the firm has low bargaining power and/or attaches a high net value to the leave, for example due to high replacement costs. The model considers however a single type of worker, which could correspond to a benchmark situation in which all workers are treated the same regardless of gender, or alternatively to a situation with segmented markets in which only women are entitled to take leave. In reality, men and women often compete for the same jobs and firms are likely to take this into consideration when assessing the value of posting a vacancy. Then, although leave entitlements are mainly enjoyed by women in OECD countries (from 54.4% in Iceland to 99.5% in Australia of total users of paid parental leave) they can also affect male outcomes, and hence the gender gaps.

In this paper we extend the labour search and matching model in Del Rey, Racionero and Silva (2017) to include two types of worker, males and females, who compete for the same jobs. Each individual can be unemployed, working or on parental leave. Similar to Del Rey, Racionero and Silva (2017), we show that an increase in the duration of type-specific parental leave can increase or decrease the wage of the targeted worker. In addition, we show that, although the type-specific parental leave does not directly affect the wage of the other worker, the new vacancy-to-unemployed ratio does indirectly affect it. If the wage of the targeted worker increases, the wage of the other worker decreases. This case is associated with a decrease in market tightness, i.e. higher unemployment. If the wage of the targeted worker decreases slightly, so does the wage of the other worker. Interestingly, unemployment increases in this case in spite of the lower wages due to the direct effect of the leave on job creation. Finally, if the wage of the affected worker decreases substantially, the wage of the other worker increases and the unemployment rate decreases.

We identify the theoretical effects, which we also represent graphically. However, given the variety of possible effects at play it is difficult to make general predictions. To obtain more concrete results, we calibrate the model to four different countries (France, Italy, Norway and Portugal) and simulate specific leave policy changes. The simulations show that, in the economies considered, increasing the duration of the parental leave reduces the wage of the targeted worker and negatively affects job creation. The wage of the other worker falls as well, although less. This suggests that, in order to

reduce existing gender wage gaps, the duration of father-specific leave should increase or the duration of mother-specific leave should decrease. For this reason, we next evaluate the relative effects of increasing the duration of father-specific leave by one month and reducing the duration of mother-specific leave by one month. Since fathers tend to take the leave less often, increasing the duration of the male-specific leave, without increasing the take-up rate, is less effective in closing the wage and unemployment gaps.

The unemployment gaps tend to be stable, as changing the duration of the leave affects the unemployment rate of both types of worker in a very similar way. Theoretically, the sensitivity of this gap to any policy change depends on the initial differences in the gender job finding and separation rates, as well as on the marginal effect of labour market tightness on the job finding rate. In our model, the gender job finding rates are assumed to be common.² Thus, our simulated results show that the unemployment gap in Norway is stable because its monthly separation rates are similar across genders. In contrast, the stability in the unemployment gaps of France, Italy and Portugal is mainly explained by the small marginal effect of labour market tightness in the job finding rate.

The rest of the paper is organised as follows. Section 2 presents the model. Section 3 derives the equilibrium wages and unemployment levels. Section 4 presents the theoretical effects of increasing the duration of the parental leave reserved to fathers and mothers respectively. Section 5 includes the calibration and simulation results for four economies: Denmark, France, Italy, and Portugal. Section 6 concludes.

2 The model

The economy consists of a measure 1 of risk-neutral, infinitely-lived firms and risk-neutral, infinitely-lived workers of two types $i = \{m, f\}$ where m stands for male and f for female. The number of male and female workers N_m and N_f is given, with $N_m + N_f = 1$. Workers can be either unemployed or employed. If employed, they can either be working or on parental leave. 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 that is common for male

²This assumption is in line with Koutentakis (2015) who finds that, in ten advanced countries, the difference in the separation rates between females and males is the major factor behind the gender unemployment gap.

and female workers (all compete for same jobs):

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

where $u = u_f + u_m$ denotes the number of unemployed workers, v is the number of vacancies, and α and g_o are the matching function parameters. Because the firm does not differentiate between both type of workers, all unemployed workers find jobs at the same rate $p[\theta] = g(u, v)/u$, and vacancies are filled, $q[\theta] = g(u, v)/v$, depend on the vacancy-to-unemployed 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 vacant. Before a position is filled, the firm has to open a job vacancy, incurring a flow cost c . A vacancy position is filled by each type of worker at the endogenous rate $q(\theta)\Omega_i$, where $\Omega_i = u_i/u$, yielding a positive net value $J_i - V$ from the job creation process, where J_i and V stand for the value that the firm attributes to a filled and a vacant position, respectively.

Each firm has a constant-returns-to-scale production technology with labor as a unique production factor, generating an instantaneous profit equal to the difference between the constant labor productivity A_i and the labor cost w_i . Filled positions can be either destroyed at the constant job separation rate s_i or interrupted at the on leave separation rate σ_i if the worker moves to the status of parental leave. The capital loss is represented by $J_i - V$ when the position is destroyed and $J_i - X_i$ when the worker is on parental leave, where X_i 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_i per period until the individual returns to the job at rate γ_i .

The values of the vacant V , type- i filled position J_i and type- i worker on parental leave X_i are given by the following three expressions:

$$rV = -c + q[\theta](\Omega_f(J_f - V) + \Omega_m(J_m - V)), \quad (2)$$

$$rJ_i = A_i - w_i - \sigma_i(J_i - X_i) - s_i(J_i - V). \quad (3)$$

$$rX_i = -\psi_i + \gamma_i(J_i - X_i). \quad (4)$$

An unemployed individual benefits from the current value of leisure b_i , which may include unemployment benefits, and finds a job at rate $p[\theta]$, which yields the net value gain $W_i - U$, where W_i and U stand for the value that the worker attributes to employment and unemployment, respectively.

Employed workers earn the endogenous wage w_i , and can either lose their jobs at the constant rate s_i or move to the status of parental leave at the constant rate σ_i .

A worker on parental leave enjoys benefit z_i , which may include leave payments, and returns to the same job position at the constant rate γ_i , which yields a net value gain $W_i - L_i$ associated with the termination of the parental leave, where L_i stands for the value that the worker attributes to being on parental leave. The inverse of γ_i , $\delta_i = 1/\gamma_i$, represents the average period the individual is on parental leave, or duration of the leave, and is hence a policy parameter. For this reason, we henceforth write $\gamma_i[\delta_i]$, with

$$\frac{d\gamma_i[\delta_i]}{d\delta_i} < 0 \quad (5)$$

The values associated with the different type- i worker status - unemployed (U_i), employed (W_i) and on parental leave (L_i) - are given by the following expressions:

$$rU_i = b_i + p[\theta](W_i - U_i), \quad (6)$$

$$rW_i = w_i - s_i(W_i - U_i) - \sigma_i(W_i - L_i), \quad (7)$$

$$rL_i = z_i + \gamma_i[\delta_i](W_i - L_i). \quad (8)$$

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

$$V = 0. \quad (9)$$

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

$$(1 - \beta_i)(W_i - U_i) = \beta_i J_i \quad (10)$$

where β_i and $1 - \beta_i$ represent the bargaining power of the type- i worker and the firm, respectively.

3 Solving the model

3.1 Dynamics of unemployment

Given the state-contingent ratio of vacancies to unemployment θ , unemployment (u_i) and employment (e_i) evolve according to the following backward-looking differential equations:

$$\dot{u}_i = s_i e_i - p[\theta] \Omega_i u, \quad (11)$$

$$\dot{e}_i = -s_i e_i + p[\theta] \Omega_i u. \quad (12)$$

where $u = u_m + u_f$ and $\Omega_i = u_i/u$.

At equilibrium, $\dot{u}_i = 0$. Then, using (11) and the fact that individuals are either employed or unemployed:

$$N_i = e_i + u_i, \quad (13)$$

we get the equilibrium unemployment level for $i = m, f$.³

$$u_i = \frac{N_i s_i}{s_i + p[\theta]}. \quad (14)$$

Let the unemployment rate be $\hat{u}_i = u_i/N_i$. Then, the unemployment rate gap $\hat{u}_f - \hat{u}_m$ is given by

$$\hat{u}_f - \hat{u}_m = \frac{s_f}{s_f + p[\theta]} - \frac{s_m}{s_m + p[\theta]}. \quad (15)$$

3.2 Job creation by firms

The free entry condition (2) and (9) imply that, the equilibrium job creation condition is:

$$\Omega_f J_f + \Omega_m J_m = \frac{c}{q[\theta]}. \quad (16)$$

To obtain the value of a job filled with a type- i worker, J_i , use (3) and (4):

$$J_i = \frac{(r + \gamma_i[\delta_i])(A_i - w_i) - \sigma_i \psi_i}{r(r + \sigma_i + s_i) + \gamma_i[\delta_i](s_i + r)}. \quad (17)$$

Note that the value of a job filled by a type- i worker is decreasing in her wage and increasing in γ_i since

$$\frac{dJ_i}{d\gamma_i} = \sigma_i \frac{(A_i - w_i)r + (s_i + r)\psi_i}{(r(r + \sigma_i + s_i) + \gamma_i[\delta_i](s_i + r))^2} > 0. \quad (18)$$

Therefore, the value of a job filled by a type- i worker is decreasing in the duration of the leave δ_i by (5).

³Recall that individuals on leave are employed.

3.3 Equilibrium wages

Each type of worker independently negotiates her wage with the employer. At equilibrium (10) is satisfied. To obtain $W_i - U_i$ first subtract rU_i from both sides of (7):

$$(r + s_i)(W_i - U_i) = w_i - \sigma_i(W_i - L_i) - rU_i. \quad (19)$$

Then calculate $W_i - L_i$ using (7) and (8):

$$W_i - L_i = \frac{w_i - z_i - s_i(W_i - U_i)}{r + \sigma_i + \gamma_i[\delta_i]}. \quad (20)$$

Finally, plug (6) and (20) into (19):

$$W_i - U_i = \frac{(r + \gamma_i[\delta_i])(w_i - b_i) + \sigma_i(z_i - b_i)}{(r + p(\theta))(r + \sigma_i + \gamma_i[\delta_i]) + (r + \gamma_i[\delta_i])s_i}. \quad (21)$$

If we then plug (17) and (21) into (10) and simplify we obtain a condition that implicitly determines the equilibrium wage for $i = \{m, f\}$ as a function of θ as well as the parameters of the model:

$$w_i = (1 - \beta_i)b_i + \beta_i A_i + \beta_i p[\theta] J_i[w_i] + \frac{\sigma_i}{r + \gamma_i[\delta_i]} [\beta_i(p[\theta] J_i[w_i] - \psi_i) - (1 - \beta_i)(z_i - b_i)]. \quad (22)$$

When σ_i , and therefore γ_i , equal zero and there are no differences between males and females, it is straightforward to obtain the standard wage equation under search and matching frictions.⁴

3.4 Equilibrium

In the model with only one type of worker, the equilibrium can be represented graphically as the point where the job creation condition and the wage equation cross. In our framework with two types of worker, an equilibrium is a set of male and female wages w_m and w_f and a ratio of vacancies to unemployment θ that simultaneously satisfy the job creation condition and the two wage equations:

$$\Omega_m[\theta] J_m[w_m] + \Omega_f[\theta] J_f[w_f] = \frac{c}{q[\theta]}, \quad (23)$$

$$w_f - (1 - \beta_f)b_f - \beta_f A_f - \beta_f p[\theta] J_f[w_f] = \frac{\sigma_f}{r + \gamma_f[\delta_f]} \left[\beta_f(p[\theta] J_f[w_f] - \psi_f) - (1 - \beta_f)(z_f - b_f) \right], \quad (24)$$

$$w_m - (1 - \beta_m)b_m - \beta_m A_m - \beta_m p[\theta] J_m[w_m] = \frac{\sigma_m}{r + \gamma_m[\delta_m]} \left[\beta_m(p[\theta] J_m[w_m] - \psi_m) - (1 - \beta_m)(z_m - b_m) \right], \quad (25)$$

where $J_i[w_i]$, $i = \{m, f\}$ is given by (17).

⁴See e.g. section 1.4 in Pissarides (2000).

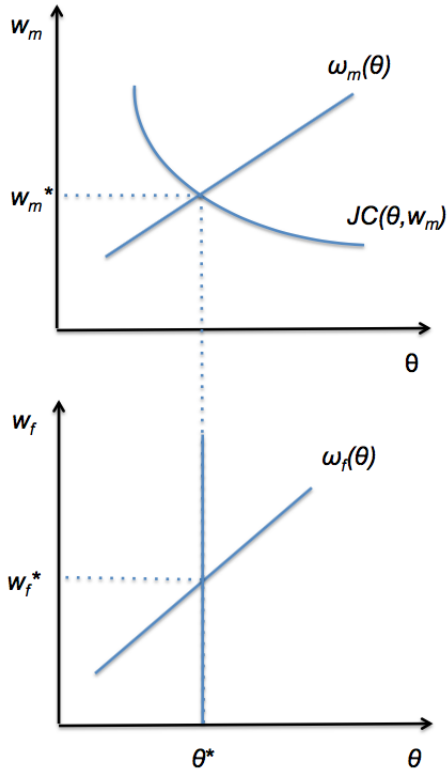


Figure 1: Equilibrium wages and market tightness

In Figure 1 we represent the equilibrium graphically as in the one type of worker case (see Del Rey, Racionero, Silva, 2017). To do this, let $w_f = \omega_f[\theta]$ be the female wage that satisfies (25) for each θ and plug this function into (23). We thus obtain a job creation condition JC that is a function of w_m and θ only:

$$\Omega_m[\theta]J_m[w_m] + \Omega_f[\theta]J_f[w_f[\theta]] - \frac{c}{q[\theta]} = 0. \quad (26)$$

The intersection of the male wage equation (24) and the new job creation condition (26) yields the equilibrium levels of w_m and θ (w_m^* and θ^* in the upper part of Figure 1). The equilibrium vacancy-to-unemployed ratio θ^* can be then plugged into the female wage equation (25) to yield the equilibrium female wage (w_f^* in the lower part of Figure 1). We next show that the signs of the slopes of the job creation condition (26) and both wage equations (24) and (25) are as depicted in Figure 1.

In the model with one type of worker, either with parental leave or without, the job creation condition is downward sloping: firms are less willing to open vacancies the higher the wage. Also, the wage equation is upward sloping: the higher the number of vacancies relative to unemployment, the

higher the wage paid is. We now study the sign of the slope of (24) and (26). Totally differentiating, first, (26) with respect to θ and w_m we obtain:

$$\left. \frac{dw_m}{d\theta} \right|_{JCC} = \frac{\frac{d\Omega_m[\theta]}{d\theta} (J_m - J_f) + \Omega_f[\theta] \frac{dJ_f}{dw_f} \frac{dw_f}{d\theta} + \frac{cq'[\theta]}{q[\theta]^2}}{\frac{\Omega_m[\theta](r + \gamma_m[\delta_m])}{r(r + \sigma_m + s_m) + \gamma_m[\delta_m](s_m + r)}}. \quad (27)$$

To determine the sign of (27) note, on the one hand, that

$$\frac{d\Omega_m[\theta]}{d\theta} = \frac{(s_m - s_f) N_f s_f N_m s_m p'[\theta]}{((s_m + p[\theta]) N_f s_f + (s_f + p[\theta]) N_m s_m)^2}$$

so, accordingly,

$$\text{sign} \frac{d\Omega_m[\theta]}{d\theta} = \text{sign}(s_m - s_f).$$

On the other hand, the other terms in the numerator of (27) are negative. Therefore, the slope of the job creation condition (27) is unambiguously negative when either

$$s_m > s_f \text{ and } J_m < J_f, \text{ or}$$

$$s_m < s_f \text{ and } J_m > J_f.$$

It seems reasonable to assume that, indeed, the job separation rate is higher the lower the value of the job position.⁵

To obtain the sign of $dw_f/d\theta$ in the numerator of (27) we totally differentiate, in turn, (25):

$$\left. \frac{dw_f}{d\theta} \right|_{\omega_f} = \frac{\left(1 + \frac{\sigma_f}{r + \gamma_f[\delta_f]}\right) \beta_f p'[\theta] J_f}{1 - \left(1 + \frac{\sigma_f}{r + \gamma_f[\delta_f]}\right) \beta_f p[\theta] \frac{dJ_f}{dw_f}} > 0. \quad (28)$$

To obtain the slope of the male wage equation, totally differentiate (24) with respect to θ and w_m . As in the case of the female wage, this slope is unambiguously positive.

It is worth noting that we can calculate first the joint determination of θ^* and w_f^* and, then, the optimal wage for the male worker. The results are the same.

4 Theoretical effects of increasing the duration of parental leave

In this section we investigate the effect of increasing the duration of father-specific leave. The effect of the duration of the mother-specific leave can be simply derived by changing all subindices.

⁵This is actually the case in three out of the four economies that we calibrate below. Norway is the exception. As we will see, the slope of the job creation condition is much lower in this country.

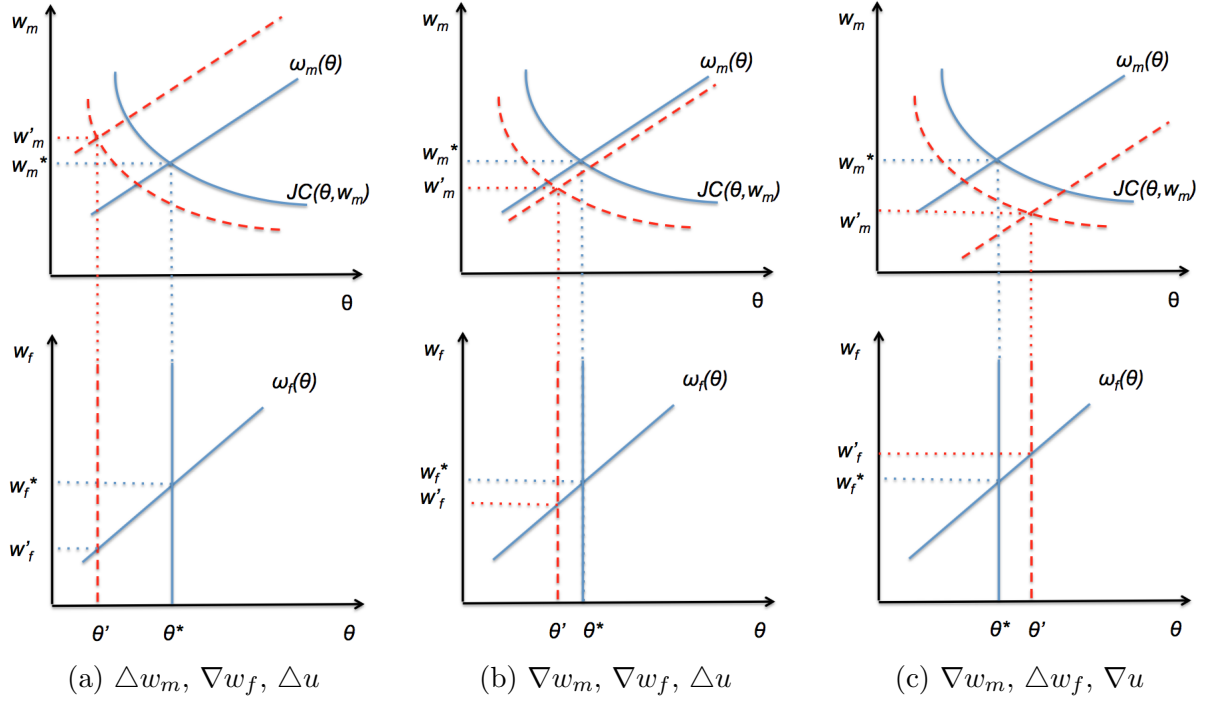


Figure 2: Effect of increased duration of paternity leave on wages and market tightness

Note that $\gamma_m[\delta_m]$ affects directly the male wage equation (24) and the job creation condition (26) but not the female wage equation (25). We start with the job creation condition, $JC(\theta, w_m)$ on the upper part of Figure 1. Totally differentiating (26) with respect to w_m and δ_m for a given θ we obtain:

$$\left. \frac{dw_m}{d\delta_m} \right|_{JCC} = - \left(\frac{dJ_m}{d\gamma_m} / \frac{dJ_m}{dw_m} \right) \frac{d\gamma_m}{d\delta_m} < 0. \quad (29)$$

The job creation condition curve always shifts downwards when δ_m increases: for any given vacancy-to-unemployed ratio, a higher duration of the father-specific leave is associated with a lower wage in the job creation equilibrium condition. The reason is that, by (18) and $d\gamma_i/d\delta_i$, a male worker is less valuable to the firm when the duration of the father-specific leave increases.

The effect of the increase in father-specific leave duration on the male wage equation (24) is ambiguous:

$$\left. \frac{dw_m}{d\delta_m} \right|_{w_m} = \left[\left(1 + \frac{\sigma_m}{r + \gamma_m} \right) \beta_m p[\theta] \frac{dJ_m}{d\gamma_m} - \frac{\sigma_m}{(r + \gamma_m)^2} [\beta_m (p[\theta] J_m - \psi_m) - (1 - \beta_m)(z_m - b_m)] \right] \frac{d\gamma_m}{d\delta_m} \quad (30)$$

There are three different terms in (30). The first term captures the direct effect of the duration of the leave on the value of the job position filled by a male worker to the firm. This effect is negative

and therefore tends to shift down the male wage curve: the lower the value of the job position filled by a male worker, the lower his wage. The second term captures the net benefit of the leave for the firm: $p[\theta]J_m - \psi_m$. The firm incurs a productivity loss, represented by ψ_m , when the worker is on leave but, because the worker returns to the same job when the parental leave expires, the firm saves the costs of replacing a type- m worker, measured represented by $p[\theta]J_m$.⁶ A positive net benefit of the leave to the firm has a positive effect on the male wage because it implicitly increases the bargaining position of the male worker. Finally, the third term captures the net benefit of the leave to the worker $z_m - b_m$. A positive net benefit of the leave to the worker is positive has a negative effect on the male wage because it implicitly decreases the bargaining position of the male worker.

Summing up, an increase in father-specific leave duration can shift the male wage equation upwards or downwards. Figure 2, upper graphs, represents all possible cases depending on whether the male wage increases (panel (a)), decreases slightly (panel (b)) or decreases substantially (panel (c)). In the lower graphs of Figure 2, the female wage equation is unaffected by the duration of the father-specific leave in all cases, but the new vacancy-to-unemployed ratio equilibrium yields a new equilibrium female wage.

First, if the male wage curve shifts up substantially, the male wage increases, the vacancy-to-unemployed ratio decreases (unemployment increases) and the female wage decreases (panel (a) Figure 2). Second, if the male wage curve shifts up or down slightly, the male wage decreases, the vacancy-to-unemployed ratio decreases (unemployment increases) and the female wage decreases (panel (b) Figure 2).⁷ Interestingly, unemployment increases in this case in spite of the lower wages, due to the direct costs of the leave on job creation. Finally, if the male wage curve shifts down substantially, the male wage decreases significantly (unemployment decreases) and the female wage increases (panel (c) Figure 2).

It is however important to emphasize the role played by the on leave separation rate σ_m on the intensity of the aforementioned shifts. This term tends to be very small for men in most countries

⁶To see this, note first that $p[\theta] = \theta q[\theta]$. Also, by (23), $q[\theta] = c/(\Omega_m J_m + \Omega_f J_f)$. Then, $p[\theta]J_m$ equals market tightness times the cost of opening a vacancy times the value of a job position filled by a male worker relative to the average value of a filled position: $\theta c J_m / (\Omega_m J_m + \Omega_f J_f)$.

⁷If the male wage curve shifts up or down slightly, the male wage decreases less or more depending on whether the male wage curve shifts slightly up or down, respectively. In both cases, if the male wage curve shift is sufficiently small with respect to the job creation curve shift the vacancy-to-unemployed ratio decreases (unemployment increases) and the female wage decreases. Panel (b) Figure 2 represents the case where the male wage curve shifts down slightly but the sign of the effects remains the same if the male wage curve shifts up slightly.

for two reasons: the rate at which men move to the status of paternity leave σ_m is very low, and the duration of this leave is also typically small making $\gamma_m[\delta_m]$ larger. Note that (18), (29) and (30) are equal to zero when σ_m is also zero, implying that neither the job creation curve nor the male wage equation will shift when the male parental leave duration δ_m changes. As a result, since firms internalize that males do not take the leave, the policy will not affect the labor market.

Given the wide range of possible effects of the leave policies, we now proceed to calibrate and simulate some useful examples.

5 Calibration and simulated results

This section undertakes a quantitative assessment of the role of type-specific parental leave duration δ_i on explaining differences in the gender gaps of four countries (France, Italy, Portugal and Norway).⁸ First, we set the levels of δ_i to the ones observed in the data and calibrate the rest of the model's parameters to reproduce the gender unemployment and wage gaps in each country. Then, we evaluate the gender effects of adjusting the length of the leave available to mothers and fathers respectively.

5.1 Calibration

We calibrate the model in section 3 at monthly frequency in order to match several empirical facts in the four economies. Table 1 summarizes all the calibrated parameters and presents the steady state values of the endogenous variables.

First, we normalize the total labor force N and the female productivity A_f to one. As in Shimer (2005), we also normalize the labor market tightness $\theta = 1$ since its calibration is intrinsically meaningless for the simulations. The monthly interest rate r is set to be consistent with the annual long-term interest rate in each country during the last ten years. Petrongolo and Pissarides (2001) show empirical support for a Cobb-Douglas matching function with constant returns to scale, and a plausible range for the empirical elasticity on unemployment between 0.5 and 0.7. Thus, we assume that $m(u, v) = \kappa u^\alpha v^{1-\alpha}$ and set $\alpha = 0.6$ in all countries. We also set the workers bargaining power at $\beta = 0.6$ to satisfies the Hosios (1990) condition for efficiency.

We first present in Block 1 of Table 1 the group of variables or parameters that we set. We target

⁸We choose these four economies because, according to Kountentakis (2014), they have similar job finding rates for men and women as we have assumed in the model. Additionally, they also have all the relevant information necessary to calibrate the parameters.

the gender labor force N_i and unemployment rates \hat{u}_i in each country. We also target the gender wage gap w_m/w_f from the OECD Database and the average wage-adjusted labor productivity ratio A/w from Eurostat in 2015. With respect to the policy parameters, we use the OECD Family Database in 2015 to set the on leave payment rates z_i/w_i and duration $\delta_i = 1/\gamma_i$ available to mothers and fathers (see Tables PF2.1.A and PF2.1.B). The net replacement rates b_i/w_i are taken from the OECD Benefits and Wage Statistics and correspond to the unemployment benefits for long-term unemployed of two-earner married couples with two children.

We calculate the on leave separation rate for fathers σ_m by multiplying the last twenty years average crude birth rate φ taken from the OECD Database by the male share of recipients of parental leave benefits ϑ_m (See Chart PF2.2.C in the OECD Family Database). Thus, the male and the female on leave separation rates are equal to $\sigma_m = \varphi\vartheta_m$ and $\sigma_f = \varphi(1 - \vartheta_m)$, respectively. The last variable we set in Block 1 of Table 1 is the job finding rate $p[\theta]$, which has been calculated by Elsbey et al (2013).

Block 2 shows the variables and parameters that have been calibrated by solving different expressions. For example, once we set θ , $p[\theta]$ and α in Block 1, the matching function scale parameter κ can be obtained using the reduced expression of the job finding rate. Thus, $\kappa = p[\theta]/\theta^{(1-\alpha)}$. The last column of Block 2 shows the expressions and equations used to calibrated these variables. We assume that while the worker is on leave the firm incurs a net productivity loss $\psi_i = \psi_o A_i$. Thus, the wages w_i , the female productivity A_f , and the parameters c and ψ_o are obtained simultaneously by solving the following five equations: the job creation condition (JC), the two wage equations, the target gender wage gap w_m/w_f and, finally, the wage-adjusted labor productivity ratio A/w .

Note that, according to these calibrations, both the value of a job position occupied by a male worker and his wage are always higher than the value of a job position occupied by a female worker and her wage. Yet, the productivity of a male worker is lower in three out of the four countries: France, Italy and Norway. The gender difference in the value of the position to the firm stems from the parental leave uptake and duration, generally higher among women (by (17), both leave duration and leave uptake reduce J_i).

Table 1: Calibrated parameters and variables

Block 1: Set parameters and variables					
Parameter/variable	France	Italy	Norway	Portugal	Source/Target
Interest rate, r	0.22	0.32	0.25	0.46	OECD database
Matching function elasticity, α	0.60	0.60	0.60	0.60	Barbara and Petrongolo (2001)
Workers bargaining power, β	0.60	0.60	0.60	0.60	Hosios (1990)
Female productivity, A_f	1.0	1.0	1.0	1.0	Normalization
Labor market tightness, θ	1.0	1.0	1.0	1.0	Normalization
Total labor force, N	1.0	1.0	1.0	1.0	Normalization
Job finding rate, $p(\theta)$	0.077	0.043	0.385	0.063	Elsby et al (2013)
Male labor force, N_m	0.539	0.611	0.535	0.544	OECD Database
Female unemployment rate, \hat{u}_f	0.088	0.109	0.032	0.087	OECD Database
Male unemployment rate, \hat{u}_m	0.080	0.070	0.037	0.070	OECD Database
Net replacement rate, $\frac{b_i}{w_i}$	0.45	0.55	0.44	0.46	OECD Benefits and Wage Statistics
On leave female payment rate, $\frac{z_f}{w_f}$	0.449	0.527	0.494	0.677	OECD family database
On leave male payment rate, $\frac{z_m}{w_m}$	0.201	1.00	0.979	0.563	OECD family database
On leave female duration (months), $\delta_f = \frac{1}{\gamma_f}$	10.5	11.9	22.8	7.5	OECD family database
On leave male duration (months), $\delta_m = \frac{1}{\gamma_m}$	7.0	0.1	2.5	5.8	OECD family database
On leave female separation rate, σ_f	0.125	0.085	0.077	0.062	OECD Database and OECD family database
On leave male separation rate, σ_m	0.005	0.011	0.053	0.047	OECD Database and OECD family database
Wage adjusted labour productivity ratio, $\frac{A}{w}$	1.142	1.100	1.273	1.096	Eurostat (Structural business statistics)
Gender wage gap, $\frac{w_m}{w_f}$	1.104	1.088	1.090	1.156	OECD Database
Block 2: Calibrated parameters and variables					
Parameter/variable	France	Italy	Norway	Portugal	Solves
Matching function scale, κ	0.077	0.043	0.385	0.063	$p(\theta) = \kappa\theta^{(1-\alpha)}$
Female labor force, N_f	0.461	0.389	0.465	0.456	$N_f = N - N_m$
Female unemployment, u_f	0.041	0.042	0.015	0.040	$u_f = \hat{u}_f N_f$
Male unemployment, u_m	0.043	0.043	0.020	0.038	$u_m = \hat{u}_m N_m$
Female job separation rate, s_f	0.0074	0.0053	0.0127	0.0060	\hat{u}_f
Male job separation rate, s_m	0.0067	0.0032	0.0148	0.0047	\hat{u}_m
Share of unemployed female, Ω_f	0.485	0.498	0.429	0.510	$\Omega_f = 1 - \Omega_m$
Share of unemployed male, Ω_m	0.515	0.502	0.571	0.490	$\Omega_m = \frac{u_m}{(u_m + u_f)}$
Job filling rate, $q(\theta)$	0.077	0.043	0.385	0.063	$p(\theta) = \theta q(\theta)$
Male productivity, A_m	0.913	0.943	0.742	1.119	JC in (23), wages in (24)-(25), $\frac{w_m}{w_f}$ and $\frac{A}{w}$
Female wage, w_f	0.794	0.834	0.652	0.896	JC in (23), wages in (24)-(25), $\frac{w_m}{w_f}$ and $\frac{A}{w}$
Male wage, w_m	0.876	0.907	0.710	1.036	JC in (23), wages in (24)-(25), $\frac{w_m}{w_f}$ and $\frac{A}{w}$
Vacancy cost, c	0.199	0.172	0.190	0.252	JC in (23), wages in (24)-(25), $\frac{w_m}{w_f}$ and $\frac{A}{w}$
Productivity loss during worker's leave, $\psi * A_i$	$0.146 * A_i$	$0.141 * A_i$	$0.207 * A_i$	$0.128 * A_i$	JC in (23), wages in (24)-(25), $\frac{w_m}{w_f}$ and $\frac{A}{w}$
Female job value function, J_f	1.540	2.463	0.271	3.661	Equation (17) for f
Male job value function, J_m	3.569	5.505	0.659	4.364	Equation (17) for m

5.2 Simulations

As in Figure 1, Figures A2-A5 in the appendix show the effects in wages and labor market tightness of increasing the length of the paid leave available to mothers and fathers by one month.⁹

Note that in spite of the variety of theoretically possible alternatives shown in section 4, the four countries display very similar patterns. First, the wage equations are upside sloping as expected. Second, the job creation condition is downward sloping in all cases. In the case of France, Italy and Portugal it could not be otherwise, because female workers have higher separation rates and lower job values of the job positions than male workers ($s_f > s_m$ and $J_m > J_f$). In Norway, where male

⁹In the model the leave granted to mothers and fathers can be paid or unpaid. In the simulations, we take the duration of paid leave because this information is easier to compare across countries.

job worker's value is also higher but the separation rate of female workers is lower, the job creation condition is flatter, also as expected.

With respect to the effect of increasing the duration of both the mother-specific and the father-specific leaves we observe that, in all cases, the wage of the targeted worker falls. This is due to the fact that, first, increasing the duration of either leave makes job creation more costly (shifting the job creation condition downwards). And, second, it decreases the implicit bargaining power of the directly affected worker (shifting the wage equation of the directly affected worker downwards). Labor market tightness also decreases and unemployment increases in all cases because the downward shifts in the job creation is bigger than the one observed in the wage equation. Thus, the wage of the targeted worker does not fall enough to compensate the negative effect of a longer leave duration on job creation. Finally, the wage of the non targeted worker also falls but only due to the reduction in the labor market tightness. These simulated results correspond to panel (b) in Figure 2 in which both wages fall and unemployment increases, i.e. labour market tightness decreases.

Notice that the reduction in the wage of the targeted worker is more significant because the policy does not have a direct effect on the wage of the non targeted worker. For example, in France and Norway a one-month increase in the duration of mother-specific leave reduces female wages by a little more than 2% while male wages fall only by 0.03% in France and remain almost the same in Norway. In turn, the effect on increasing the duration of father-specific leave on wages is smaller, as we have already pointed out, due to lower take-up of parental leaves among men. Still, we continue to observe that the effect is larger on affected workers: male wages fall by 1.11 % in Norway while female wages remain almost at the same level.

Table 2 evaluates the gender wage and unemployment gap effects of reducing the gender gap in parental leave entitlements (i.e. the difference in duration between the paid leave available to mothers δ_f and the paid leave reserved to fathers δ_m). It contains three different blocks with different policies and scenarios. Block 1 reduces δ_f by one month while block 2 increases δ_m by the same amount of time.¹⁰ Finally, in Block 3 we close the parental paid leave gap by adjusting the fathers parental leave until $\delta_f = \delta_m$.

It becomes clear by comparing the results in Blocks 1 and 2 that reducing the duration of mother-

¹⁰We explore the effects of these alternative changes by means of a numerical exercise. In reality, and in particular if fathers don't take up father-specific leave, reducing the duration of mother-specific leave may not be feasible.

Table 2: Gender wage and unemployment gap effects of reducing gender leave gap

Block 1: $\downarrow \delta_f$						
	δ_f (months)		$\hat{u}_f - \hat{u}_m$ (% points)		$(\frac{w_m}{w_f} - 1) \times 100\%$	
Country	benchmark	$\downarrow \delta_f$	benchmark	$\downarrow \delta_f$	benchmark	$\downarrow \delta_f$
France	10.5	9.5	0.80	0.80	10.4%	8.2%
Italy	11.9	10.9	3.90	3.88	8.8%	7.5%
Norway	22.7	21.7	-0.50	-0.50	9.0%	6.7%
Portugal	7.5	6.5	1.70	1.59	15.6%	14.7%
Block 2: $\uparrow \delta_m$						
	δ_m (months)		$\hat{u}_f - \hat{u}_m$ (% points)		$(\frac{w_m}{w_f} - 1) \times 100\%$	
Country	benchmark	$\uparrow \delta_m$	benchmark	$\uparrow \delta_m$	benchmark	$\uparrow \delta_m$
France	7.0	8.0	0.80	0.80	10.4%	10.4%
Italy	0.1	1.1	3.90	3.90	8.8%	8.6%
Norway	2.5	3.5	-0.50	-0.50	9.0%	7.8%
Portugal	5.6	6.6	1.70	1.71	15.6%	15.0%
Block 3: $\uparrow \delta_m$						
	δ_m (months)		$\hat{u}_f - \hat{u}_m$ (% points)		$(\frac{w_m}{w_f} - 1) \times 100\%$	
Country	benchmark	$\uparrow \delta_m$	benchmark	$\uparrow \delta_m$	benchmark	$\uparrow \delta_m$
France	7.0	10.5	0.80	0.81	10.4%	10.2%
Italy	0.1	11.9	3.90	3.91	8.8%	6.6%
Norway	2.5	22.7	-0.50	-0.53	9.0%	-14.7%
Portugal	5.6	7.5	1.70	1.71	15.6%	14.4%

specific paid leave by one month is more effective in reducing the gender wage gap than increasing the duration of father-specific paid leave by the same amount. For example in France and Italy the one month reduction in the mother-specific paid leave reduces the gender wage gap from 10.4 % and 8.8 to 8.2% and 7.5% respectively. In contrast, a one month increase in the duration of the father-specific paid leave leaves the gender wage gap unaffected in France and only reduces it from 8.8% to 8.6% in Italy. As mentioned before the differences in the magnitude of the effects is to a large extent due to differences in leave uptake between fathers and mothers.

The gender unemployment gap is more stable, although it tends to increase when labor market tightness falls when female unemployment is larger. This is in line with the predictions of the model since differentiating (15) with respect to θ :

$$\frac{d(\hat{u}_f - \hat{u}_m)}{d\theta} = - \left(\frac{\hat{u}_f}{s_f + p(\theta)} - \frac{\hat{u}_m}{s_m + p(\theta)} \right) p'[\theta].$$

Note that the size of the effect depends upon the initial differences in the gender job finding and separation rates as well as on the marginal effect of labour market tightness on the job finding rate. In our model, the gender job finding rates do not play any role because they are common by assumption. Thus, our simulated results show that the unemployment gap in Norway is stable because its monthly

separation rates are not too dissimilar across genders. In contrast, the stability in the unemployment gaps of France, Italy and Portugal is mainly explained by presence of a small marginal effect of labour market tightness in the job finding rate.

6 Concluding remarks

We have explored the effect of mother-specific and father-specific leave entitlements on gender wage and unemployment gaps. To do so we extended the labour search and matching model in Del Rey, Racionero and Silva (2017) to include two types of workers, males and females, who compete for the same jobs. We have shown that an increase in gender-specific leave duration has an ambiguous effect on both job creation and wage of the targeted worker. We have identified the mechanisms behind these ambiguous effects. Although the type-specific leave does not directly affect the wage of the other type of worker, the new vacancy-to-unemployed ratio does indirectly affect it. In general, we can show that, if the wage of the targeted worker increases, the wage of the other worker decreases. This case is associated with a decrease in market tightness, i.e. higher unemployment. If the wage of the targeted worker decreases slightly, so does the wage of the other worker. Interestingly, unemployment increases in this case in spite of the lower wages due to the direct effect of the leave on job creation. Finally, if the wage of the affected worker decreases substantially, the wage of the other worker increases and the unemployment rate decreases.

Given the variety of possible effects, we next calibrated the economies of Denmark, France, Italy and Portugal and simulated changes in these policies. In all countries considered an increase in the duration of either leave negatively affects job creation and the bargaining position of the targeted worker. As a result, both wages fall.

Finally, we also explored the effect of closing the gender gap in leave duration and showed that the gender wage gap is reduced by more than the gender unemployment gap. The assumption that the job finding rate is the same for both genders is key to this result, and it may be worth exploring the implications of relaxing this assumption. Also, differences in leave take-up rates across genders have proven critical in explaining the different effects of changing the duration of the leave reserved to mothers and fathers, respectively. Since fathers tend to take the leave less often, increasing the duration of the male-specific leave, without increasing the take-up rate, is less effective in closing the wage and unemployment gaps. Making the take-up decision endogenous would enrich the analysis.

Our present approach has allowed us to clearly identify the theoretical effects, and represent them graphically, and could serve as a basis for these worthwhile extensions.

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7 Appendix

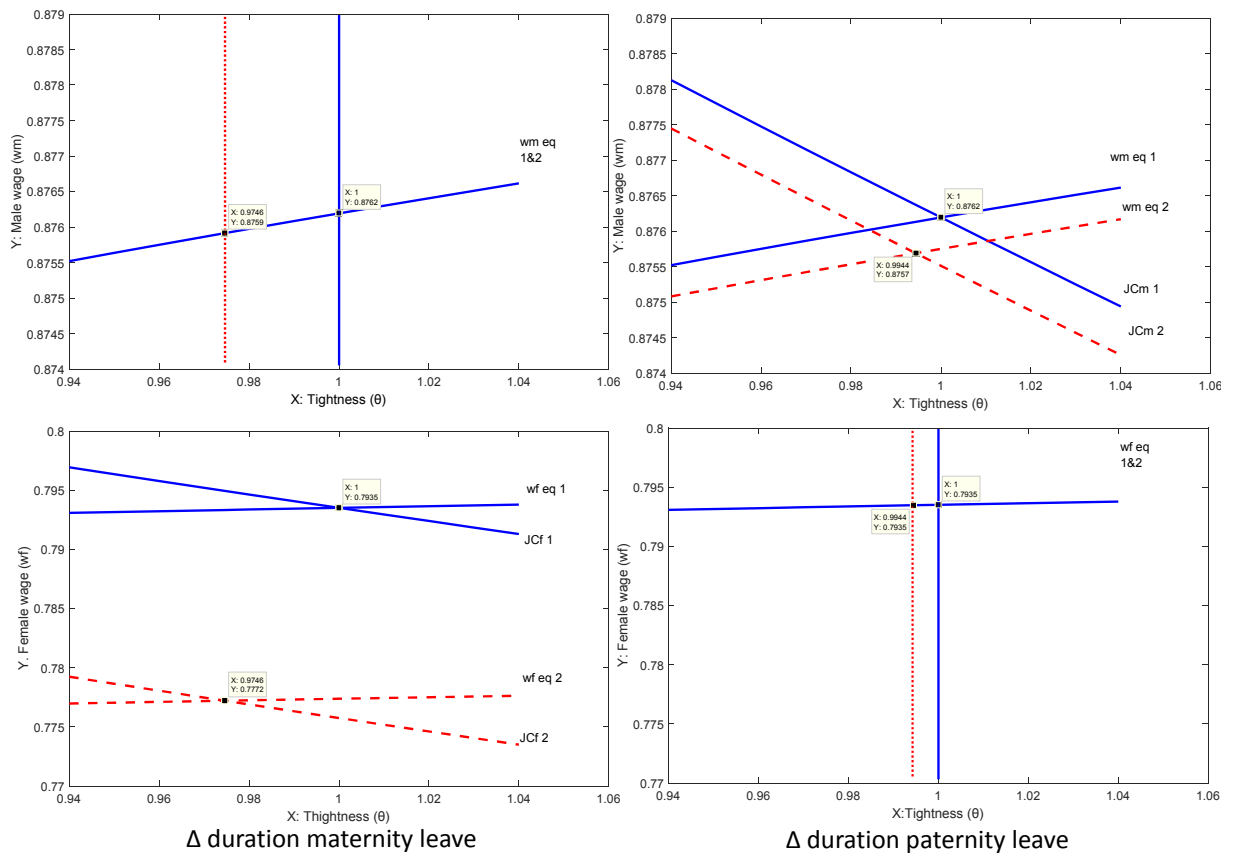


Figure A2: Gender effects of increasing paid leave duration: France

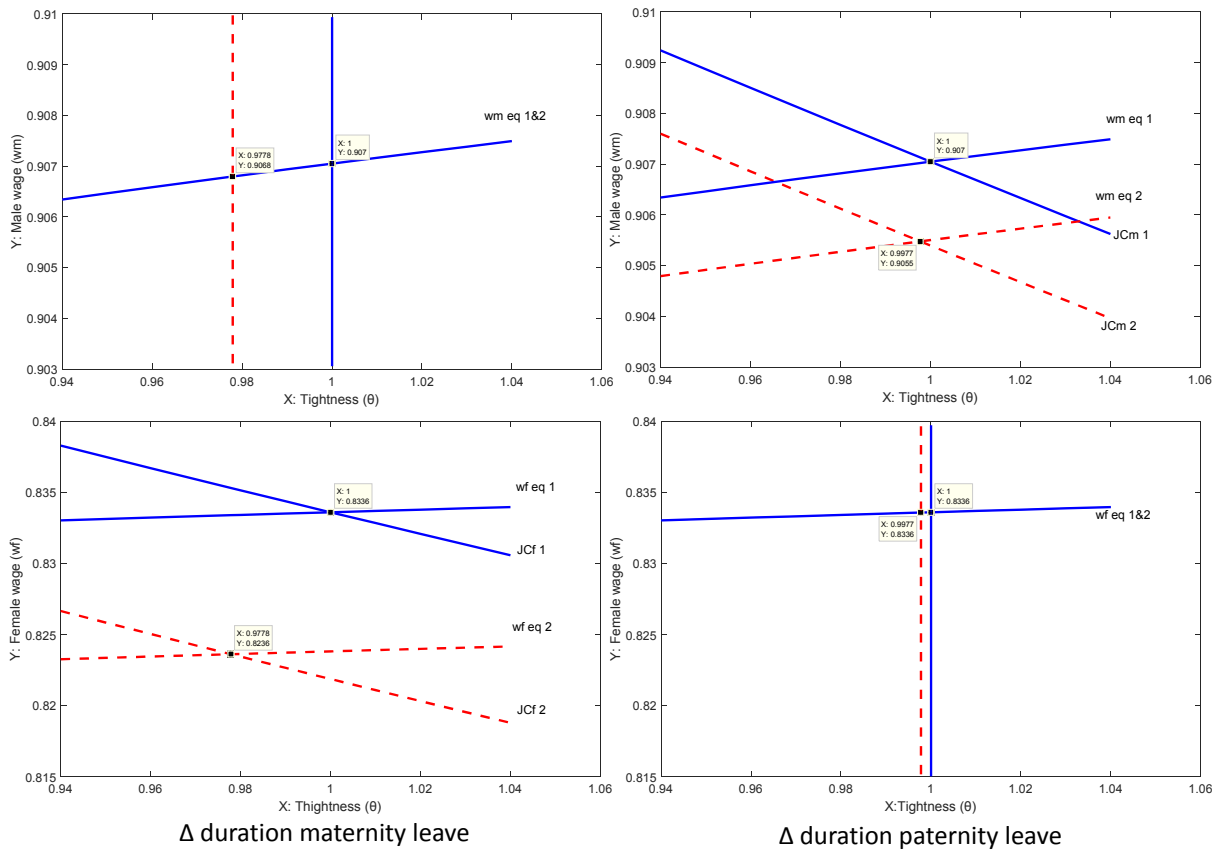


Figure A3: Gender effects of increasing paid leave duration: Italy

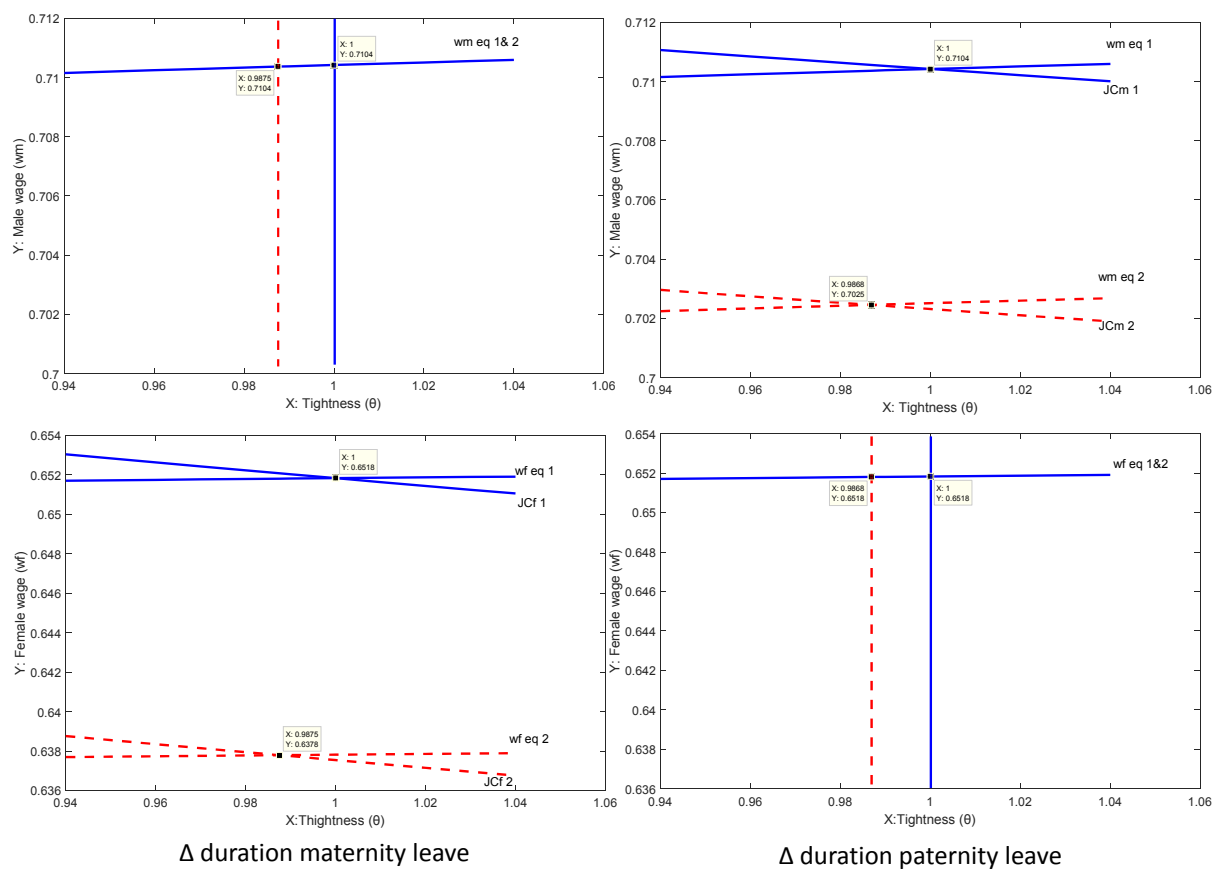


Figure A4: Gender effects of increasing paid leave duration: Norway

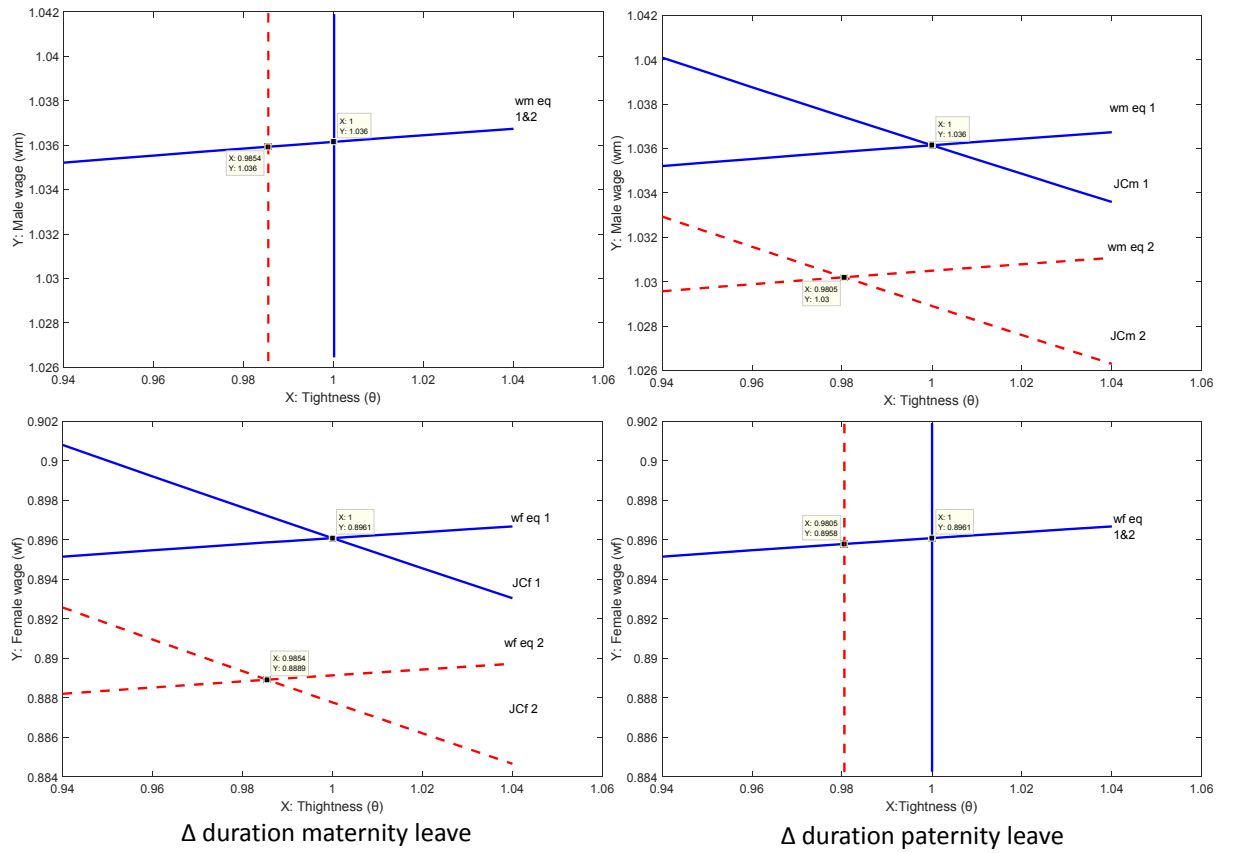


Figure A5: Gender effects of increasing paid leave duration: Portugal