Men, women and capital
Estimating substitution patterns using a size and gender-dependent childcare policy in Chile *

Diego Escobar † Jeanne Lafortune‡ Jose Tessada§

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Abstract

This paper uses a policy implemented in Chile that obliges firms to fully fund childcare costs for their female employees, but only if they hire more than 19 women. Using plant level data from manufacturing firms, we first show that this policy has had a substantially detrimental impact on the hiring of women above that threshold, in particular since the policy has become more binding, in industrial sectors that hire fewer women and in larger firms. We then use the response of firms to study whether women workers are more or less complementary to capital than men. We find that firms that avoid the legislation by having just below 20 female workers are significantly more capital intensive than firms just above the threshold. This suggests that firms that want to avoid being subject to the regulation replace women with capital but in such a way that the capital to men ratio increases. We use our estimates to calibrate a production function and find that our results are consistent with a framework where women are weakly substitutes with capital (while men are complementary) in this emerging economy's manufacturing sector. This does not seem to be driven by a change in skill composition of the workforce. We also find some evidence of other changes: average wages and total workforce are lower for firms who hire 20 women than those who hire just below that threshold but labor productivity is unaltered.

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†Pontificia Universidad Católica de Chile
‡Pontificia Universidad Católica de Chile.
§Pontificia Universidad Católica de Chile and FinanceUC.

1 Introduction

In most models of production, female and male workers are treated as perfect substitutes. However, there is a large debate in other literatures, about the comparative advantage that each sex may enjoy in different activities (brain versus brawn). Acemoglu, Autor, and Lyle (2004) demonstrate that in mid-20th century US, women were particularly substitutes of higher-skilled men than lower-skilled ones. However, if this is due to the fact that women lack the physical strength that men can display, we may also anticipate that other factors of production may also respond to a change in the workforce composition. This paper thus uses a shift in the gender composition of the workforce as generated by a mandated benefit policy in Chile to estimate whether capital (measured using different proxies) has different degrees of complementarity or substitution with each gender. It focuses on the manufacturing sector because of data constraint but also since this is where this substitution pattern should be the most noticeable.

Our usual assumption is that, in today's economy, capital is particularly complementary to high-skill workers and less so with physical strength (see (**?**) for the modern manufacturing sector). Given that women are usually viewed to be endowed with more "brains" than "brawn", women could be anticipated to be more complementary to capital than men. This is what Juhn, Ujhelyi, and Villegas-Sanchez (2014) shows using NAFTA as a trade shock in the United States. Looking at a less modern manufacturing sector in a developing economy, however, may provide different answers since technology in that context may be less complementary to high-skill workers. Lafortune, Tessada, and Lewis (2015) show that capital-skill complementarity arose with the Second Industrial Revolution in the United States, which leads to believe that the relationship between gender and capital may also be a fluent one. Furthermore, understanding this relationship may be highly relevant in developing economies where formal female labor supply is still, in general, much below that of developed countries. Chile is no exception to that with a female labor force participation of 55.7 in 2014, about the same rate as Italy and Mexico and much lower than the OECD average.

The policy we study is a non-typical one. Since 1917, Chilean law has had a legislation in place such that firms that employed a certain number of women should provide childcare for children of their female employees. The law has evolved over time in many ways and has become more binding as more and more women enter the labor force. Today, any firm that employs more than 19 *female* workers must either provide child care on-site or reimburse the expenses related to child care for any child below the age of 2 of any female employees. This is a mandated benefit like those studied by Gruber (1994) but with the added twist that firms to avoid it must limit to 19 their hiring of women, thus potentially penalizing exactly the workers it wishes to benefit. In order to comply with the regulation, firms have 3 options. First, they can create and maintain child care centers on the work place. Alternatively, firms can build or habilitate common services with other establishments in the same geographic region. Finally, firms can also pay directly to extern day care centers. In practice the latter is the most used modality. An estimate of the cost of providing such a service is about US$200 per month, compared to the minimum wage of about $400.

We first empirically test if firms respond to this unconventional policy by avoiding to become subject to it. If the mandated benefit can easily be passed to workers through lower wages, we should not observe firms avoiding having more than 19 female workers since the benefit would be of no cost to them. However, if firms are unable to pass the additional cost to the workers themselves, then we would anticipate bunching around 19 women. We thus begin by empirically testing whether there is evidence of such bunching. Given that the number of women hired is a discrete and not a continuous variable, we use a variety of tests specific to discrete distributions. Our conclusion is that there is strong evidence that, in the manufacturing sector, firms avoid being subject to the law by hiring just 18 or 19 women instead of 20 and more. This is particularly marked for the most recent period (where enforcement and rules have become tougher), for sectors that hire few women and in firms of more than 100 employees. We obtain similar results whether we use a polynomial to construct a counterfactual distribution as in Chetty et al. (2011) or if we use the most traditional test of McCrary (2008) for distributions.

This offers us a unique opportunity of comparing firms that have a different number of women above and below the cut-off generated by the law and explore how other factors respond to that change. This is akin to the shocks created by immigration on factor ratios, as in Lewis (2013) and Lafortune, Tessada, and Lewis (2015). By comparing how other factor ratios respond, we can estimate the relative degree of substitution and complementarity between these factors and men and women workers. We find that we observe a similar discontinuity when comparing the capital stock of firms with a number of female workers just below the threshold than just above the threshold to the one we observed in the number of firms. Specifically, firms with fewer women have a larger capital stock per worker than those just above the threshold.

We then use a parametric model derived from the studies of immigration to estimate directly relative degree of q-complementarity between capital and men and women workers. Our results suggest that capital is relatively more complementary with women workers than with men. Specifically, we find that the ratio of the cross partial derivative of the production function with respect to capital and to male workers would only be less than 40 percent of the value of that cross-partial derivative with respect to capital and women workers. For machinery and equipment, we even find some evidence that the work of men could be considered a q-substitute with respect to capital while that of woman would be highly complementary.

Our study is most similar to the paper by Prada, Rucci, and Urzúa (2015) that study the same program as we do but using an administrative individual workers' database. They find no evidence of bunching and strong evidence of wage penalty for women on one side of the discontinuity than the other. The big difference between their results and ours may be driven by the fact that they use large firms in all sectors of the economy instead of only in manufacturing and particularly because they focus their attention on firms that switch over the span of their panels between having more than 19 women and less. It may very well be that firms that are likely to switch over time are exactly those where the cost can be easily passed to workers directly while our sample focus on firms that may be permanently selecting to be below or above the threshold. We show that we see much less evidence of bunching when we look at firms that have switched over the years from being subject to being exempt from the law. We thus see our paper as complementary rather than critical of their work, suggesting that some firms systematically avoided the legislation by maintaining themselves below the threshold and substituting female workers for capital while some firms moved between being subject to the law and being exempt and those firms were able to pass most of the costs to the female employees themselves.

The impact of improving access to childcare has been studied in a various settings. Most studies conclude that preschool education has positive impacts on future scholar performance (e.g. ,NICHD Early Child Care Research Network (2005) and Berlinski, Galiani, and Gertler (2009)). While most of the international evidence argues that increasing childcare access may increase labor force participation (see for example Baker, Gruber, and Milligan (2005)), the evidence in Chile has been more muted. For instance Encina and Martinez (2009), Aguirre (2011) and Manley and Vásquez (2013) show that an exogenous increase in preschool education has no effects on female labor participation. If firms are strongly incentivized not to hire women because of the existing mandate, then we could anticipate that granting subsidized childcare to women would not increase their employment.

We are not the first ones to study how legislations may distort firm size decisions. There are several studies related to firm size regulations which are known as *regulatory tiering*. Brock and Evans (1985) develop a model where regulators may use taxes to reduce externalities but such taxes are costly to raise. The model also includes firm size heterogeneity produced by differences in access to managerial ability. In such context, the authors predict that firm size regulations may be Pareto-superior to unique norms. Regulatory tiering has been empirically treated in terms of the effect of differentiated tax rates and environmental and labor regulations. The latter is particularly relevant for this case since such rules are normally applied based on the number of workers. Amirapu and Gechter (2015) show that Indian labor regulations, which apply only to firms with more than 10 employees, strongly distort the distribution of firm employment. They find evidence that the avoidance costs, however, may be more linked to an interest in avoiding corruption than the actual costs of the labor regulation. In this fashion, Becker and

Henderson (2001) show that non uniform environmental regulations tend to generate changes in firm dimension, altering industrial structure. Moreover, Gao, Wu, and Zimmerman (2009) indicates that firms respond to costly regulations applied to large firms by maintaining a small size. In particular, companies invest lower amounts and distribute more dividends in order to avoid growth. Almunia and Lopez-Rodriguez (2014) show that in Spain, firms bunch below the revenue cut-off over which they would face more careful auditing. However, we see this paper as the first one to use this type of bunching to estimate relative complementarity of production factors.

More generally, this paper relates to the literature on mandated benefits. As Gruber (1994) points out, the public supply of child care would imply a deadweight loss because of the inefficiencies produced when collecting taxes. Hence, if the benefits received are valued by those who receive them, then the deadweight loss produced by mandated benefits is lower than the one produced by taxation. Furthermore, if there is full valuation of the benefits by employees, then wage will diminish to compensate the mandated cost. Therefore, in absence of rigidities that prevent wages from adjusting, no bunching would be produced if valuation if complete (this is because in practice the total cost of hiring women would not raise as a result of this law). Nevertheless, Gruber (1994) also suggest that the previous argument would not be true when benefits apply specifically to demographically identifiable group within the workplace, as is the case with women. This is produced because of elements as minimum wage, firm internal rules, union agreements or equality laws that prevent wages from adjusting.[1] Moreover, in cases where it is not possible to adjust relative wages, mandated benefits would introduce inefficiencies even when there is full valuation. Consequently, rigidities could provoke higher amounts of bunching independent of benefit valuation by women, since it would not adapt to reflect real valuation and hiring costs.

The rest of the paper is organized as followed. Section 2 describes in more detail the legal background of the legislation we use and presents a framework that will be the basis for our empirical analysis. The following section describes our data and empirical strategy while Section 5 presents the results of our analysis. Finally, Section 6 compares firms at the discontinuity to derive conclusions regarding the substitutability or complementarity of factors within the production function and the last section concludes.

[1]The Law 20.348 of wage equality between men and women was promulgated in 2009 in Chile, so it does not affect the period being studied. Moreover, even today when it is currently active, it compliance is seriously questioned. Consequently, it would not affect the salary adjustment.

2 Legal and Theoretical Framework

2.1 Legal background

The first law regulating child care payment by firms in Chile was promulgated in 1917, called *Ley de Salas Cuna*, and forced every factory, workshop or industrial establishment that hires fifty or more women over eighteen years old shall dispose child care, specially conditioned to receive female employees' children under 1 year old during working hours.[2] Since then, the law has been modified in several opportunities, first diminishing the required amount of female workers from 50 to 20 in 1931 and, in 1987, raising the coverage period from 1 to 2 years.[3],[4]

A series of modifications has also been introduced since 1990, as can be seen in Table 1. Among these modifications the most relevant related to manufacturing are those implemented in 1998 and 2002. The first one expanded the coverage of the regulation, extending the unity over which number of workers is counted from "establishment" to "firm" [5] (this is relevant when a firm has more than 1 productive establishment because "establishment" refers uniquely to the physical place where each one of the firm's plants are located). Hence, the modification made in 2002 obligated industrial and service establishments administered under a common legal entity to finance day care even when the number of women they hired was below the threshold at the plant level as long as it was above the threshold at the firm level.

The 2 changes mentioned above point in the direction of increasing the number of firms susceptible to be forced to provide childcare. Therefore, there are firms that previously to the reforms were not affected by the regulation that were became obligated to pay day care after 1998 and 2002. Consequently, there is an increase in the number of firms that may have incentives to reduce women hiring. Additionally, it is possible that the control level was enhanced during the period next to the reform, as usually occurs after legal modifications (at least temporarily).

As a result, the Chilean labor code in its article 203 currently says that all firms that hire 20 or more women must have annexed rooms where female workers can maintain and feed their children as long as they are below 2 years old. The code also indicates that the same obligation applies to commercial, industrial or services centers or complexes administered under a common legal entity which establishments hire in total 20 or more women. In order to accomplish with the normative, firms have 3 options. First, they can create and maintain child care centers annexed to the work place. Alternatively, firms can share child care facilities with other establishments in

[2]Law 3.186, (1917), Chile.

[3]DFL 178, (1931), Chile.

[4]DL 2.200, (1987), Chile.

[5]According to Chilean labor laws, a firm is "every organization of personal medias, material and immaterial, ordered under a direction for the achieving of economic, social, cultural or benefic goals, endowed with a legal individuality".

the same geographic region. Finally, firms can also pay directly to external day care centers. In practice the latter is the most used modality, as can be seen in Table 2. What can also be seen from this table is that a large fraction of firms simply pay a bonus to the mother which is not sufficient according to the law. The table also evidences the increasing share of firms that are complying with the law over the years.

The cost of providing childcare for two years is relatively important for a firm. According to Aedo (2007), the average cost of registering a child in a daycare was of CLP$100,000 per month (in 2002), which is about US$200. As a comparison, the average wage (for men and women) in the manufacturing sector in that same year was about CLP$218,000 per month. This suggests that this cost is relatively high compared to wage levels. A similar value is obtained by Rau (2010) who measures the cost of daycare for 2008 by calling 30 establishments and obtains an average value of CLP$137.438 for a full-day daycare.

It is worth mentioning that there is no distinction in terms of the type of contract for women to be counted towards the threshold of 20. Therefore, it is irrelevant if women are hired permanently or for specific tasks. Moreover, female workers count the same toward the quota whether they are working full or part time. For this reason, it is probable that firms prefer to avoid hiring part-time female workers, imposing an obstacle to labor flexibility. This element is particularly relevant considering that women are arguably the most benefited group from that kind of work arrangement. Moreover, as Rau (2010) points out, a second reason why firms may avoid contracting part time female employees is that day care centers charge, in average, more than proportionally for the amount of time that children are in child care (taking as reference the full time price). Lastly, it should be noted that firms are not directly forced to pay day care to the children of their subcontracted workers, although they are considered when counting total employees. The obligation then lays on the subcontractor company, which in turn probably transfer the cost to the principal firm.

2.2 Theoretical framework

Having described the legal framework in place, we now model the expected behavioral response of firms to that regulation. A firm i can produce its output Y_i using a production function $\alpha_i F(W, M, K)^\sigma$ where W represents the number of women, M represent the number of men and K, the capital. As is common in the literature, we may think of α_i as the mangerial ability of the entrepreneur. F is assumed to be increasing in each of its argument and displays constant returns to scale in the three factors of production. For ease of exposition, we will further assume that it is a CES production function such that:

$$F(W,M,K) = \left(\left(K^\theta + W^\theta\right)^{\frac{\rho}{\theta}} + M^\rho\right)^{\frac{1}{\rho}}$$

Note that is not very restrictive since we include the Leontief (as $\theta, \rho \to -\infty$), perfect substitutes (as $\theta, \rho \to 1$) and Cobb-Douglas (as $\theta, \rho \to 0$). Note that we will have capital neutrality when $\theta = \rho$ and capital being more complementary to men's than women's labor when $\theta > \rho$.

The firm sells Y in a competitive market where the price is p. Denote the unit cost of each factor as w_W, w_M and r respectively. However, its costs differ depending on whether $W \leq 19$ or $W > 19$. In the latter case, the firm faces an additional cost that it must pay for all women it hires, given by τ.

Firm size here is determined by α_i. More productive entrepreneurs will have larger firms, all factor uses will be increasing in α_i and there will be a lower bound below which all entrepreneurs will chose not to open a business.

Given that the production function is homothetic, factor ratios will be entirely determined by factor prices, as long as firms do not distort their decisions to avoid becoming subject to the policy. Thus, the policy will decrease the relative use of women's work compared to that of men and capital.

Proposition 1 *The childcare policy will distort factor choices once firms become subject to the policy away from women and towards capital and men, except if factors are perfect complements. M/W and K/W will be lower than for firms whose optimum is $W < 19$ and K/M will be lower if $\theta < \rho$.*

Proof. From the first order conditions:

$$K/W = \left(\frac{w_W}{r}\right)^{\frac{1}{1-\theta}}$$

and

$$M/W = \frac{w_W^{\frac{1}{1-\theta}} \left(r^{\frac{\theta}{\theta-1}} + w_W^{\frac{\theta}{\theta-1}}\right)^{\frac{\theta-\rho}{\theta(1-\rho)}}}{w_M^{\frac{1}{1-\rho}}}$$

which are increasing in w_W. Finally, we have that

$$K/M = \frac{w_M^{\frac{1}{1-\rho}}}{r^{\frac{1}{1-\theta}} \left(r^{\frac{\theta}{\theta-1}} + w_W^{\frac{\theta}{\theta-1}}\right)^{\frac{\theta-\rho}{\theta(1-\rho)}}}$$

which is increasing in w_W when $\rho < \theta$, namely when capital is more complementary to men than women's labor. ■

However, the policy also has an additional distortion in that some firms may find it optimal to remain artificially small in terms of women employees to avoid being subject to the policy. Firms will do this if the profits from restricting their hiring of female workers to 19 is higher than that of becoming subject to the law. Denote $\underline{\alpha}$ as the α_i where the hiring of women is just equal to 19 in the unconstrained case and $\bar{\alpha}$ as the firm that will be just indifferent between restricting its hiring to 19 female workers and becoming subject to the law.

Proposition 2 *Over the range $\alpha_i \in [\underline{\alpha}, \bar{\alpha}]$, K/W and M/W are increasing such that there is a discontinuity at $\bar{\alpha}$ where firms with $\alpha_i < \bar{\alpha}$ have substantially higher K/W and M/W ratios than those with $\alpha_i > \bar{\alpha}$. K/M will be increasing over that range as well if $\theta > \rho$ and be decreasing when $\theta < \rho$. K/M will also jump discontinuously at $\bar{\alpha}$ with firms with $\alpha_i < \bar{\alpha}$ having a larger (smaller) K/M ratio than those with $\alpha_i > \bar{\alpha}$ when $\theta > \rho$ ($\theta < \rho$).*

Proof. The first order conditions of the problem with firms being restricted to elect $W = 19$ become $\alpha_i \sigma F(19, M, K)^{\sigma-1} M^{\rho-1} = w_M$ and $\alpha_i \sigma F(19, M, K)^{\sigma-1} \left(K^\theta + 19^\theta\right)^{\frac{\rho-\theta}{\theta}} K^{\theta-1} = r$. It is easy to show that as α_i increase, marginal products must decrease for the equalities to remain valid and as such $M/19$ and $K/19$ must rise. Once more, whether K/M will rise or fall will depend on whether capital is more or less complementary to men's than women's labor as the ratio of marginal productivity requires that

$$K/M = \frac{w_M}{r}^{\frac{1}{1-\rho}} \left(1 + \frac{19}{K}^{\theta}\right)^{\frac{\rho-\theta}{\theta(1-\rho)}}$$

In all cases, for values very close to $\bar{\alpha}$, we will have discontinuity in factor ratios. To ease the exposition, let us assume, without loss of generality that before the policy, $w_M = w_W = r = 1$. Then, it can be shown that for $\alpha_i < \underline{\alpha}$, $K = W$ and for $\alpha_i > \bar{\alpha}$, $K/W = (1+\tau)^{\frac{1}{1-\theta}}$. It can be shown that factor choices (K, M) would be the same for α_i approaching $\bar{\alpha}$ from the left as for α_i approaching $\bar{\alpha}$ from the right if $19/K = (1+\tau)^{\frac{1}{\theta-1}}$. But if that was the case, then it can be shown that the profits of a firm that restricts itself to 19 women would be lower than those of a firm where they do become subject to the policy since

$$\frac{\pi_{W>19}}{\pi_{W=19}} = \left(\frac{\frac{1+(1+\tau)^{\frac{1}{\theta-1}}}{1+(1+\tau)^{\frac{\theta}{\theta-1}}} + \left(1 + (1+\tau)^{\frac{\theta}{\theta-1}}\right)^{\frac{\rho(\theta-1)}{\theta(1-\rho)}}}{1 + \left(1 + (1+\tau)^{\frac{\theta}{\theta-1}}\right)^{\frac{\rho(\theta-1)}{\theta(1-\rho)}}} \right)^{\frac{\sigma}{1-\sigma}}$$

This is less than 1 since $(1+\tau)^{\frac{\theta}{\theta-1}} > (1+\tau)^{\frac{1}{\theta-1}}$. This is because the output of both firms is the same but one of the firm must pay a higher cost for female workers. Thus, if firms not subject to the policy were to chose factor ratios that would be identical to those who would be subject to the policy, they would not be indifferent between the two options, which means that we would not be at the point $\alpha_i = \bar{\alpha}$. Given that profits for the firms below the threshold are decreasing in $19/K$, firms will continue to increase their use of capital beyond the point where $K/W = (1+\tau)^{\frac{1}{1-\theta}}$ until their profits are equalized. This will imply that we will have discontinuous jumps in factor ratios around the threshold. Finally, since for $\alpha_i < \bar{\alpha}$, $K/M = (1+(19/K)^{\theta})^{\frac{\rho-\theta}{\theta(1-\rho)}}$ while it is equal to $(1+(1+\tau)^{\frac{\theta}{\theta-1}})^{\frac{\rho-\theta}{\theta(1-\rho)}}$ when $\alpha_i > \bar{\alpha}$, by the same argument, we must know that K/M will have a discontinuous jump around $\bar{\alpha}$ and that the direction will depend on whether θ is larger or smaller than ρ. ■

A graphical representation of the model is provided in Figure 1 and 2. These show that if there is bunching, the sign of the jump is K/W and M/W will always be the same but the direction of the jump for K/M will depend on the relative complementarity or substitution between capital and each type of workers.

Finally, we can also derive conclusions regarding the extent of "bunching" around $W = 19$ and how it depends on the elasticities of substitutions of factors.

Proposition 3 *The range of $\alpha_i \in [\underline{\alpha}, \bar{\alpha}]$ will be decreasing in θ and increasing in ρ/θ.*

Proof. The degree of bunching will be reflected in how different will be $K/19$ and $M/19$ below the discontinuity and K/W and M/W above it. In the two extreme cases, perfect substitutes and perfect complements, we will have an infinitely large difference and no difference at all for the Leontief production function. Thus, when it is least costly for the firm to change the factor ratios is when we will have the most amount of bunching. The returns to having different factor ratios decreases with θ and ρ until, in the Leontief case, it is nonexistent. Thus, bunching will be decreasing in θ. From the profit ratio equation above, it can be shown that the profit ratio decreases as the ratio of ρ to θ increases. As that ratio decreases, there is more incentives for firms to avoid the legislation by bunching before hiring 20 women. ■

This will direct the rest of our empirical analysis. We will try to focus on sectors, firm sizes and periods where firms may have been either facing a higher τ, thus making the restriction more stringent, or on firms where the elasticities of substitutions may be higher. Given the low level of female participation in the manufacturing sector in Chile, this implies focusing on groups of firms where women are hired in smaller numbers.

3 Empirical strategy and data

We then use the context generated by this law and our theoretical framework to first test for some evidence of bunching just below the legal cut-off. We finally present the data employed in our analysis.

3.1 Empirical strategy

We first used the method suggested by Chetty et al. (2011), which estimates a counterfactual density using a polynomial approximation. This method has been used by Kleven and Waseem (2013) and by Ito and Sallee (2014) to study the distribution of tax payers and the weight of cars in response to regulations.

This method involves estimating a counterfactual that ignores the bunching to then compare the actual values with the ones observed in the data. For this, we first estimate the distribution excluding the point in which we anticipate bunching. Following Ito and Sallee (2014) , denote C_j the quantity of firms that hire j female workers. To estimate the counterfactual distribution, we run the following regression

$$C_j = \sum_{s=0}^{S} \beta_s \cdot j^s + \sum_{j=18}^{21} \gamma_j^0 D_j^0 + \epsilon_j \tag{1}$$

where D_j^0 a dummy that takes, initially, the value of 1 for each point where we suspect bunching. Using the estimates of that regression, we can compute the counterfactual distribution $\hat{C}_j^0 = \sum_{s=0}^{S} \hat{\beta}_s \cdot j^s$. Then, the excess of firms that hire k female workers with respect to the counterfactual distribution is given by $\hat{B}^0 = C_k - \hat{C}_k^0 = \hat{\gamma}_k^0$. However, this measure is inappropriate because it does not take into account that the bunching comes from lower density in other parts of the distribution, in our case, for firms with more than 19 workers. We adopt the methodology of Kleven and Waseem (2013) and start including firms with one more woman worker in our value of D. We can then calculate, in addition to the extra bunching $\hat{B}$, the area missing to the right of the cutoff $\hat{M}$. In their example, the continue to expand the range of D until $\hat{B} = \hat{M}$ since their running variable is continuous. However, since in our case, our running variable is discrete, we must stop at the point where $\hat{B}$ is closest to $\hat{M}$. We explored this and, almost always, $\hat{B}$ is smaller than $\hat{M}$ when we include up to 21 workers and passes to be larger when we include 22 workers. We will thus often present both sets of results since they are not equivalent. Also, since in our case $\hat{B} \neq \hat{M}$, we will present both estimates. One measure the excess bunching at values slightly below the discontinuity while the second measures the lack of firms above the threshold. We think that, in this context, both estimates may be relevant. Following Kleven and

Waseem (2013), we use residual bootstrap to obtain a distribution for the parameters β_s and then construct an empirical distribution for $\hat{B}$ and $\hat{M}$.

As an alternative, we use the method of McCrary (2008) based in a regression discontinuity design. However, we need to make adjustments to McCrary's methodology since the use of local linear regression may not be best here given that our running variable (number of female employees) is discrete. Instead, in that case, it is usually recommended to use a polynomial approximation, see for example Card and Shore-Sheppard (2004), Kane (2003) and DiNardo and Lee (2004).[6] We thus regress the density of firms with j women workers on a polynomial of j interacted with a dummy for being above the threshold.

Following Lee and Lemieux (2010), we use the following specification:

$$\ln f = \alpha + \beta D + \gamma(j^S - 20) + \delta D(j^S - 20) + \epsilon \quad (2)$$

where we use a window of 15 above and below the threshold and a polynomial of degree 2 in the baseline specification. We check this specification using graphical analyses and robustness checks such as altering the degree of the polynomial and the size of the window.

4 Data

The data employed to conduct these empirical specifications are from the *Encuesta Nacional Industrial Anual* (ENIA) which is a panel of manufacturing firms. We have this data for the years 1995 through 2007, which includes the years in which the legal obligations to the firms have become more binding. The survey includes firms with more than 10 workers which operate in the manufacturing sector of Chile.[7]

The survey includes, at the level of an establishment, key variables regarding sales, employment, costs, etc. We will focus in particular on the number of men and women workers, total earnings as well as various measures of capital and output. These variables are all self-reported. We think this is potentially better than administrative data since we may see more bunching in administrative data since firms would be unwilling to report a twentieth woman to their payroll to labor regulators but may be very willing to report that they have 20 women in their firm to the survey (similar to Blank, Charles, and Salle (2009)). Thus, the bunching we find could be seen as

[6] Frandsen (2014) develops a different methodology to analize bunching, which proxies the observed distribution to a binomial with probability 1/3 for each of the 3 points around the discontinuity. However, this method does not work well in distributions that are decreasing (instead of "flat") like the one we have.

[7] The survey also includes establishments with less than 10 workers because they are part of a multi-unit firm with more than 10 workers. However, these are not included in our sample since we cannot determine the total number of workers in that firm using the survey.

a conservative estimate, including "hidden" workers that would not be captured in administrative data. Furthermore, if firms round their responses, answering mostly multiples of 5 or 10, we may underestimate the bunching we faced since many firms will round 18 or 19 female workers to 20.

The sample includes more than 70,000 firm-year observations. From that sample, 50 percent have less than 5 women hired and 85 percent of the sample has less than 20 women hired. By restricting our sample to those within a window of 10 or 15 women of the discontinuity, we focus on 17 and 35 percent of the sample respectively. Since a large part of firms are surveyed multiple times, we find that many firms remain within the sample each time they are surveyed while a majority are sometimes within our sample and sometimes outside. About a third of the firms subject to the law because they hire more than 20 women have always been so in the sample while the remaining has had some years below and some years above.

The next table compares firms above and below the threshold within a window of 15. It also separates the sample according to the years, firm size and by sector. We denote sector A the 5 most female sectors in the sample.[8] Specifically, this corresponds to the manufacturing of food products and beverages, textiles, wearing apparel, leather and medical, precision and optimal instruments. Sector B, on the other hand, includes the remaining sectors. We cannot use, as a counterpart, the 5 sectors that have the least amount of women since, within those sectors, the number of firms close to the threshold is extremely limited. While one may be worried because we used our own data to classify industries into female and less female-intensive sector, the United States' manufacturing sector, for example, shares 4 out of the 5 sectors we use here as their most female intensive, suggesting that our results are unlikely to be driven by the fact that we selected these sectors within Chilean's manufacturing sector.

This table shows that firms below and above the threshold are different in many ways. Firms below the threshold are smaller in terms of male employment and much less numerous. Average salaries and labor productivity are also lower in firms below the threshold. The number of women hired in each type of firm appears to have been stagnant over the years while men employment, in particular in firms that hire more than 20 women, has been increasing. The fast economic growth experienced by Chile is visible in the increase in average salaries and labor productivity over the period of the study. The most female sectors are not hiring much more women than other sectors but they are hiring much fewer men. They are also sectors where wages and labor productivity are lower. Finally, firms with less than 100 employees hire slightly fewer women but they hire much fewer men. This suggests that large firms are the ones where female workers are particularly scarce. Small firms are also paying lower wages and tend to have lower labor productivity. It is worth noting that only in small firms do we see firms with fewer

[8] This corresponds to sectors 15, 17, 18, 19 and 33 of the CIIU classification Rev. 3

than 20 women having higher labor productivity than those who are above the threshold.

It is worth noting that a major disadvantage of this database is the fact that we have extremely limited information regarding the characteristics of the employees except their gender. We will explore the little disaggregation there is by occupation later on in the paper.

5 Empirical results

Having described our empirical strategy and the data we will employ, we now turn to empirically testing whether there is evidence of bunching in response to the law, both in aggregate and in some subgroups as guided by our theoretical framework.

5.1 Graphical evidence

We first present graphical representation of the number of women in the firms in our sample. Figure 3 shows a histogram where we display the number of firms who hire a given number of women, within 8 of the policy threshold, for the full sample of year-firm observations from the ENIA. We find some weak evidence that firms appear to be more numerous just below 20 firms than at 21 and 22 firms but in the overall sample, bunching is only weak.

Our next figure shows the same histogram but this time divided into three time periods. We see that as the legal framework became more and more binding, the bunching becomes clearer and clearer. Already, in 1999-2002, there seemed to be a much smaller number of firms hiring more than 20 female workers than in the previous years and some additional mass between 15 and 19 employees. However, there were also a large number of firms at exactly 20 female employees, suggesting either rounding bias or simply a fair number of firms who do not avoid altogether the legislation despite their best efforts. By 2003, the histogram seems to visually indicate much more bunching below 20 women.

We then contrast histograms by the industrial sector where the firm is operating. Firms in sector A correspond to sectors where female employment is the highest in aggregate, and thus where limiting the number of women may be more difficult. The rest of the firms are in sectors (denoted as Sector B) where women workers are, in general, much less numerous and thus where a firm may be able to restrict the number of women it hires more easily. The histograms presented in Figure 5 suggest exactly that. While the histogram of sector A shows little difference in the number of firms with 19 and 20 female workers, the one of sector B shows very striking change in the number of firms above and below 20 female employees. There are about 80 fewer firms with 20 female workers than firms with 19 women workers. In this case, firms clearly seem to avoid the threshold of 20. This is even more marked if we only look at firms in sector B in the later period, where the pattern is more marked.[9]

We then separate our sample by size. Large firms are much more likely to have a number of women workers close to the threshold given the number of workers they have. In small firms, avoiding the 20 female worker threshold is relatively easy since only 10 percent of the firms in that sample hire more than 15 women. Crossing the threshold may also be much less costly for small firms since monitoring by the Labor Directorate is much less intense in small firms than in large and that small firms may be able to offer their female employees alternative benefits to compensate the absence of child care. Figure 6 show that there is no evidence of bunching in firms of less than 100 employees. However, in firms with more than 100 employees, the impact of the law is really striking. There is 20 percent fewer firms with 20 female workers than with 19. And the graph shows that large firms are relatively successful at avoiding hiring any number of women above 20 since the number of firms above 20 remains equally stunted.

We finally separate our sample according to the exercise performed by Prada, Rucci, and Urzúa (2015). In their study, they use fixed effects for firms, which is equivalent to using only firms that switched over time between being subject and not to the law. It is clear that these firms may be different than firms that purposefully avoid the cut-off. We thus split our sample of years-firms into those that include firms that switched from being subject to not subject to the law and those that have always been on one side of the discontinuity. It is a matter of statistics that the graph of switching firms would have a hump-shape while the graph of those who never switched would be hollowest exactly at the cut-off. However, it is telling that while in both cases, we find evidence that firms seem to dislike having more than 20 female workers, it is only within non-switching firms that a discontinuity can be observed exactly at 20. This seems to indicate that firms that pass the threshold from time to time appear to pass it mostly at 20 or 21 while firms that have managed to avoid being subject to the law have carefully bunched before the threshold. This may explain why the aforementioned paper cannot reject the hypothesis that there is no strategic positioning on each side of the discontinuity but we find evidence of it in various sub-sample.

5.2 Polynomial approximation method

We now turn to our formal tests to quantify the magnitude of the bunching. We start with the polynomial approximation of the distribution as suggested by Chetty et al. (2011). These results are presented in Table 4. For each column, we present the "excess bunching", which is the mass at 18 and 19 workers that is above what the polynomial would have predicted and the "missing

[9] Available upon request.

mass” at 20, 21 and 22 (only in Panel B) workers which is below what the polynomial would have predicted. As we indicated before, we present both measures since, given that we are in a discrete setting, they are not equal to each other. We include in brackets the standard deviation of the distribution of bootstrapped parameters. The “randomness” in the parameter comes from the fact that our polynomial is estimated and not exact.

Our results suggest that there is strong evidence of missing mass above 20 female workers. A large number of estimates are statistically significantly different from 0. However, the evidence of excess bunching at 18 or 19 female workers is much weaker. We only find statistically significant evidence of excess bunching for the 2003-2007 period and for large firms. We find that, in general, the patterns we identified graphically are confirmed by this methodology such that the largest bunching is found for recent periods, sectors with few female workers and large firms. The magnitudes are relatively striking. We find that on average, some 100 firms may be “missing” compared to what the counterfactual polynomial would predict. We find excess bunching in 18-19 female workers of about 20-40 firms. When we include all years, sectors and firm size, we have about 1100 firms with 18-19 female workers and 900 (1300) firms with 20-21 (20-22) female worker, which suggest that this corresponds to about 10 percent of excess mass and about 3 percent of excess bunching. However, the results also indicate that this method is relatively fragile in predicting whether the graphical evidence we presented before is indicative of bunching and this may be because the distribution of firms is far from being smooth.

5.3 Test of McCrary

We thus turn to an alternative test which is the test of McCrary (2008) which we altered given the discreteness of our data as discussed above. This test allows for the distribution of firms below and above to have a different polynomial approximation, which would then potentially provide us with a different result than the ones with the polynomial approximation. It also directly measures whether there is a discrete jump at the point of the threshold instead of comparing the masses to a counterfactual distribution. The results of the test are presented in Table 5 using the same divisions as the previous table.

The results suggest that we observe a discrete jump in the log number of firms around the legal threshold. The magnitudes are relatively large. For our larger window, on average, we find 23 percent fewer firms above 20 than below that threshold. For our smaller window, we find an even bigger estimate (26 percent). However, exactly as before, we also find heterogenous patterns in these results. Before 1998, the law barely appears to have affected the hiring decisions of firms. However, by 2003, when the law becomes even more strict, we observe a very large and significant different in the log number of firms above and below the threshold. Similarly, we find strong evidence of an effect for more male-intensive sectors than those more intensive in women workers. Finally, we find evidence that only large firms alter their hiring decisions around the threshold.

While not reported, the test of McCrary shrinks but remain significant if we measure the log number of years a given firm has a given number of female worker as our dependent variable and include firm fixed effects, that is to say, we ask instead if there is a discontinuity in the number of years in our sample where a firm reports a given number of female worker. This suggests that even within switchers, we continue to find evidence of a discrete jump around 20 female workers.

6 Adjustment mechanisms

We then turn to studying in particular how firms on each side of the discontinuity differ in other input choices than only women to try to derive some conclusions regarding the relative complementarity of capital and women/men labor. To do this requires the additional assumption that after the controls we include in the regression, firms are using the same production function on each side of the discontinuity. Then we can use the framework we presented above to derive how each type of labor may be substitute or complementary to capital. We conduct all analysis in log terms.

We first demonstrate that at the threshold, firms experience a substantial change in the ratio of male to female in their workforce. Table 6 shows that firms that have just above 20 female workers have, on average, 7-8 percent fewer men per women workers than firms just below that threshold. When computed in levels, this implies about 0.4 fewer male per women workers at the discontinuity. Once we split our sample into sub-groups as we have done earlier, we find that the same places where we noticed irregular bunching are the points where we are able to find also evidence of a jump in the male-to-female ratio within workers, although the evidence is stronger for our smaller window than the larger one. This suggests that firms that elect to hire more than 20 female workers substitute in part from hiring male workers. This is consistent with our theoretical framework which suggests that it is for groups of firms where bunching is most salient because of the cost of the policy or the capacity to substitute to other factors that we should observe a discontinuous jump in the number of men per woman in the firm's workforce.

We now turn to evaluating how measures of capital-ratios differ above and below the discontinuity. For this, we use 3 different measures, each presented in a different panel of the following tables. One is the value of capital. This is the most comprehensive measure we have access to but is only available starting in 2001. We thus use two alternative measures which involve complementary inputs to machinery and equipment capital, namely expenditures on electricity and expenditures on fuel. While it is clear that neither of these measures is ideal, we think that their combination should provide us with a more complete picture than any of them separately.

Table 7 shows the discontinuity we observe in terms of capital per women workers around the threshold. It presents the estimate at the discontinuity for our smaller window of firms between 10 and 30 workers. Results when using a smaller window are weaker in that case for capital but similar for the other measures. Table 7 shows that in the case where capital is measured by the value of the capital stock, we observe very marked decreases in that ratio as firms become subject to the policy. On average, the results suggest about 33 percent fall in the capital per female worker. This increases when we focus only on the most recent period. It is also more marked again for sectors where we observed bunching, mainly those less intensive in female workers and the largest firms (although only significantly so for the first one). The results for electricity and fuel expenditure are also relatively consistent with our hypothesis, showing, in the cases of the sub-sample where we observed bunching and shifts in male/female ratios, some negative and significant coefficient for many cases. In the case where we do not observe bunching, we have some positive coefficients, which is again what we would expect since the cost of female workers would be higher above the discontinuity and thus would lead to a higher capital-per-women ratio above the threshold than below if firms do not strategically behave to avoid the law.

We then present, in Table 8, the discontinuity in terms of capital per male worker. Our framework suggested that if we observe a decrease in the capital per male worker around the discontinuity, this would be indicative that capital is more strongly complementary to men's labor than women's labor. We find in Table 8 large, negative and statistically significant jumps in the log of capital per male worker when comparing firms just above the discontinuity to firms just below it. Interestingly, we find again that these are much stronger (only statistically significant) in sub-samples where we saw a significant decrease in male per female worker, namely more recent and more male-intensive sectors. This suggests that as firms above the discontinuity hire more women, they substitute away from capital more strongly than they do so with male workers. This is thus an indication that they capital complement more strongly men than women's work. Our alternative measures of capital do not indicate necessarily the same pattern. We find a positive and significant increase in the expenditures on electricity or fuel per male worker in a few instances but only in sub-samples where we observed limited bunching. This is again what we expected given our model that in groups where firms do not distort size very strongly, K/M would be higher when the firms have to pay a larger wage to women as long as capital particularly complements men's work. We thus see this as evidence that in this particular setting, capital complements much more strongly the work of men than that of women.

This could be because male and female workers are fundamentally different or because female have different skill levels than men and capital responds to skill levels. We unfortunately do not have information regarding the educational level of workers in the ENIA but we do have access to their occupation. We classify as high-skill workers the following categories provided by the database: owners, directors, specialized workers and administrative personnel. The corresponding categories for low-skill are: commission workers, unskilled direct workers, unskilled indirect workers and personal service workers. While clearly not ideal divisions, they should help us identify if the avoidance of women was done in a way to favor a type of skill or another. Table 9 present the test of discontinuity in the log of the high per low skill worker for all workers (in Panel A), and for men and women in the subsequent panels. They use the smaller window but results are extremely similar when using firms between 5 and 35 workers. These results indicate no statistically significant change in the skill ratio around the cut-off of the law. This suggests that the avoidance of female workers did not, at least based on our coarse definition of skills, lead to a change in skill composition that could explain the response in capital we previously documented. We do find some evidence that as firms cross the threshold, the skill ratio of *female* workers fall in the most recent period, suggesting that firms who limit the hiring of women do so more intensively in low-skill occupations than in high-skill ones. This is logical if this is a group that can be more easily substitutable. We also redid this exercise using 3 skills group instead of 2 to try to approach more the "automatizing tasks" but found limited evidence of a change in this case as well.

We confirm that capital is key to the puzzle we display by also dividing sectors between those intensive in capital and those less intensive in capital. To obtain a definition that is as far as possible from the Chilean context, we use definitions from either the US capital share by manufacturing industries (from the Bureau of Labor Statistics Multifactor Productivity Tables) or from Manova (2013)'s physical capital intensity measure.[10] While not reported here, we find that the discontinuous pattern we find here are most marked when we remove the sectors with a physical capital intensity of less than 0.05 (compared to an industry average of 0.07) in the case of Malova and sectors with capital shares below 10 percent (in the case of the BLS). This suggests that sectors that are more intensive in physical capital were more likely to experience bunching and much more likely to show the pattern of higher complementarity between men and capital than women, which we showed above.

Finally, we also check whether there is evidence of adjustments in terms of other variables. The results of these regressions are presented in Table 10. We first estimate whether there is a discontinuity in the log total number of workers around the cut-off in Panel A. This would be expected to be 0 if firms were simply replacing female workers with male workers when they wished to avoid the legislation. We find some evidence of this in aggregate but not in the sub-groups where bunching was most visible since in this case, we have a clear decrease in the

[10] We obtain similar results if we rank, within our data, the industries by K/L and drop the least capital intensive sectors from the analysis.

number of workers when firms hire more than 20 workers. This is normal since it is in this context that we found the most evidence of substitution with capital. In Panel B, we explore the only variable we have available regarding wages and find some weak evidence that firms that hire 20 female workers pay on average lower wages than those who hire just 19. However, since we do not have wages by gender, it is very difficult to make any inferences from this result. It could be, for example, that by hiring more women, if women have lower wages than men, that this would lower the average wage paid to workers. In definitive, if the wages were lowered sufficiently to make firms indifferent between hiring and not hiring the twentieth woman in the firm, we should not expect to observe the bunching we documented before. Finally, our framework suggest that if we are truly capturing firms that are indifferent between the two levels of woman hiring, we should observe that firms that hire more than 20 women and those that hire less should have similar profits since they must be indifferent. We use value added per worker as a measure of labor productivity and find no evidence that this changed discontinuously around the cut-off of 20 women. The substitution for capital is thus made in a way that does not increase value added per worker.

7 Calibration

To calibrate our model, we need to obtain credible estimates of the parameters of the production function. We focus in firms that hire less than 17 women to try to avoid the zone of bunching. First, we use the average wages and the share of male and female employees to compute the average salary paid by gender. For this purpose, we use data on the gender wage gap in Chile, which suggests that women with less than high school earned about 80 percent of their male counterparts over this period, while for those with more than high school this was about 65 percent. We use a 75 percent wage gap in our base estimates. By doing this we obtain an average wage per year in our constrained sample of M$ 5,935 for men and M$ 4,451 for women.

We then use the estimate of r computed in Caselli and Feyrer (2007), equal to 0.26. We use our equations on factor ratios and the average factor ratios observed in the data to obtain the parameters ρ and θ. Finally, we set the firms returns to scale parameter, σ, by matching the firms reported value added with the production level given our estimates of the parameters and the average amount of each factor reported by firms in the data. The values for each parameter and subsample are displayed in Table 11.

Following our theoretical model, we then need to calibrate the managerial ability or productivity factor, α_i. We perform this by matching total number of workers of the firms hiring up to one hundred employees.[11] To do this we assume that the distribution of α_i follows a Pareto distri-

[11] This forces us to drop the subgroup of larger firms from our data. Likewise, we exclude the subgroup of smaller

bution, which is a common assumption in the literature and simplifies the problem by allowing us to choose a single parameter.

Once we estimate the underlying parameters of the Pareto distribution, we use it to obtain random draws and compute the optimal hiring of capital, men and women, given the previous parameters. We then use this to compute women's hiring under different assumptions for the cost of the policy to firms. Figure 8 shows the results of our estimation for the period 2003-07 assuming that there is no cost associated to the policy. These distributions are consistent with our previous findings, indicating a decrease in the number of women's hiring for firms above the threshold and a slight amount of firms bunching just below the threshold coming from missing firms just above the threshold. The picture suggests that firms may avoid hiring women by selecting to hire 16-19 women instead of bunching exactly in 19.

Our calibration then allows us to obtain bunching estimates under alternative scenarios, assuming different costs of the policy to the firms. We compute our baseline cost measure using data from the *Encuesta de Caracterización Socioeconómica Nacional* (CASEN) from 2006 to obtain the proportion of women who have children under the age of 2 who are employed, which is 5.7 percent. We then use data of the childcare cost per children and average wages for women in the ENIA to calculate that the average cost of the policy is equivalent to 1.5 per cent of the wage of women hired in unconstrained firms.[12]

Using this cost estimate, Figure 9 shows the estimates obtained in our calibration for the period 2003-07 assuming that firms bear the full cost of the policy, producing a bunching of 34.4 per cent. However, as Gruber (1994) points out, it is plausible that part of the cost of this kind of policies is also transmitted to the benefited population through lower wages. Unfortunately, we do not have wages information at the worker level to directly measure this outcome. Despite this, our calibration permits us to contrast the bunching level observed in the actual data with the bunching we observe under different degrees of cost transmission from firms to women. Thus, we use this to find the proportion of the cost that has to be passed-through from the firms to women so that the observed level of bunching matches that in the model.

Table 12 shows the estimated bunching for each of the calibrated periods. We compare this results with our bunching estimates from the McCrary estimations, which we consider to be more precise, and find that for the whole sample the results are consistent with a context where firms transfer 42.9 percent of the cost to women through lower wages. Our results also suggest that an important mechanism leading the increase in bunching in the more recent period was a lower degree of pass-through of the cost from firms to women. In specific, our calibration shows that

firms from the analysis because there is no direct comparison group available.

[12]This computation assumes that women cannot sort into larger or smaller firms around the threshold. In particular, if women with children under two years old could sort into larger firms then the cost would be larger and our estimate would represent a lower bound.

the proportion of the cost transferred to women amounts to 28.6 percent in the period 99-02 and disappears in the latter period. Moreover, these results are also consistent with our hypothesis that compliance with the law has increased over time, as reflected in the data. Similarly, we find results consistent with a scenario where firms in Sector A, where it is easier to substitute women, transfer a larger proportion of the cost to women, while firms in sector B bear the whole cost of the policy.

Thus, our calibration results suggest that not only did change in elasticities between the different samples made the bunching more likely, there are also other factors that appear to have been at play, more likely in how much of the impact of the policy the firms were able to pass through to their workers.

8 Conclusions

This paper thus documents the existence of marked concentration of firms below the threshold of 19 women in the Chilean manufacturing sector that appears to be a way for firms to avoid becoming subject to the mandated childcare policy in place. This is more evident in more recent periods (where enforcement appears to have increase) and in firms with higher substitution capacities (those in industries with low numbers of women workers and larger firms). We also document that this bunching has translated into distorted factor ratio use that favor capital and men over women around the discontinuity. The patterns suggest that in this context, capital is more complementary to men than women's labor.

This is the evidence from one given sector, namely manufacturing. We elected this dataset because it was one of the only available dataset that would give us measures of capital. However, our framework also suggests that the substitutability of factors is key for this type of policy to distort firm choices. In agreement with this, we have found limited evidence of bunching in other sectors than manufacturing and primary sectors, using a firm survey in Chile (ELE, Encuesta Longitudinal de Empresas). This would reinforce our point that the existence of capital as a valid substitutes for women workers is key in the pattern we document. We think that this has been mostly ignored in other studies of size-dependent labor policies and would be worth more analysis.

The evidence we suggest also implies that while this policy may benefit mothers who have an employment in Chile, it may do so at the cost of limiting female employment. Given that Chile has a very low level of female participation, this type of policy should thus be reevaluated to remove the disincentives of the law in the hiring of women.

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9 Tables and Figures

Table 1. Legal changes between 1900 and 2010

Year	Law	Summary
1993	19.250	Allows, during vacation periods, the use of schools to function as daycare centers
1995	19.408	Alters article 203, extending the daycare benefit to commercial centers or buildings administered under a single legal name or entity.
1998	19.591	Alters article 203, changing the term “establishments” for “firms”.
2002	19.824	extending the daycare benefit to industrial and service establishments administered under a single legal name or entity.
2007	20.166	Extends the right of working mothers to breastfeed their children during their work day even when there does not exist a daycare.
2009	20.399	Extends the right to daycare benefits to workers who are the legal guardian of children of less than 2 years old, to fathers if the mother has died and to working fathers who are the legal gardian of their children.

[1] *Source: Dirección del Trabajo, Ministerio del Trabajo, Chile.*

Table 2. Compliance with daycare law

	1995 (%)	1999 (%)	2002 (%)	2004 (%)	2006 (%)
Has their own/shared daycare	9.3	7.1	8.5	5.6	5.1
Pays the costs of daycare	57.6	43.8	47.2	58.0	69.2
Pays a bonus to the mother	16.6	20.1	36.8	19.6	14.5
Does not give any benefits	16.6	24.9	7.3	9.2	9.4
Other response	0	4.1	0.2	7.6	1.7
Total	100	100	100	100	100

[1] *Source: Dirección del Trabajo, Ministerio del Trabajo, Chile.*
[2] *The sample include only firms with 20 or more women and at least one child of less than 2 years old.*

Table 3. Description of firms above and below the threshold

	N Women		*N* Men		W/L		VA/L		*N* firms	
	$W < 20$	$W \geq 20$	$W < 20$	$W \geq 20$	$W < 20$	$W \geq 20$	$W < 20$	$W \geq 20$	$W < 20$	$W \geq 20$
1995 - 2007	9.5	26.0	53.7	109.6	5.1	5.6	22.1	29.5	24249	4347
1995 - 1998	9.6	25.9	55.9	101.4	4.0	4.5	16.6	20.8	8099	1621
1999 - 2002	9.4	25.9	50.9	104.7	4.6	5.3	22.3	25.8	7247	1145
2003 - 2007	9.4	26.1	53.9	121.6	6.5	6.9	27.0	41.1	8903	1581
Sector A	9.5	26.1	30.1	53.4	3.3	4.0	12.8	14.8	13066	2544
Sector B	9.4	25.8	81.2	188.9	7.1	7.8	33.1	50.2	11183	1803
Small	9.1	25.8	25.4	24.0	3.9	4.6	16.1	12.9	20279	2746
Large	11.3	26.3	205.1	254.0	7.5	8.4	52.8	58.0	3970	1601

[1] *Sector A includes the 5 sectors with the highest female participation while Sector B includes the other sectors.*
[2] *W/L is the wage bill per worker (men and women) in millions of Chilean pesos of 2007.*
[3] *VA/L is the value added per worker in millions of Chilean pesos of 2007.*

Table 4. Results of Counterfactual Polynomial

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
				Panel A: Using up to 21 workers				
"Excess bunching"	40.855	-13.505	13.993	41.149***	31.098	10.153	1.370	40.870***
	(33.202)	(12.969)	(15.242)	(15.369)	(30.950)	(22.881)	(29.743)	(9.473)
"Missing mass"	96.868***	23.100	29.051	47.171***	14.237	86.053***	46.912	51.328***
	(32.637)	(13.479)	(16.308)	(16.169)	(31.063)	(24.633)	(31.323)	(9.754)
				Panel B: Using up to 22 workers				
"Excess bunching"	18.654	-19.405	5.965	30.725*	28.222	-7.455	-11.371	31.312***
	(33.365)	(13.484)	(16.780)	(15.884)	(33.316)	(22.891)	(31.942)	(9.460)
"Missing mass"	196.550***	48.110**	63.226*	92.862***	32.312	167.104***	104.343*	93.701***
	(53.791)	(22.177)	(28.709)	(26.933)	(51.467)	(38.260)	(52.070)	(15.580)

Standard deviation of the bootstrapped distribution presented in parentheses. The regression included a 5th order polynomial in number of women workers and a dummy for firms with 18-21 workers in Panel A and with 18-22 workers in Panel B. The number of stars specify how much of the bootstrapped distribution is below 0. *: less than 5 %; **: less than 1%; ***: less than 0,1%.

Table 5. Results of McCrary's test

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
	Panel A: Using firms with 5 to 35 female workers (N=31)							
$W \geq 20$	-0.225***	-0.067	-0.264*	-0.360***	-0.059	-0.423***	-0.152	-0.370***
	(0.080)	(0.074)	(0.149)	(0.107)	(0.083)	(0.126)	(0.096)	(0.101)
	Panel B: Using firms with 10 to 30 female workers (N=21)							
$W \geq 20$	-0.257**	-0.101	-0.279	-0.402***	-0.072	-0.485***	-0.168	-0.432***
	(0.102)	(0.084)	(0.175)	(0.130)	(0.109)	(0.149)	(0.125)	(0.106)

Standard errors in parentheses. The regression includes a 2nd order polynomial above and below the threshold and the dependent variable is the log of the number of firms in each bin. *: significant at 10 %; **: at 5%; ***: at 1%.

Table 6. Discontinuity in the log of men per women workers

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
	Panel A: Using firms with 5 to 35 female workers							
$W \geq 20$	-0.079*	-0.131*	-0.049	-0.077	-0.026	-0.153**	-0.015	-0.065
	(0.043)	(0.078)	(0.078)	(0.069)	(0.057)	(0.066)	(0.043)	(0.042)
N	28,374	9,664	8,320	10,390	15,416	12,958	23,750	4,624
	Panel B: Using firms with 10 to 30 female workers							
$W \geq 20$	-0.073	-0.107	0.105	-0.194**	-0.016	-0.152*	-0.042	-0.099*
	(0.053)	(0.098)	(0.094)	(0.086)	(0.070)	(0.081)	(0.053)	(0.050)
N	13,256	4,679	3,795	4,782	7,393	5,863	10,156	3,100

Standard errors in parentheses. The regression includes a 2nd order polynomial above and below the threshold and the dependent variable is the log number of male/female workers. *: significant at 10 %; **: at 5%; ***: at 1%.

Table 7. Discontinuity in the log of capital per female workers

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
				Panel A: Value of capital stock				
$W \geq 20$	-0.331**			-0.425***	-0.233	-0.458**	-0.140	-0.251
	(0.137)			(0.157)	(0.203)	(0.182)	(0.153)	(0.198)
N	6,488			4,702	3,383	3,105	4,926	1,562
				Panel B: Expenses in electricity				
$W \geq 20$	-0.007	-0.141	0.288*	-0.148	0.193*	-0.265*	0.103	-0.214
	(0.083)	(0.133)	(0.152)	(0.154)	(0.103)	(0.136)	(0.079)	(0.174)
N	13,331	4,696	3,818	4,817	7,461	5,870	10,237	3,094
				Panel C: Expenses in fuel				
$W \geq 20$	-0.015	0.040	0.057	-0.242*	0.157	-0.215	0.148	-0.319**
	(0.094)	(0.174)	(0.174)	(0.144)	(0.123)	(0.144)	(0.097)	(0.157)
N	11,701	3,496	3,388	4,817	6,326	5,375	8,745	2,956

Standard errors in parentheses. The regression includes a 2nd order polynomial above and below the threshold and the dependent variable is the log of the proxy for capital per female workers. *: significant at 10 %; **: at 5%; ***: at 1%.

Table 8. Discontinuity in the log of capital per male workers

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
				Panel A: Value of capital stock				
$W \geq 20$	-0.197*			-0.236*	-0.181	-0.241*	-0.151	-0.130
	(0.109)			(0.123)	(0.169)	(0.136)	(0.132)	(0.176)
N	6,435			4,669	3,331	3,104	4,873	1,562
				Panel B: Expenses in electricity				
$W \geq 20$	0.077	-0.016	0.198	0.045	0.235***	-0.119	0.159**	-0.114
	(0.066)	(0.098)	(0.124)	(0.126)	(0.084)	(0.105)	(0.069)	(0.163)
N	13,207	4,649	3,776	4,782	7,354	5,853	10,113	3,094
				Panel C: Expenses in fuel				
$W \geq 20$	0.057	0.109	0.002	-0.044	0.158	-0.050	0.168*	-0.200
	(0.075)	(0.137)	(0.143)	(0.108)	(0.100)	(0.112)	(0.086)	(0.143)
N	11,616	3,475	3,359	4,782	6,244	5,372	8,660	2,956

Standard errors in parentheses. The regression includes a 2nd order polynomial above and below the threshold and the dependent variable is the log of the proxy for capital per male workers.*: significant at 10 %; **: at 5%; ***: at 1%.

Table 9. Discontinuity in the log of high per low skill workers

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
				Panel A: All workers				
$W \geq 20$	0.024	0.065	0.133	-0.047	0.145	-0.130	0.062	-0.089
	(0.075)	(0.103)	(0.154)	(0.139)	(0.102)	(0.109)	(0.086)	(0.155)
N	12,218	4,416	3,427	4,375	6,757	5,461	9,315	2,903
				Panel B: Male				
$W \geq 20$	-0.030	-0.023	-0.015	0.056	0.086	-0.168	-0.013	-0.062
	(0.076)	(0.104)	(0.158)	(0.139)	(0.102)	(0.112)	(0.087)	(0.156)
N	11,253	4,073	3,139	4,041	5,933	5,320	8,369	2,884
				Panel C: Female				
$W \geq 20$	-0.063	0.157	0.053	-0.357**	0.004	-0.144	-0.041	-0.111
	(0.086)	(0.141)	(0.162)	(0.149)	(0.116)	(0.128)	(0.094)	(0.175)
N	10,302	3,619	2,909	3,774	5,850	4,452	8,185	2,117

Standard errors in parentheses. The regression includes a 2nd order polynomial above and below the threshold and the dependent variable is the log of the proxy for capital per female workers. *: significant at 10 %; **: at 5%; ***: at 1%.

Table 10. Discontinuity in other variables

	95 - 07 (1)	95 - 98 (2)	99 - 02 (3)	03 - 07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
				Panel A: Log total number of workers				
$W \geq 20$	-0.035	-0.031	0.046	-0.120**	0.004	-0.091	-0.008	-0.080*
	(0.034)	(0.062)	(0.059)	(0.055)	(0.039)	(0.058)	(0.026)	(0.047)
N	13,385	4,729	3,839	4,817	7,505	5,880	10,285	3,100
				Panel B: Log average wages				
$W \geq 20$	-0.000	-0.034	0.026	0.003	0.062	-0.087*	0.036	-0.107**
	(0.030)	(0.046)	(0.055)	(0.055)	(0.038)	(0.046)	(0.034)	(0.051)
N	13,385	4,729	3,839	4,817	7,505	5,880	10,285	3,100
				Panel C: Log value added per worker				
$W \geq 20$	-0.029	-0.007	-0.047	-0.030	0.034	-0.123	0.010	-0.128
	(0.049)	(0.080)	(0.099)	(0.082)	(0.064)	(0.077)	(0.053)	(0.098)
N	13,288	4,700	3,808	4,780	7,437	5,851	10,213	3,075

Standard errors in parentheses. The regression includes a 2nd order polynomial above and below the threshold and the dependent variable is identified in each Panel. *: significant at 10 %; **: at 5%; ***: at 1%.

Table 11. Production Function Parameters

	All (1)	95-07 (2)	99-02 (3)	03-07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
r	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
W_m	5,444	4,021	5,416	6,855	4,373	6,149	5,122	8,418
W_w	4,083	3,016	4,062	5,141	3,280	4,612	3,841	6,313
θ	0.239		0.229	0.225	0.194	0.258	0.185	0.286
ρ	0.063		0.051	0.051	0.051	0.061	0.033	0.051
σ	0.682		0.609	0.628	0.600	0.677	0.450	0.647

Table 12. Model Bunching Comparison and Cost Pass-Through (Percent)

	All (1)	95-07 (2)	99-02 (3)	03-07 (4)	Sector A (5)	Sector B (6)	Small (7)	Large (8)
Panel A: Bunching								
McCrary	22.5	0.067	26.4	36.0	5.9	42.3	15.2	37.0
Model Assuming No Cost-Transfer	35.0		33.8	34.4	32.3	36.3	31.9	
Panel B: Pass-through								
Estimated Cost-Transfer	42.9		28.6	0.00	85.7	0.0	57.1	

Figure 1. Impact of bunching on capital-women and men-women factor ratios

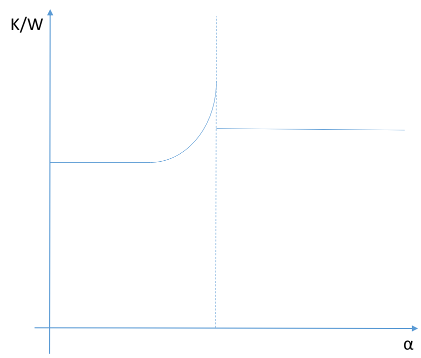

Figure 2. Impact of bunching on capital-men factor ratio

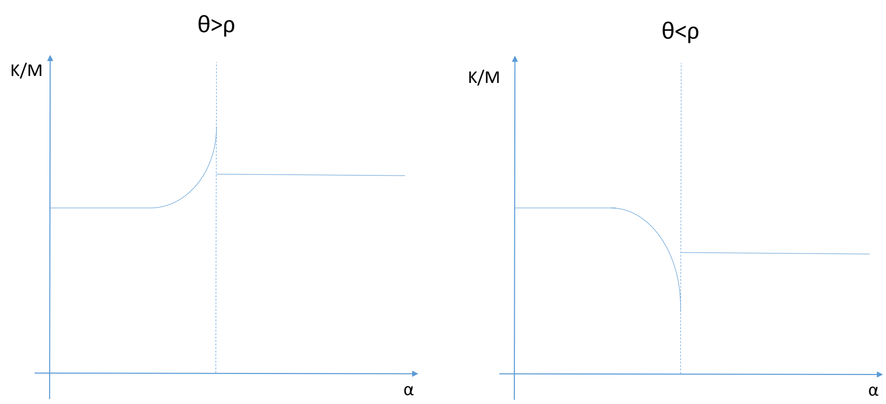

Figure 3. Histogram of the number of female workers per firm.

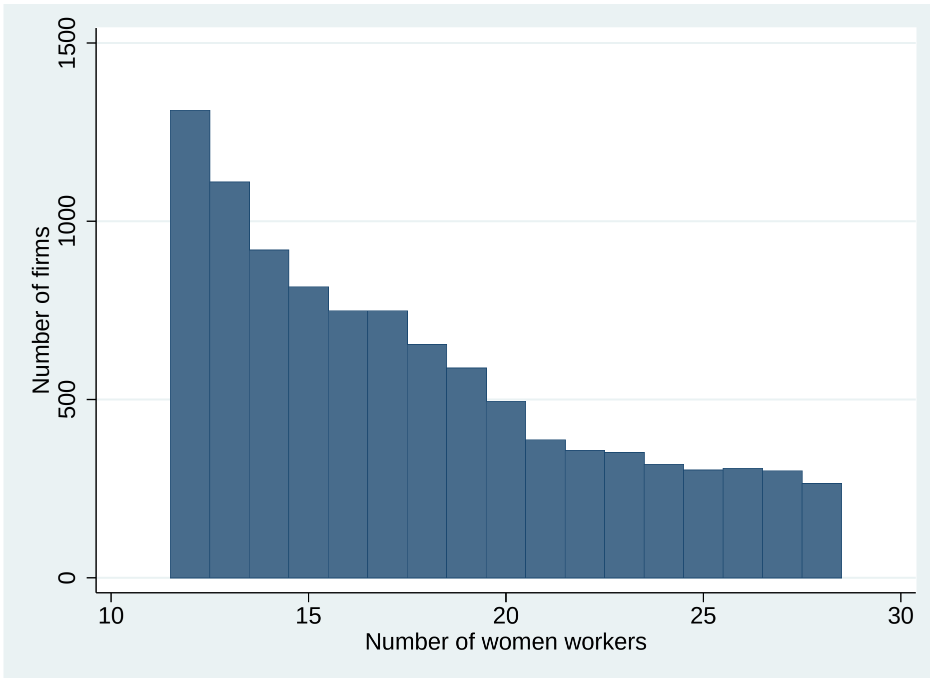

Figure 4. Histogram of the number of female workers per firm-by time period.

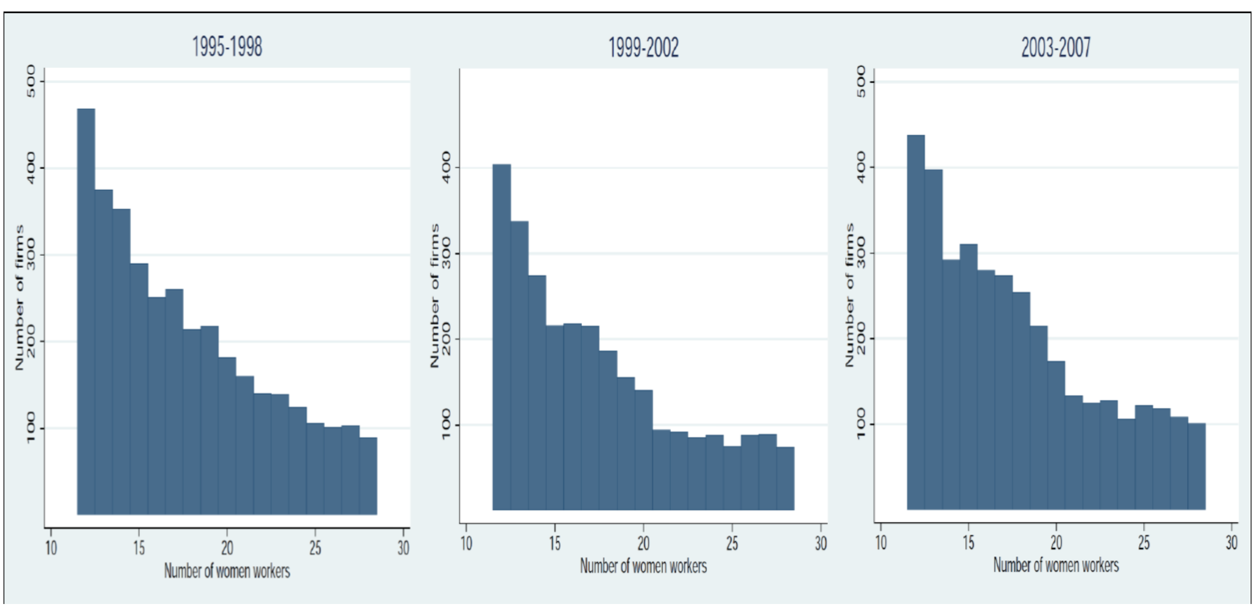

Figure 5. Histogram of the number of female workers per firm-by sector.

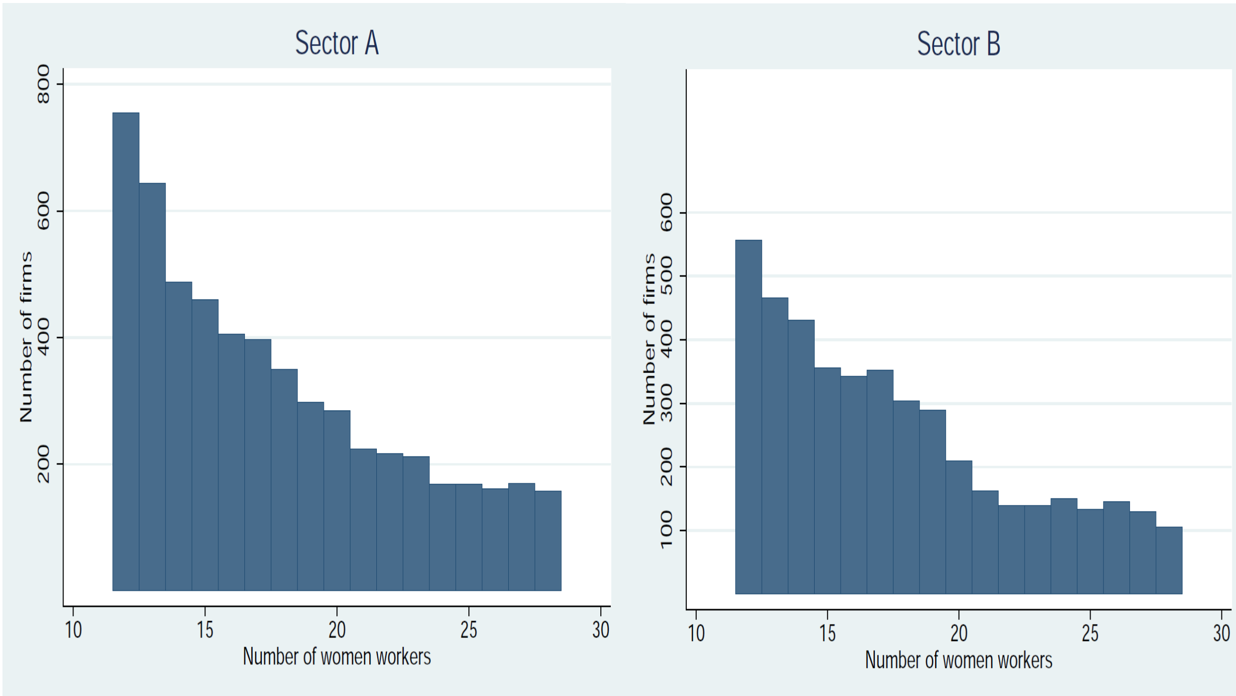

Figure 6. Histogram of the number of female workers per firm-by size.

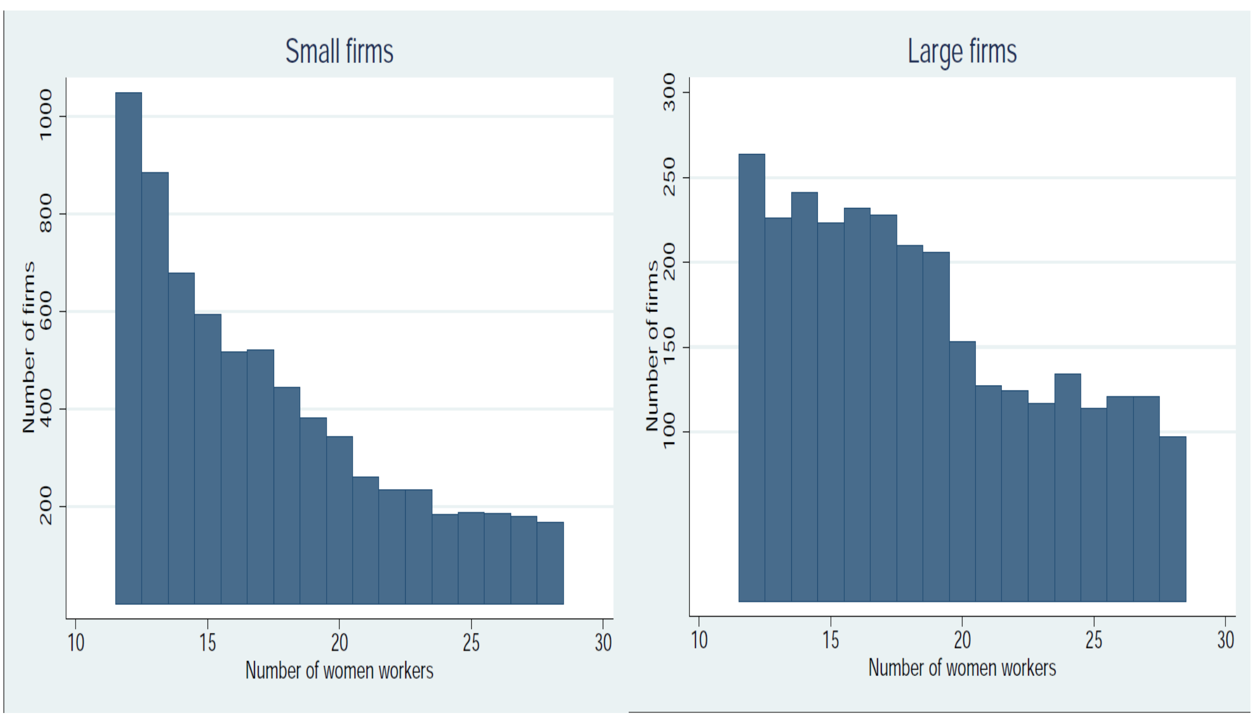

Figure 7. Histogram of the number of female workers per firm-by threshold-crossing status.

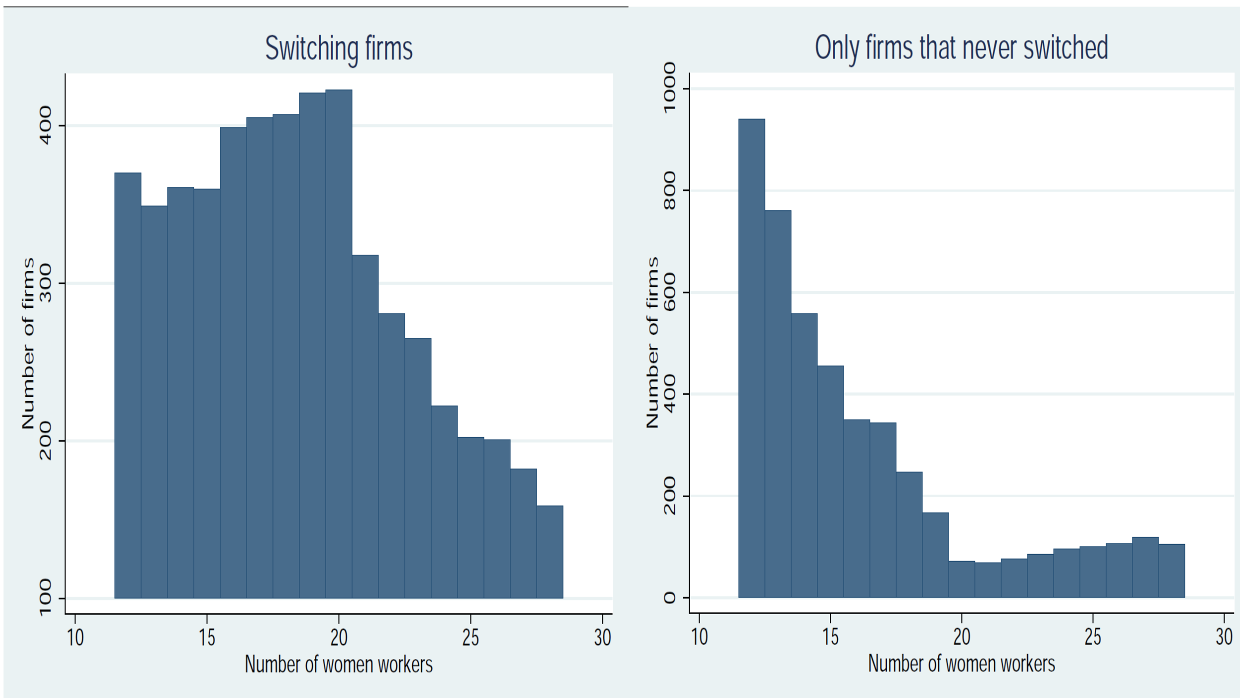

Figure 8. Number of Female Employees: Real versus Simulated

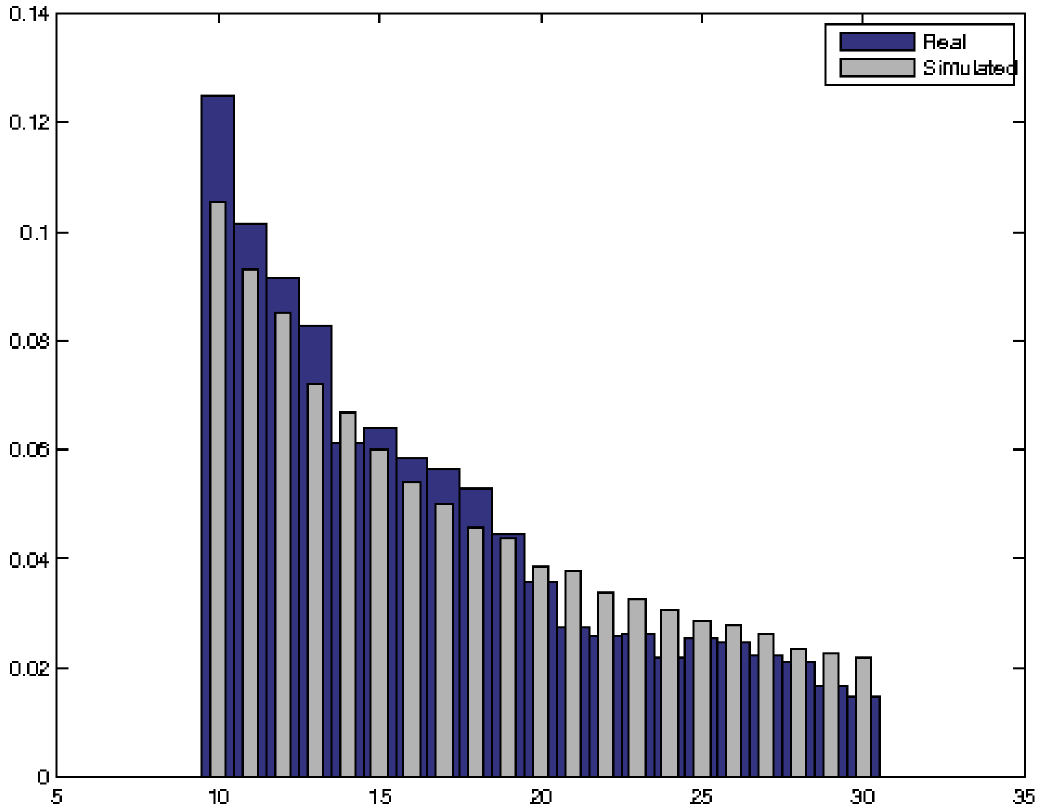

Figure 9. Number of Female Employees: Calibrated With and Without Policy