Permanent exemption from social security contributions in Belgium: The role of hiring frictions

CRETE

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Disclaimer: The views expressed in this study are those of the authors and do not necessarily reflect those of the NBB.

Motivation

- Hiring credits and tax exemptions are commonly used instruments to foster employment growth Kaas and Kircher (2015); Kitao et al. (2010)

- To evaluate the effectiveness of government policies aimed at stimulating job creation, it is essential to draw on evidence from episodes in which governments have intervened in labor markets through subsidy or tax measures.

- In October 2015, the Belgian government unexpectedly announced that firms that started hiring after January 1, 2016, would be permanently exempt from the social security contributions (SSC) for one employee.
  - After the reform, new employers pay a rate of SSC on an employee's monthly gross wage of about 3% vs 18% before.

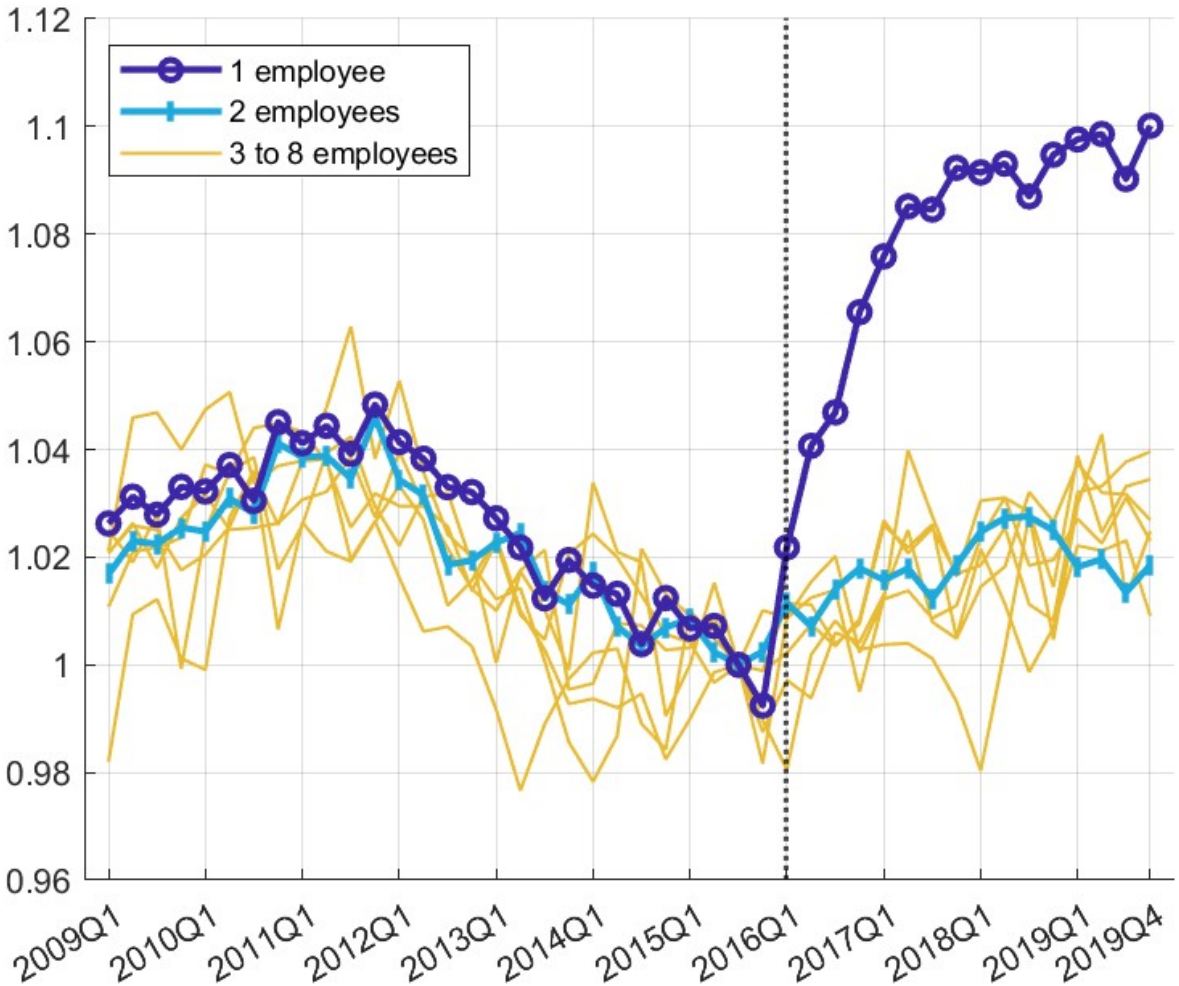
Motivation

Policy objectives...

- The objective of the reform was to encourage employment growth primarily among newly established firms. Since 2009 Belgium has witnessed a substantial increase in the number of firms with zero employees.
- At the same time, the numbers of multi-worker firms have remained largely unchanged.
- Potentially small firms find it difficult to attract workers given frictions, vacancy creation costs and competition from larger firms.
- A policy that could induce these firms to transition from being owner-run to employing workers could, potentially, also enable them to continue growing and hire a second, third, or even more employees.

Motivation

This is not what happened...



The figure illustrates the changes in the stock of firms with 1 to 8 employees. For each firms' group, we normalize the number of firms to 1 in 2015Q3. The vertical dashed line marks the beginning of the policy in 2016.

This paper...

- Extends the directed search model of Kaas and Kircher (2015) to an economy with indivisible workers, so that firms employ an **integer number of workers** .
  - Further extension: endogenous entrepreneuship (e.g. Cagetti and De Nardi (2006))
- Estimates the model using Belgian microdata to recover parameters that govern hiring frictions.
- Analyzes the Belgian policy.
  - Vacancy creation costs and average operating costs are decreasing in firm employment (so larger firms have an advantage in terms of hiring).
  - However, the lack of growth of small firms is mostly due to low productivity.
- Using the model as a laboratory we evaluate alternative policies.

Literature

Literature on size-dependent policies (Guner et al., 2008; Braguinsky et al., 2011; Gourio and Roys, 2014; Garicano et al., 2016; Cahuc et al., 2023; Rotemberg, 2019)

- Mainly neoclassical models. Here search frcitions.

Equilibrium job search models that examine spillover effects and labor market frictions in the context of payroll tax reductions (Shephard, 2017; **?**; Bíró et al., 2022; Cahuc et al., 2019, 2022):

- More in common with (Cahuc et al., 2019, 2022). But we employ a employing a large-scale quantitative model estimated with microdata to simulate the policy's impact.

The model (1)

Directed search equilibrium with heterogeneous firms as in Kaas and Kircher (2015).

- Constant mass of agents who are infinitely-lived, risk-neutral, and discount future income with a factor $\beta < 1$.
- At the beginning of each period, each agent can be employed, search for a job, or run a firm.
- Firms are multi-worker and heterogeneous in productivity; they produce a homogeneous good, using homogeneous labour, and the market for this good is perfectly competitive.

The model (2)

Firm preliminaries

- Firm revenues $R(L, x)$ where $L \in \mathbb{N}_0$ is the number of workers.
- R is strictly increasing and concave in L. Moreover, $R(L = 0, x) > 0$. Output is not zero even if there are no employees.
- $x \in X = [x_1, x_2, ..., x_n]$ is the firm's idiosyncratic productivity.
- Firms create jobs by posting vacancies subject to convex costs (described later). Each vacancy advertises a contract (a state contingent path of wages and separation/retention). We assume full commitment.
- We represent the contracts recursively with the promised utility approach (Spear and Srivastava, 1987): a contract promises utility W to a worker.

The model (3)

Firm preliminaries

- The firm creates vacancies by posting W. Higher W implies more applicants.
- $\lambda_W \in \mathbb{N}_0$ denotes the 'queue length' and $m(\lambda_W)$ the probability that the vacancy will be filled.
- $\frac{m(\lambda)}{\lambda}$ is the probability that a worker is hired.

The model (4)

Job seekers

- Unemployed individuals can either apply for a vacancy or start their own business. S = expected utility.
- Value of a new firm with initial idiosyncratic productivity x is $\mathcal{J}(L = 0, x, \{.\})$.

The optimal search decision is

$$\max_W S_W = \max_W b + \beta(1-\delta_0)\frac{m(\lambda_W)}{\lambda_W} W + \beta\left(1-(1-\delta_0)\frac{m(\lambda_W)}{\lambda_W}\right) U'. \tag{1}$$

Choice between searching and starting a business.

$$U = \max\left\{\sum_{x\in X} \sigma_x \mathcal{J}(L = 0, x, \{.\}) - s_b, \max_W S_W\right\}. \tag{2}$$

σ_x governs initial productivity draw. s_b cost of business creation.

The model (5)

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The model (6)

Firm's program

- $\mathbf{W} \equiv \left\{ W_i \right\}_{i \in \mathbf{L}}$ is the vector of promised values. $\mathbf{W} = \{.\}$ if the firm has 0 workers.

The firm's profit solves:

$$\mathcal{J}(x, L, \mathbf{W}) = \max_{\widetilde{\phi}^i(.), d(.), V \in \mathbf{N} \cup \{0\}, W_V, \widetilde{\mathbf{W}}'} \overbrace{R(L,x)}^{\text{Revenue}} \overbrace{-c(L) - \sum_{i \in \mathbf{L}} w_i(1+\tau)}^{\text{Operating cost}}$$
$$- \underbrace{C(V,L)}_{\text{Vacancy Cost}} + \beta(1-\delta_0)\mathbf{E}\Omega(x', L', \widetilde{\mathbf{W}}') + \beta\delta_0 U \qquad (5)$$

The model (7)

$$L' = \sum_{i=1}^{L} \widetilde{\phi}^i(\widetilde{s}', L, \mathbf{W}) I^i_{(\widetilde{s}')} + L_V(\widetilde{s}') \qquad \text{(Employment in } \widetilde{s}') \tag{6}$$

$$I^i_{(\widetilde{s}')} = 1 \quad \text{if} \quad i \text{ does not separate exogenously} \quad (Prob = 1 - s_0) \tag{7}$$

$$L_V(\widetilde{s}') \equiv \sum_{v \in \{1,2,,\ldots,V\}} I^v_V(\widetilde{s}') \tag{8}$$

$$I^v_V(\widetilde{s}') = 1 \quad \text{if vacancy} \quad v \quad \text{is filled in } \widetilde{s}' \tag{9}$$

$$W_i = w_i + \beta(1-\delta_0)\mathbf{E}\widetilde{\phi}^i(\widetilde{s}', L, \mathbf{W}) I^i_{(\widetilde{s}')} d_{(\widetilde{s}', L, \mathbf{W})} W'_{\widetilde{s}', i} +$$

$$+\mathbf{E}\Bigg[\delta_0 + (1-\delta_0)\Bigg(d_{(\widetilde{s}', L, \mathbf{W})}\Big((1 - I^i_{(\widetilde{s})}) + (1 - \widetilde{\phi}^i(\widetilde{s}', L, \mathbf{W}))I^i_{(\widetilde{s}')}\Big) +$$

$$(1 - d_{(\widetilde{s}', L, \mathbf{W})})\Bigg)\Bigg] U \tag{10}$$

The model (8)

- $\delta_0 = (s_0 =)$ exogenous firm (job) destruction rate.
- C vacancy creation cost (Kaas and Kircher (2015)). $c(L)$ additional operating cost.
- $\widetilde{\phi}^i(\widetilde{s}', L, \mathbf{W})$ is the retention policy for worker i in state $\widetilde{s}'$
- $d_{(\widetilde{s}', L, \mathbf{W})}$ is the endogenous exit rule. Implicit in the continuation profit:

$$\Omega(x', L', \widetilde{\mathbf{W}}') = \max\left\{\mathcal{J}(x', L', \widetilde{\mathbf{W}}'), U - \text{Cost}(W_V(\widetilde{s}'))\right\}$$

- **Remark 1:** Because employment is integers the firm faces uncertainty about future employment. We introduce $\widetilde{s}'$ to summarize this.
- **Remark 2:** In general the competitive equilibrium is not efficient since firms could engage in too much hiring out of precaution or hoard labour.

The firm's program is difficult to solve! One needs to keep track of promised values $\mathbf{W}$.
However, the following result (similar to Schaal (2017)) establishes a key simplification.

Result 1. *The optimal policies for firing, hiring and firm exit, can be obtained as the solution to a dynamic program in which the firm maximizes a function $K(x, L)$, with productivity and employment as the only state variables. It is not necessary to keep track of the vector $\mathbf{W}$ of promised values.*

Thus, one does not have to keep track of $\mathbf{W}$.

Moreover,

Result 2. *Given the total number of workers* $\sum_{i=1}^{L} I^i_{\widetilde{s}'} - F'$ *that the firm wants to retain in* $\widetilde{s}'$ *(where* F' *denotes workers fired in* $\widetilde{s}'$*), the optimal policy* $\widetilde{\phi}^i(\widetilde{s}', L, \mathbf{W})$ *(retain worker* i*) is a lottery in which worker* i *is retained with probability* $\frac{\sum_{i=1}^{L} I^i_{\widetilde{s}'} - F'}{\sum_{i=1}^{L} I^i_{\widetilde{s}'}}$.

Moment matching. We estimate model parameters to match firm level data. Our dataset contains the population of firms with small and medium sized firms (no more than fifteen employees).

Some functional forms:

- Matching function is Cobb–Douglas. Vacancy filling $\mu_m \cdot (\frac{1}{\lambda})^{-\gamma_m}$. $\gamma_m :=$ elasticity with respect to number of jobseekers. $\mu_m :=$ matching efficiency parameter.
- Firm productivity: Initial draw $\sim$ Pareto distribution. Afterwards, productivity is a random walk (Bilal et al. (2022)).
- $R(L, x) = x \cdot (L+1)^{\alpha}$,
  $c(L) = \mu_o \cdot L^{\gamma_o}, \quad C(V, L) = \mu_C \frac{V^{(1+\gamma_C)}}{(L+1)^{\gamma_C}}$

Externally calibrated parameters

Parameter	**Description**	**Value**
β	Quarterly discount rate	0.987
τ	Payroll tax rate (pre-reform)	0.183
τ_1	Payroll tax rate (post-reform)	0.029
n	Number of idiosyncratic productivity levels	100
x_1	Lowest idiosyncratic productivity	1
δ_0	Quarterly exogenous exit rate	[0.023, ...]
s_0	Quarterly exogenous separation rate	0
γ_m	Elasticity of matching function w.r.t. λ	0.5

Estimated parameters

Parameter	**Description**	**Value**
x_n	Highest idiosyncratic productivity X	17.7
σ_P	Shape parameter, Pareto distribution	1.22
α	Production function elasticity	0.76
$\sigma_{\mathcal{N}}$	Std. dev. of shocks in random walk	0.55
μ_C	Scale parameter, cost of posting vacancies	1.76
γ_C	Elasticity of cost of posting vacancies	0.66
μ_m	Scale parameter, matching function	0.12
μ_o	Scale parameter, non-pay expenditures	1.98
γ_o	Elasticity of non-pay expenditures w.r.t. L	0.32
b	Quarterly out-of-work income	1.69
s_b	Sunk cost to open a firm	90

Comparison between observed and simulated moments

Moment	**Description**	**Data**	**Simulated**
Share of firms with 0–5 employees	N_0/N	79.09%	71.43%
	N_1/N	6.50%	5.82%
	N_2/N	3.51%	2.72%
	N_3/N	2.21%	1.78%
	N_4/N	1.52%	1.37%
	N_5/N	1.08%	1.45%
Ratio of average revenues (0 vs. 1 employee)		25.74%	25.58%
New firms by initial size	$N_{\text{new},0}$	95.55%	96.40%
	$N_{\text{new},1}$	2.30%	1.99%
	$N_{\text{new},2}$	0.93%	0.91%
	$N_{\text{new},3}$	0.44%	0.44%

Comparison between observed and simulated moments

Moment	**Description**	**Data**	**Simulated**
Firms with 0 employees: transitions (next year)	$0 \to 0$	88.88%	88.97%
	$0 \to 1$	1.62%	1.80%
	$0 \to 2$	0.31%	0.24%
Firms with 1 employee: transitions (next year)	$1 \to 0$	17.91%	7.94%
	$1 \to 1$	64.41%	71.75%
	$1 \to 2$	9.98%	10.80%
Firms with 2 employees: transitions (next year)	$2 \to 0$	6.12%	3.12%
	$2 \to 1$	17.02%	4.74%
	$2 \to 2$	54.67%	63.25%

Notes: EES = employees; JVR = job vacancy rate. N is the total number of firms, N_0 the number with zero employees, and $N_{\text{new},0}$ the

Policy Functions

- The model generates an inaction region in which firms neither hire nor fire.
- Sufficiently productive firms hire
  - Small firms hire aggressively, posting higher W and fewer vacancies
  - than larger firms which post more vacancies due to the scale effect pf $C(V, L)$ function.

How we introduce the exemption

- Before the reform, all firms pay a tax rate $\tau > 0$ on the wages of all their workers.
- Then, firms that begin hiring after the policy announcement pay a tax rate of $0 \leq \tau_1 < \tau$ on the wage of a single employee, while they continue to pay the rate τ on the wages of their other employees.
- Additional assumptions: *i) Exemptions cannot be reassigned until the employee leaves the firm. ii) If the subsidized employee is fired the exemption is randomly reassigned iii) Firms that create multiple vacancies randomly assign the exemption to one of their new hires.*

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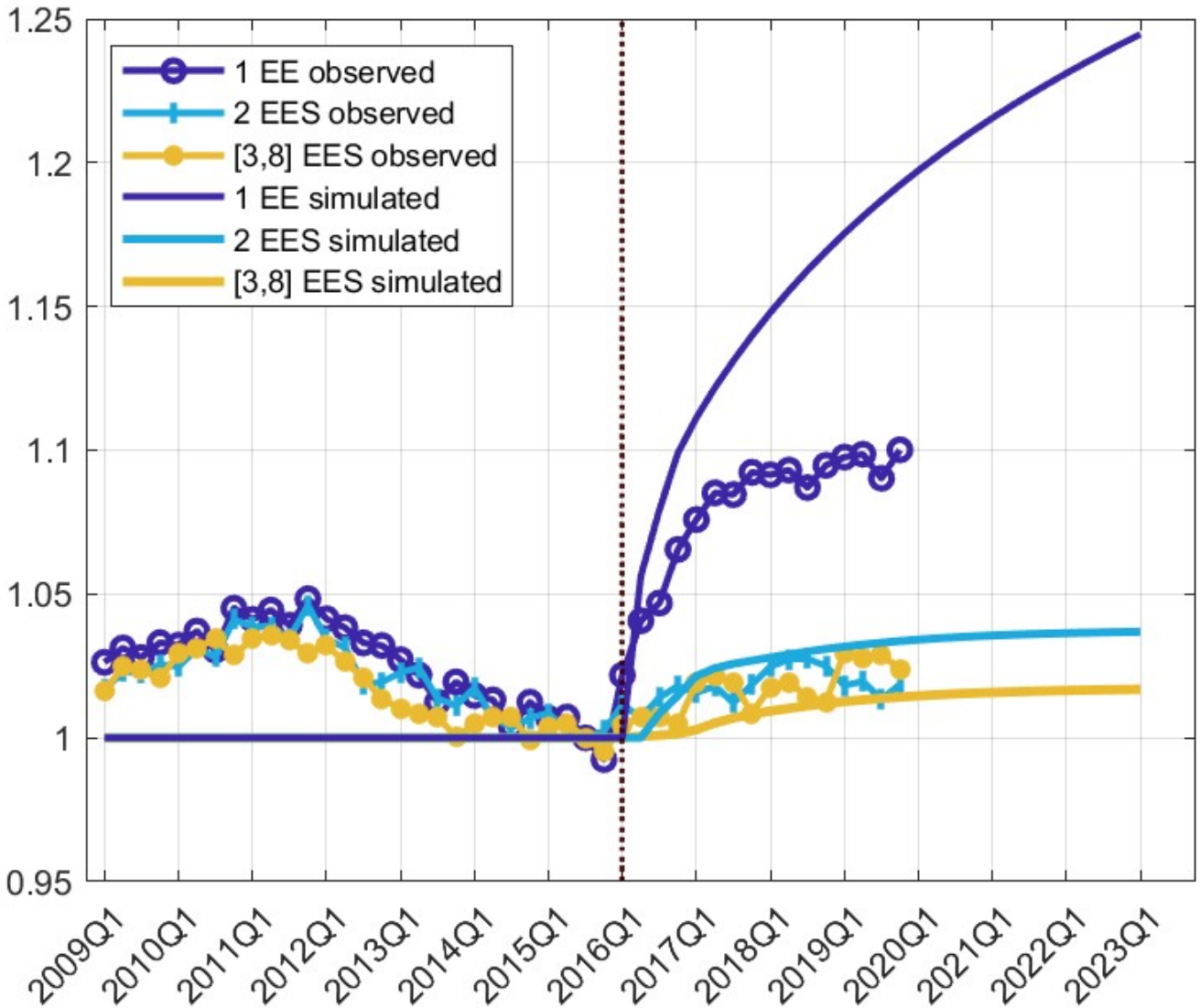
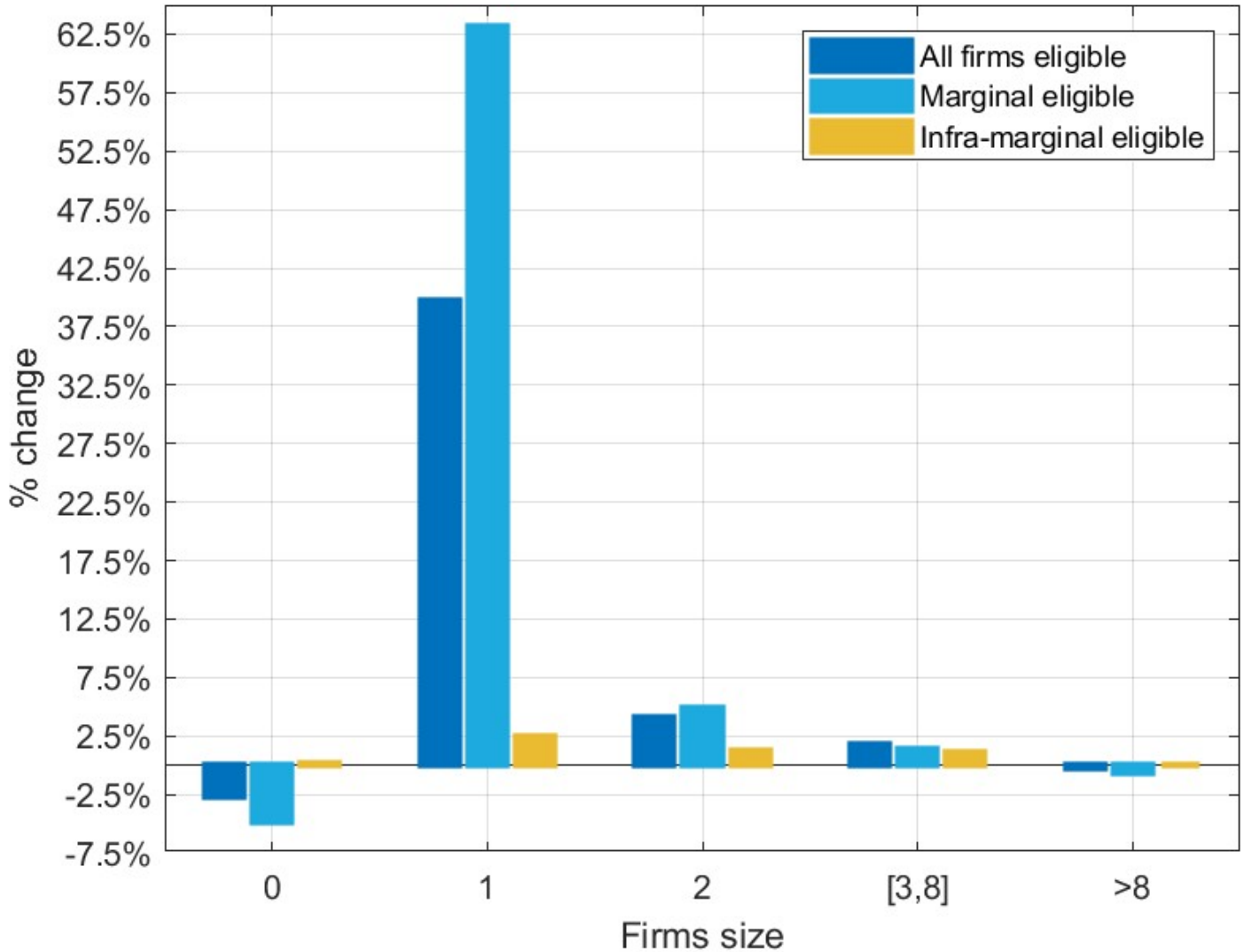
What happens after the exemption: Evolution stock of firms

Observed vs. simulated



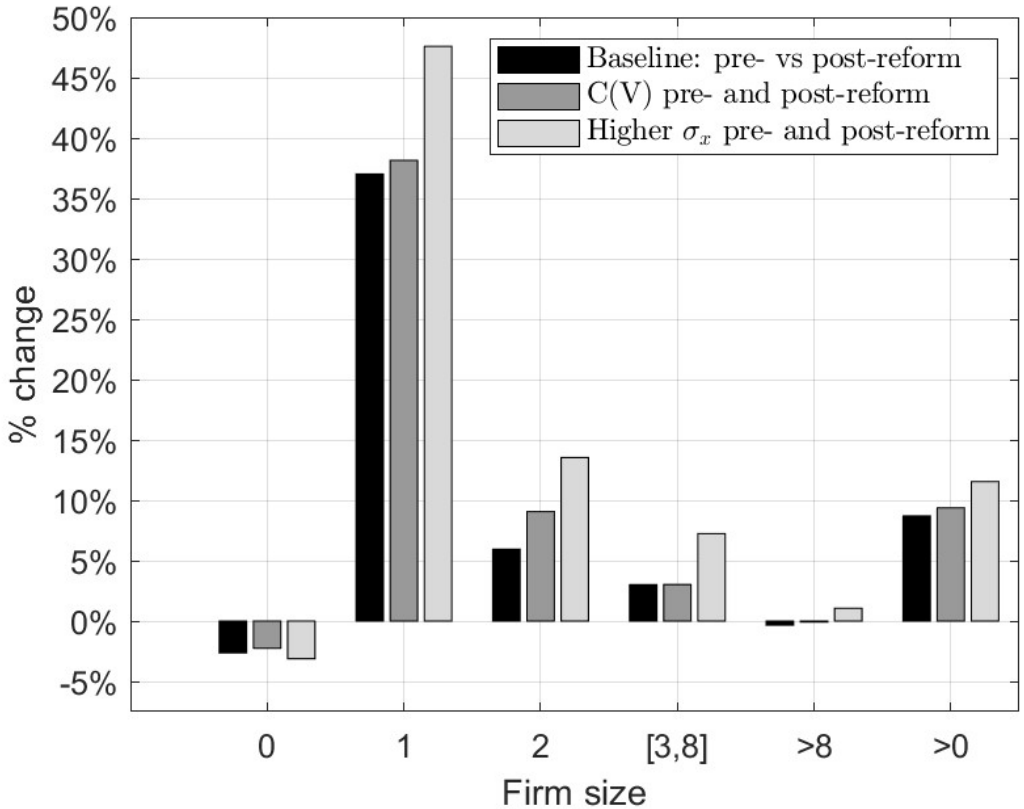
Change (in %) in the stock of firms



This figure shows the change in the stock of firms with 0, 1, 2, [3,8], and more than 9 employees between the before and after steady states.

- Substantial growth in the number of firms with 1 employee.
  - These are firms that didn't hire before the reform because of large costs $c(L)$ and $C(V, L)$ (and non-convexities)
  - They hire one worker
  - However, they do not continue hiring because these are relatively unproductive firms.
- It is not the case that small firms do not grow because of steep job creation costs and competition from larger (and more productive firms).

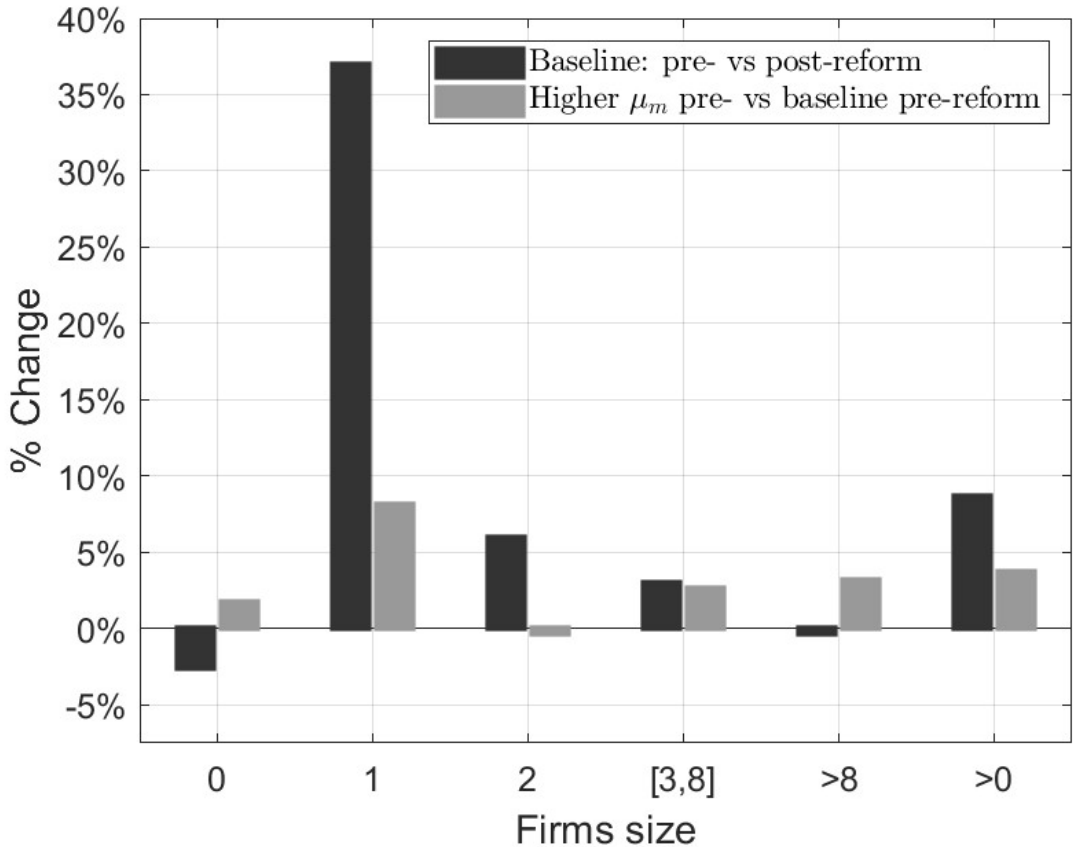
The role of productivity and vacancy creation costs.



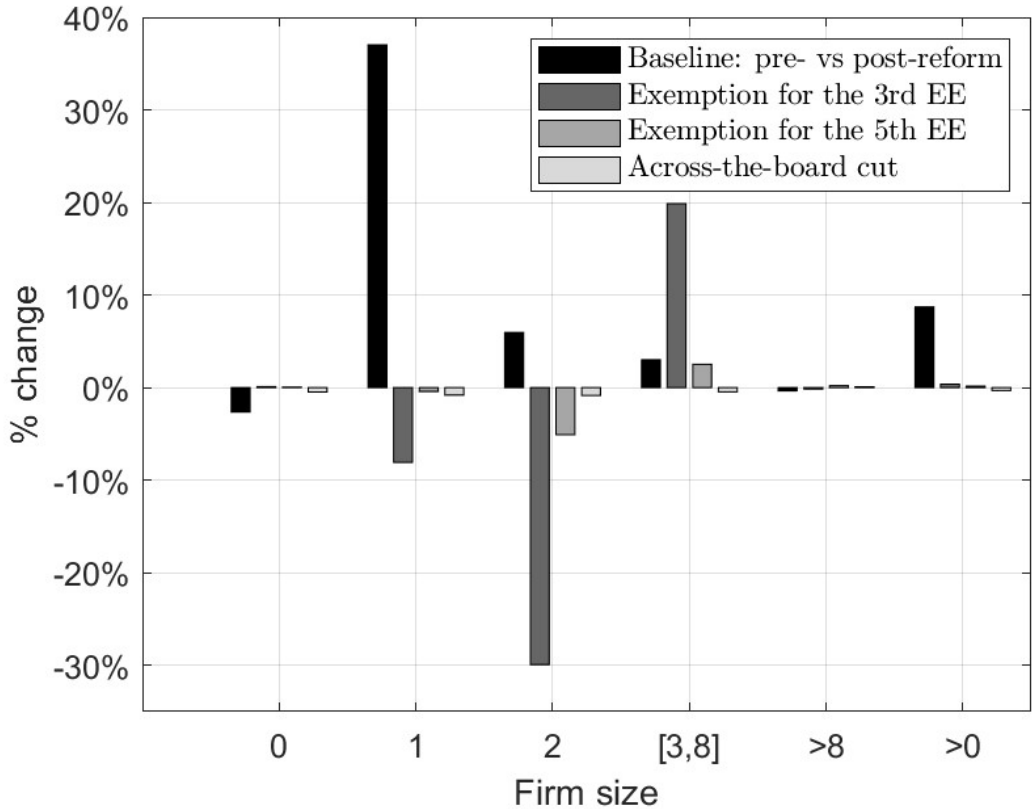
Baseline reform vs higher matching efficiency.

- An ad hoc objective of policy. Compare the results with an increase in matching efficiency to see what a policy that alleviates the frictions produces.

Baseline reform vs higher matching efficiency.



Other reforms: Subsidizing the *n*th employee and across the board subsidies.



Conclusions

Thank you for your attention!

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