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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Barriers to Entry and the Labor Market.*

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Abstract

We study the labor market effects of Temporary Barriers to Entry (TBEs). Estimates from a mixed-frequency Bayesian VAR show that TBEs: (i) reduce job creation by new entrants, but boost it for incumbent firms; (ii) persistently increase employment concentration in large firms; (iii) temporarily reduce unemployment, but are recessionary in the long run; and (iv) mainly result from federal regulation. We build a macroeconomic model, featuring firm heterogeneity, endogenous entry and exit, and labor market frictions, which successfully reproduces the VAR evidence. The model shows that TBEs temporarily boost short-run economic activity by favoring existing firms, but are ultimately costly. Policy measures aimed at protecting incumbent firms, even if temporary, entail welfare costs.

Keywords: Job Creation; Reallocation; Unemployment; Heterogeneous firms; BVAR.

JEL classification: C13, E32.

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1 Introduction

Recent literature highlights troubling trends in the United States: increasing sales concentrations alongside declining entry rates of new firms and job flows. The reduction in new market entrants may be due to barriers to entry such as regulatory hurdles, high startup costs, or financial costs. Studies by Grullon et al. (2019), and Bessen (2016), identify barriers to entry as key contributors to these trends. Gutierrez Gallardo et al. (2019), argue that a series of entry cost shocks led to the rise in the profit share and markups observed in the US since the 2000s, together with the decrease in firm entry. Both Davis (2017) and Gutierrez Gallardo et al. (2019) identify the growing complexity of regulations as a primary driver of these barriers.[1]

In this paper, we study the macroeconomic effect of temporary barriers to entry. We depart from the existing literature along two dimensions. First, we shift the focus from the trend to the business cycle. Second, we study the labor market rather than the goods market. Our analysis identifies regulation as a major source of barriers to entry. Regulatory measures are frequently repealed, often having a temporary nature. For example, the Federal Communications Commission (FCC) implemented net neutrality regulations in 2015, requiring internet service providers (ISPs) to treat all internet traffic equally. These regulations were repealed in 2017. In the aftermath of the 2008 financial crisis, many states temporarily increased licensing fees for various professions to address budget shortfalls. For instance, California temporarily raised fees for contractors, accountants, and other licensed professionals. In the wake of the 2008 financial crisis, the Dodd-Frank Wall Street Reform and Consumer Protection Act temporarily increased capital requirements for banks to ensure greater financial stability. These higher capital requirements were phased in over several years, creating a temporary barrier for new banks attempting to enter the market. These examples illustrate that temporary regulatory measures are often introduced to protect incumbent firms from challenges of various nature. Once these challenges are addressed, such measures are typically repealed or replaced with more permanent regulations. For these

[1] As argued by Goldschlag and Tabarrok (2018) the increase in the regulation burden is an economy-wide phenomenon, and not a sectoral one.

reasons, we define these measures as Temporary Barriers to Entry (TBEs). [2]

Haltiwanger et al. (2013) show that new firms are a major source of job creation in the U.S. Hence, factors that obstacle firm entry, even if temporary, could have repercussions on the labor market. There is, however, limited empirical evidence on the effects of barriers to entry on unemployment, the job creation of alternative categories of firms, especially distinguishing between new firms and incumbents, and the size distribution of firms. As argued by Fattal-Jaef (2022) one reason for this lack of evidence is the absence of a direct measure of barriers to entry.

In the first part of the paper, we overcome this issue using sign restrictions in a mixed-frequency Bayesian vector autoregression model (BVAR) applied to US data from 1982 to 2018. We impose that TBEs temporarily reduce the entry rate of new firms and simultaneously increase incumbent firms' stock market values. The rationale behind this identification strategy is that barriers to entry break the link between entry and future profit opportunities, represented by the stock market values of incumbent firms. Notice that this identification strategy is supported by the macroeconomic model that we propose in the second part of the paper. In the latter just shocks to the costs of creating a new firm, that in our framework are meant to capture barriers to entry of various nature, lead to a negative correlation between the entry rate and stock market values. Shocks to aggregate technology, the technology of incumbent firms, fixed costs of production, and the cost of creating new jobs, all lead to a positive correlation between those two variables. Four key findings emerge from our empirical exercises. Tighter barriers to entry: (i) depress the job creation of new entrants, but boost that of incumbent firms; (ii) lead to a rise in employment concentration at large firms; (iii) have short-run beneficial effects on unemployment, but are recessionary in the longer-run, and (iv) are predominantly the result of federal regulation. The measure of employment concentration we consider is the fraction of workers employed at firms with 500 or more employees. As anticipated, in the second part of the paper, we lay down a macroeconomic model that aligns with the empirical findings. The model integrates a heterogeneous firms

[2]The US government has occasionally imposed temporary tariffs on imported goods to protect domestic industries. For instance, in 2018, the Trump administration imposed temporary tariffs on steel and aluminum imports. These tariffs increased costs for manufacturers relying on these materials, acting as a temporary barrier to entry for new firms.

model with endogenous entry and exit in a framework with search and matching frictions in the labor market. As in Elsby and Michaels (2013) and Bilal et al. (2022) a firm is a profit-maximizing technology with decreasing returns to scale and stochastic productivity, that chooses optimally whether to enter and exit the market. Firm idiosyncratic productivity is the product of a permanent and a transitory component. The former is assigned at birth, and remains constant through the life cycle of the firm, the latter is driven by a persistent stochastic process. Following Bilbiie et al. (2012a), and Sedláček (2020) firm entry involves time-varying sunk costs that investors pay with the expectation of future profits. The variation in entry costs over time allows for a reduced form modeling of temporary increases in barriers to entry for new firms. Firms grow by posting costly vacancies that are matched to unemployed workers. The size of firms is determined by their decreasing return to scale technology and wage bargaining happens over the marginal surplus created by a match, as proposed in Stole and Zwiebel (1996) and applied in general equilibrium by Elsby and Michaels (2013) and Sedláček (2020). We calibrate the model using data from the Business Dynamics Statistics (BDS) and examine the effects of a persistent increase in the non-fundamental component of entry costs. This component represents the model's equivalent of the temporary barriers to entry that we identified in the empirical analysis. A key aspect of the data over the last 40 years is that, on average, incumbent firms with fewer than 100 employees exhibit a negative net job creation rate, meaning small and medium-sized firms shrink over time. Conversely, firms with 100 or more employees tend to expand on average. Our analysis reveals that this difference in net job creation rates is entirely attributable to exit rates. If we disregard job destruction due to exit, all firm size categories show a positive net job creation rate. Once firms grow large, their exit rates drop to nearly zero.[3] Considering this dimension of heterogeneity across firms is useful not just to characterize the long-run distribution of net job creation rates by size, but also to capture the estimated response of employment concentration to a shock to barriers to entry. In response to a rise in barriers to entry, our model features a decrease in entry. Lower entry, in turn, determines a future lower vacancy posting, a lower expected job market tightness, and, through this channel, a lower average wage. Incumbent firms will capitalize on the

[3]As shown by Haltiwanger et al. (2013) this holds independently of firm age.

lower wages to create new jobs. Consistently with the VAR evidence, the rise in job creation by incumbents more than compensates for the loss of job creation by new entrants in the sort-run, leading to a decrease in the unemployment rate. However, after a few periods, the missing job creation by the lost generation of new entrants increases unemployment and lowers GDP. As previously noted, small businesses have a higher exit rate than large ones. Therefore, job creation by new firms, which are predominantly small, plays a crucial role in sustaining the employment share of small firms. Since an unexpected rise in barriers to entry hampers job creation by new entrants, the shock decreases the employment share of small businesses, leading to a rise in employment concentration within larger firms. In a counterfactual model exercise, where the exit rate is independent of firm size, we show that the response of employment concentration to the shock is muted. For this reason, we argue that matching the size-dependent exit rate observed in the data is crucial to capture the dynamic effect of a tightening in regulation on the firm size distribution. Further, neglecting the relationship between size and exit rates, leads to an underestimation of the welfare costs of the fluctuations generated by TBEs. Our analysis underscores the importance of both macro and micro forces to understand both the aggregate and distributional effects of barriers to entry.

The policy message of our paper is that while temporary barriers to entry may promote economic activity in the short run by favoring the activity of incumbent firms, they remain costly. Policy measures aimed at protecting incumbent firms, even if temporary, entail welfare costs.

The rest of the paper is organized as follows. Section 2 discusses the related literature. Section 3 outlines the empirical evidence. Section 4 presents the model. Section 5 reports the main results. Section 6 concludes. Technical details and robustness exercises are left to the Appendix.

2 Related literature

Our paper is related to several strands of the macroeconomic literature. The first one is represented by the empirical literature studying the effects of entry barriers on firm entry and growth. Bartelsman et al. (2005), using a panel of ten OECD countries, find that successful start-ups grow faster in the U.S. than in Europe due to lower entry barriers, which leads in turn to higher competition, productivity and growth of firms. Klapper et al. (2006) find, in a panel of 71 countries, a significant negative correlation between entry regulations and firm entry. The negative relationship between entry and entry regulation persists even controlling for financial development, labor regulation, and protection of intellectual property. Ciccone and Papaioannou (2007) find that countries where it takes less time to open a new business experience higher entry rates in response to expansionary demand and technology shocks. A second strand of the literature related to our analysis is that concerning the macroeconomic implications of entry and exit of firms for business cycle fluctuations. Bilbiie et al. (2012b), Etro and Colciago (2010), Jaimovich and Floetotto (2008), Clementi and Palazzo (2016), Hamano and Zanetti (2017), Lewis (2009), Rossi (2019) among others, find that firm entry and exit amplify and propagate the effects of aggregate shocks. Cacciatore and Fiori (2016) in a panel VAR for OECD countries find that labor and good market reforms aim at deregulation can have short-run recessionary effects, despite being expansionary in the long run. They show that a framework with endogenous product creation and labor market frictions deliver results consistent with the evidence in response to a permanent decrease in the cost of entry for new firms. In a recent contribution, Barattieri et al. (2021) study the macroeconomic effects of temporary trade barriers. They find that, even when temporary, trade barriers do not help macroeconomic stabilization. With respect to these contributions we focus on temporary barriers to entry, and identify empirically different job creation patters among entrant and incumbent firms that result in a persistent change in employment concentration. Further, we explain our findings using a fully fledged macroeconomic model with heterogeneous firms. Gutierrez Gallardo et al. (2019) propose a structural model to study the interaction between barriers-to-entry, investment, and monetary policy. They show that entry cost shocks can rationalize the coexistence of increasing markups and low inflation. They estimate their model on U.S. data and find that a series of entry costs led to the decline in the entry rate of new firms observed in the US since the 2000s. With respect to the them we focus on the effects of entry cost shocks on the labor market, and develop a model with heterogeneous firms and endogenous unemployment dynamics to explain our empirical findings. The third strand of the literature related to our analysis is the one identifying the sizeable contribution of new firms to aggregate job creation. Haltiwanger et al. (2013) find that new firms contribute disproportionately, with respect to their employment share, to aggregate employment growth. Their analysis spurred increasing interest in studying the quantitative impact of firm entry on aggregate job creation and employment. Karahan et al. (2019) argue that the increasing startup deficit in the US implies a lower aggregate elasticity of employment to business cycle conditions. Sterk et al. (2021) find that economic growth is largely driven by few startups with high-growth potential. Further, they point out that ex-ante heterogeneity across firms, rather than persistent ex-post shocks, explains most of the differences in the growth performances among firms over their life cycle. Gourio et al. (2016) estimate the response of GDP, aggregate productivity, and exit to an exogenous increase in entry. They identify significant and very persistent effects on real GDP and productivity. Finally, our work is related to the business cycle literature featuring firm dynamics and worker flows in heterogeneous firm models. Original contributions to this literature are Hawkins (2011), and Kaas and Kircher (2015), who show that heterogeneity across firms is not enough to amplify the response of unemployment to exogenous shocks. Elsby and Michaels (2013), More recent contribution are provided by Moscarini and Postel-Vinay (2013), Coles and Mortensen (2016), Schaal (2017), Elsby and Gottfries (2022), and Bilal et al. (2022). Papers most closely related to ours are Sedláček (2020) and Siemer (2014). Both contributions observe an unprecedented decline in firm entry during the great recession and attribute the slow recovery in the post-2008 period to a "missing generation" of entrants. Compared to them, we provide empirical evidence concerning the effects of temporary barriers to entry on unemployment, the job creation of incumbents with respect to that of new entrants, and employment concentration. Further, we emphasize that models with heterogeneous firms, search and matching friction in the labor market, and endogenous firm dynamics must feature a data-consistent distribution of exit rate according to size to replicate the macroeconomic effects of temporary shocks to entry barriers.

3 Empirical evidence: mixed frequency BVAR

3.1 Data, identification, and estimation

In this section, we present empirical evidence on the macroeconomic effects of changes in barriers to entry, focusing on the labor market and the firm size distribution. Our econometric approach estimates a Bayesian Vector Autoregression (BVAR) model that combines a mixture of financial and macroeconomic variables with data on business dynamism and employment concentration. The benchmark specification includes the S&P500, real GDP, and the unemployment rate at a quarterly frequency between 1982Q3 and 2018Q1. These variables are extracted from The Federal Reserve Economic Database (FRED). Also, it includes the entry rate of new firms, and the employment share of firms with at least 500 employees. We take the latter as our measure of employment concentration. The entry rate and employment concentration are sourced from the 2018 release of the Business Dynamics Statistics (BDS) database. Data, in this case, are annual covering the period from 1983 to 2018.

Variable	Sign	Quarters
Entry rate	-	1-4
Stock market index	+	1-4

Table 1: Sign restrictions to identify a temporary tightening in barriers to entry.

A complication arises due to the discrepancy in observation frequencies: BDS data are annual, whereas FRED data are quarterly. To deal with this discrepancy, we estimate a mixed-frequency Bayesian VAR model. [4]. We pre-filter variables with a two-sided HP filter to focus the analysis on cyclical components, consistently with the output of our theoretical analysis. Appendix A reports the definitions of the variables included in the BVAR, and their treatment. The identification of shocks to barriers to entry relies on sign restrictions. Barriers to entry break the link between entry and future profit opportunities, represented by the stock market values of incumbent firms. For this reason, we impose that barriers to entry are associated with a rise in incumbents' stock market values together with a reduction

[4] We use the MATLAB toolbox developed by Canova and Ferroni and set a Conjugate prior on the VAR parameters.

in the entry rate of new firms. Table 1 summarises the sign restrictions imposed to identify the shock.[5] This identification strategy is consistent with the macroeconomic model that we propose below. In Appendix F we show that, in our model economy, the only aggregate shock leading to a negative correlation between the entry rate and the market value of firms, is that to entry costs. Further, it is consistent with the recent analysis in Gutierrez Gallardo et al. (2019).

3.2 Results

Figure 1 displays the dynamics of key variables in response to an unexpected tightening in barriers to entry. Continuous lines illustrate the median IRF, while dashed lines represent the 68 percent credibility bands.

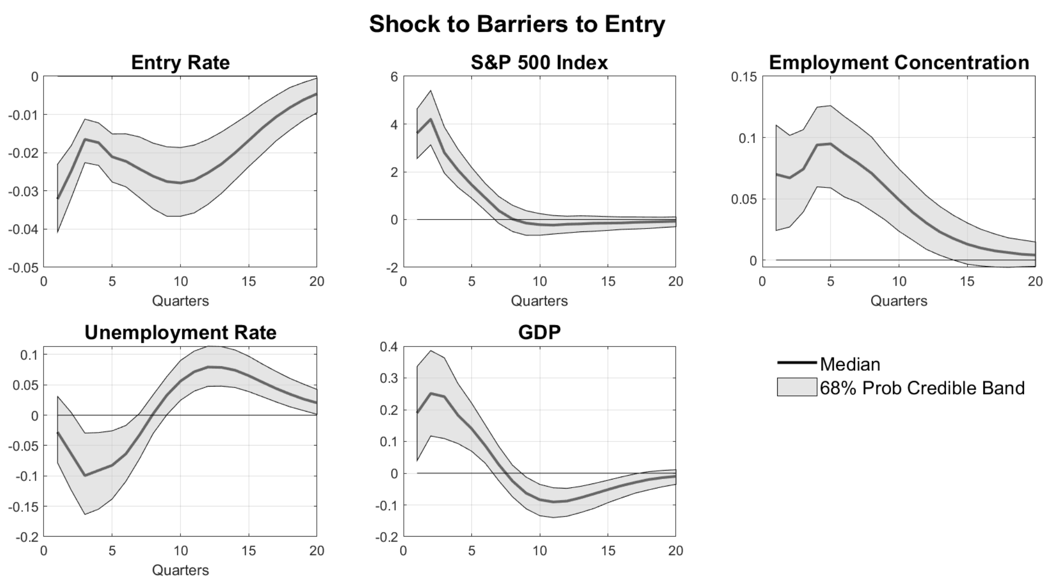

Figure 1: IRFs to an increase in entry barriers. Baseline BVAR specification

The unemployment rate initially decreases for several quarters, peaking at a reduction of approximately 0.1%. Conversely, GDP increases for about 7 quarters, indicating a short-term expansionary impact from the shock. However, this expansionary effect is temporary, as the shock eventually becomes contractionary. Approximately two years after the shock, the unemployment rate begins to rise and remains above the baseline for several years.

[5]We experimented with alternative durations of these restrictions and our results are robust.

The proportion of workers employed by firms with at least 500 employees, our measure of employment concentration, persistently increases, peaking at a 0.1% rise five quarters after the shock, before gradually returning to baseline over five years. These findings suggest that even a temporary shock to entry barriers has lasting effects on the labor market and the firm size distribution.

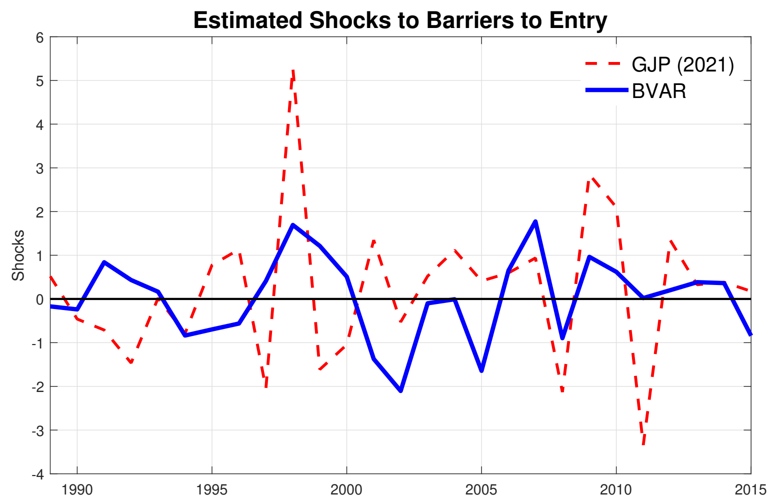

Figure 2: Comparison of structural shocks: Gutierrez, Jones and Philippons's (2021) and baseline BVAR.

To validate our estimates of shocks to entry barriers, we show that the shocks derived from the entry equation in our baseline model correlate with independent estimates of entry cost shocks from Gutierrez Gallardo et al. (2019), especially so after the mid 90s. These authors use a structural model to examine the interaction between entry barriers, investment, and monetary policy in U.S. data. They find that entry cost shocks play an important role in explaining the rise in sales concentration observed over the last few decades.[6] The dashed line in Figure 2 shows the entry cost shocks estimated by Gutierrez Gallardo et al. (2019), while the solid line shows the shocks derived from our baseline BVAR entry equation. Notably, periods of significant entry cost shocks in Gutierrez Gallardo et al. (2019) align with periods of substantial entry barrier shocks in our analysis. In the next section, we further investigate the nature of barriers to entry.

[6]We thank the authors for kindly providing us the series of entry costs shocks they estimated.

3.3 The nature of barriers to entry

Similarly to Covarrubias et al. (2020), we distinguish between two hypotheses concerning the nature of barriers to entry.[7] The first one posits that barriers to entry have a technological nature. As argued by Crouzet and Eberly (2021), while technological progress allows efficiency gains, it may also imply that entering a market has become increasingly more costly in terms of the initial sunk costs. The second hypothesis that we test posits that Government regulation is a main source of barriers to entry. To distinguish between the two hypotheses we proceed as follows. First, we append, one at a time, to the baseline VAR three different measures of technology, namely: TFP, output per hour, and output per worker. Next, to test the second hypothesis, we augment the baseline BVAR with a measure of the extent of business regulation from the RegData database. RegData collects annual observations on the number of regulatory restrictions on economic activities by sector from the Code of Federal Regulations in the period 1983-2018 [8]. Figure 3 displays the findings. The three technology measures we considered show no statistically significant response to the shock to barriers to entry identified using our strategy. In contrast, we observe an increase in regulation. We interpret this result as suggesting that the main source of barriers to entry is federal regulation and not technology. To further support this claim, we take two additional steps. First, we identify a positive technology shock through sign restrictions using the baseline BVAR augmented with output per hour as a measure of productivity. To identify the shock, we impose no restrictions on the entry rate, but impose that both labor productivity and GDP increase in response to the shock. The identification strategy is detailed in Appendix H. Figure 16 shows that in this case, in line with results in the literature, an expansionary technology shock generates a positive correlation between the entry rate and the stock market index.

The rise in regulation occurs with a delay compared to the response of other variables in the baseline model, suggesting an anticipation effect of the regulatory change. One approach

[7] Covarrubias et al. (2020) study the reasons behind the secular rise in sales concentration in the US distinguishing between good and bad concentration. In their approach, good concentration results from technological progress and investment in intangibles, while bad concentration arises from barriers to competition.

[8] Data are available at https://www.reghub.ai/data/bulk. See Al-Ubaydli and McLaughlin (2014) for a description of the text analysis adopted to count restrictions implied by federal regulation.

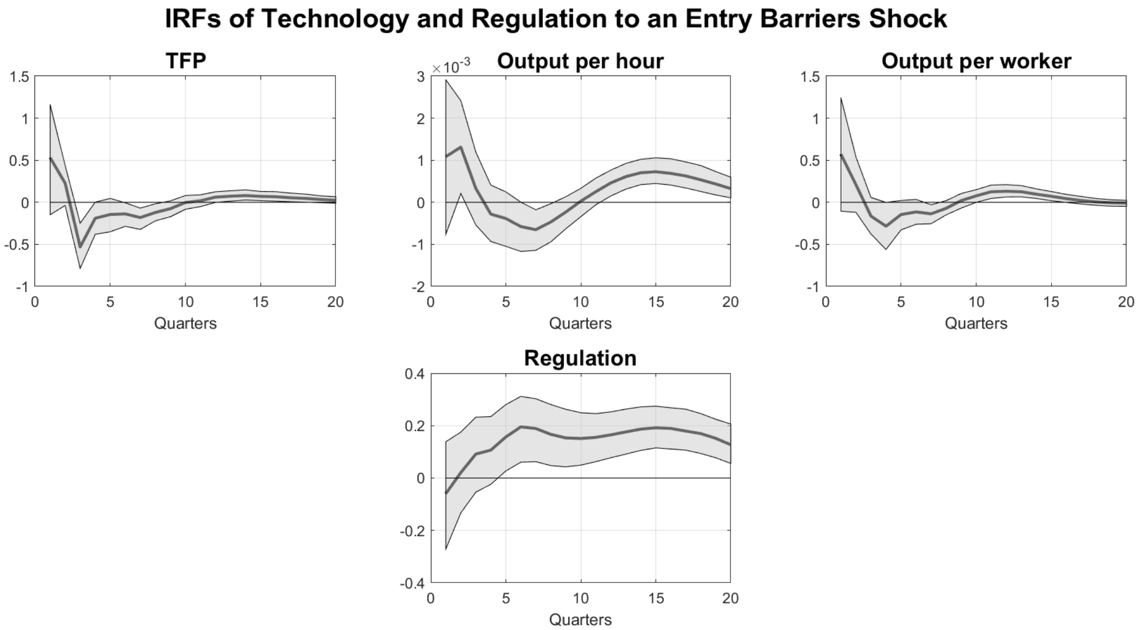

Figure 3: IRFs of 3 measures of technology (first row) and regulation (second row) to an increase in entry barriers.

suggested in the literature to address potential anticipation effects is to include forward-looking variables in the VAR model. These variables can intuitively capture agents' expectations regarding future innovations. In addition to implementing our identification strategy, incorporating the stock market index in the baseline VAR also serves this purpose. Given the findings in this section, and to further mitigate potential estimation biases due to anticipation effects, in the remainder of the empirical analysis, we extend the baseline BVAR with the measure of regulation extracted from Regdata. In the extended BVAR, the identification of shocks to barriers to entry features an additional restriction compared to those discussed earlier, namely that regulation rises for 4 quarters after the shock. Figure 4 shows that none of the results previously discussed is affected by this restriction.[9]

[9]The number of restrictions on economic activity could increase even due to new regulations aimed at promoting competition. In such a case, however, we should not observe a decrease in entry, as imposed by our identification strategy. Our identification strategy identifies regulatory measures that hurt new entrants and benefit incumbents.

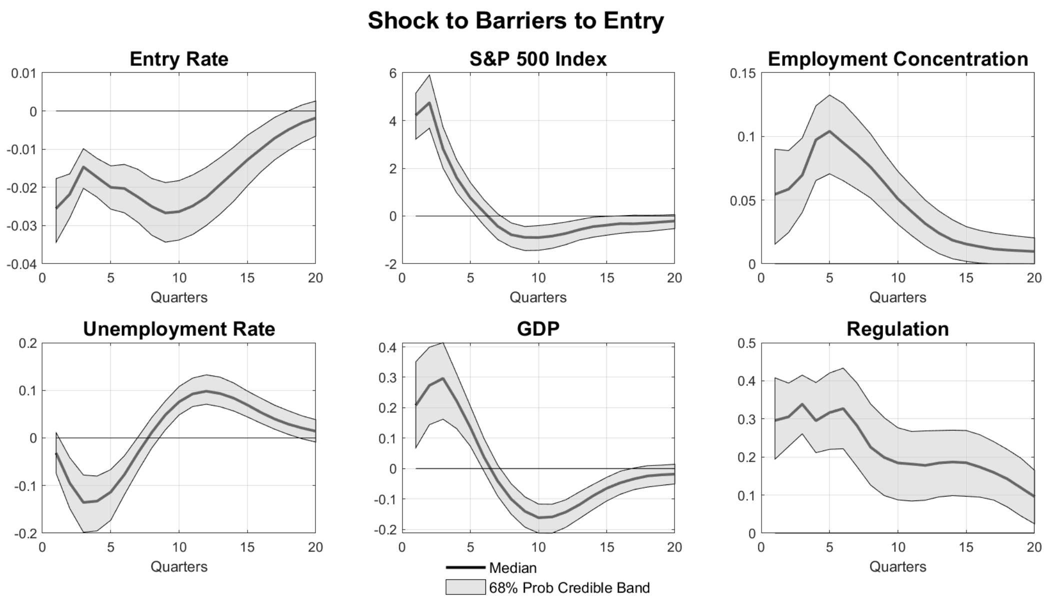

Figure 4: BVAR with additional restriction on Regulation.

3.4 Unemployment and job flows

To comprehend the origin of the dynamic response of unemployment to TBE, we consider the baseline BVAR augmented with regulation and append to it aggregate job flows, job flows from different categories of firms, and job market tightness one at a time. Results are displayed in Figure 5. Aggregate job creation is measured annually. Initially, it increases in response to the shock, then it undershoots before returning to baseline after about 15 quarters. In the second specification, we add aggregate job destruction to the fixed set of variables. Job destruction does not show a statistically significant response to the shock. Therefore, the analysis suggests that the dynamics of unemployment shown in Figure 1 are driven by job creation rather than job destruction. Indeed, the unemployment rate's response mirrors that of job creation. For this reason, we dig deeper into the response of job creation, distinguishing between job creation by incumbents and new entrants. Both are measured annually. Given the drop in entry of new firms estimated earlier, one could have expected a fall in the job creation by new entrants, which is indeed large and statistically significant. Conversely, job creation by incumbent firms rises for a few quarters after the shock, then returns to baseline in a pattern similar to aggregate job creation. In summary, the analysis indicates a contrasting response between job creation by new firms and incumbent firms, with job creation by incumbent firms ultimately driving unemployment dynamics.[10] It remains to justify the initial rise in job creation by incumbents in response to the shock. To address this, we append job market tightness to the set of fixed variables. Initially, job market tightness increases but then persistently drops. Incumbent firms capitalize on the lower future job market tightness, which depresses wages, to create new jobs.

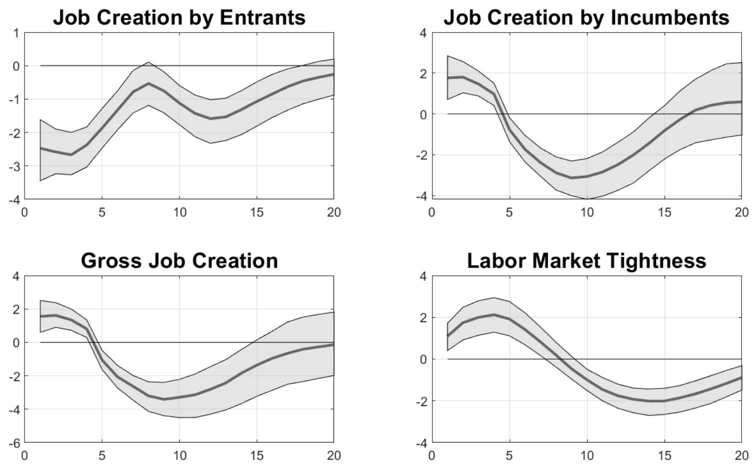

Figure 5: Job flows and job market tightness. IRFs to an increase in entry barriers.

4 The model

To interpret the empirical facts we uncovered in the previous sections, we propose a model where the labor market is characterized by search and matching frictions as in Mortensen and Pissarides (1994). Time is discrete and the horizon is infinite. We adopt the convention of denoting lagged values with the subscript -1, and forward values with a prime. When necessary, we will denote variables that are decided at time t, with time index t. Firms have heterogeneous productivity and hire multiple workers as in Sedláček (2020). Both entry and exit of firms are endogenous as in Hopenhayn (1992), and Clementi and Palazzo (2016). The creation of a new firm entails a cost expressed in terms of units of the final good, which is time-varying. The latter is meant to capture the effects of time-varying exogenous barriers

[10]While the deviation from the trend in job creation by incumbent firms is smaller in magnitude than the decrease in job creation by new entrants, incumbents employ the vast majority of workers. This explains the overall increase in aggregate job creation.

to entry of various nature. The demand side is characterized by a representative household, and markets are complete.

Figure 4 summarizes the sequence of events in a typical period. The aggregate shock to entry cost hits the economy at the beginning of the period. Potential entrants pay the entry cost to draw the permanent component of their idiosyncratic productivity. They will start production in the next period if economically convenient. Incumbents, that is firms which entered the market in period t-1 or prior, are hit by idiosyncratic productivity shocks. After that, they make their hiring decisions while simultaneously bargaining the wage with the newly hired. Production occurs and the fixed cost of production is drawn. At this point, incumbents decide whether to continue their activity in the next period or to exit.

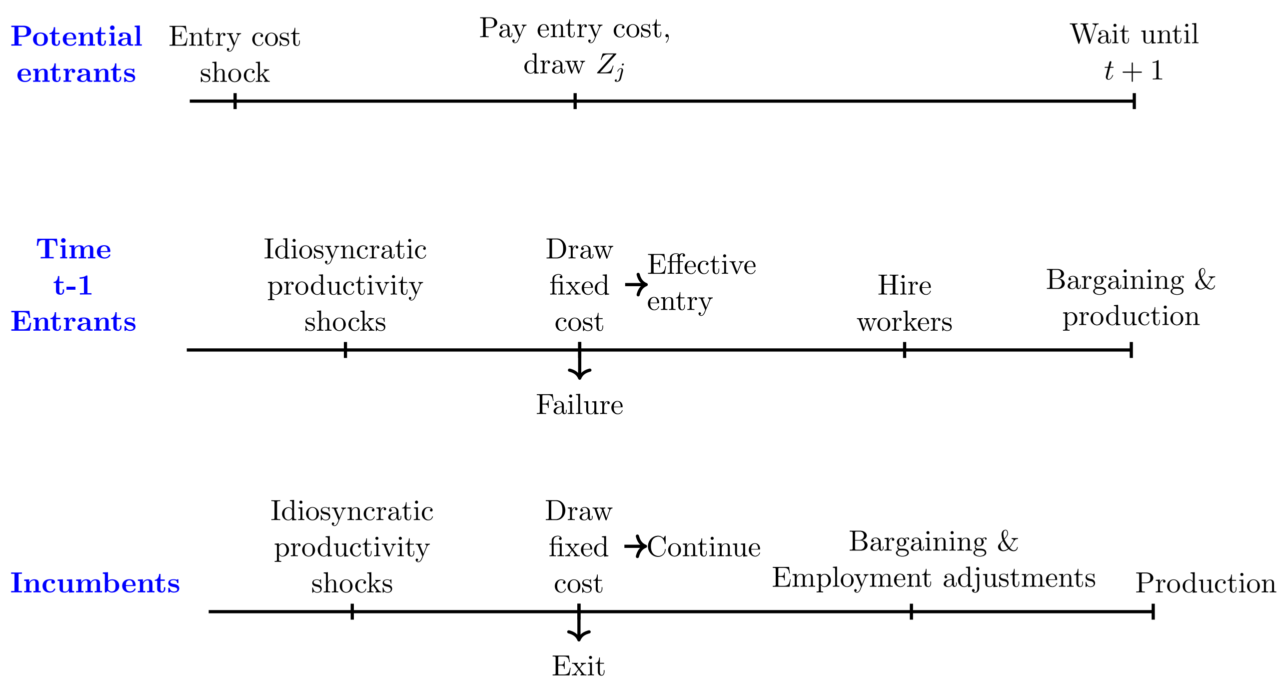

Figure 6: Timing.

4.1 Labor market

Firms post vacancies to create new jobs. Unemployed workers and vacancies combine according to a constant returns to scale matching function which delivers a mass M_t of new hires, or matches, in each period. The matching function reads as:

$$M = M(U, V) = \mu U^{1-\gamma} V^{\gamma} \tag{1}$$

where U and V denote, respectively, the mass of unemployed workers and total vacancies. By defining $\theta = \frac{V}{U}$ as the tightness in the labor market, the matching function can be rewritten as:

$$M = \mu \theta^{1-\gamma} V.$$

The probability that a vacancy is filled is $q_t = \frac{M}{V} q(\theta) = \mu\theta^{1-\gamma}$, and it is taken as given by firms. The probability of finding a job for an unemployed worker is $\phi = \frac{M}{U} = \mu\theta^{\gamma}$. As soon as unemployed workers are matched with firms and their wage is set, they become productive.

4.2 Firms

At time t, a positive mass of price-taking firms produces a homogeneous good with the following decreasing returns to labor production function:

$$y(Z, z, n) = Zzn^{\alpha}, \tag{2}$$

with $\alpha < 1$. The idiosyncratic productivity level of a firm is made by a permanent and a transitory component. Upon entry, a firm pays a fixed amount in terms of output to draw its permanent idiosyncratic productivity component, Z, from a time-invariant distribution G. Productivity Z remains constant through the life cycle of the firm. The transitory component of the idiosyncratic productivity is denoted by z. Its logarithm follows an autoregressive process of order 1, with parameter ρ_z, formally $\log z' = \rho_z \log z + \epsilon^z$. The variable ϵ^z represents an idiosyncratic productivity shock, drawn from a normal distribution with zero mean and variance σ_z^2. It is empirically relevant to consider both productivity components since Sterk et al. (2021) find that the ex-ante heterogeneity across firms, rather than persistent ex-post shocks, explains most of the differences in the performances of the firms over their life-cycle. Let $H(z'|z)$ denote the conditional distribution of z, and $\tilde{H}(z)$ its unconditional distribution. The distribution of operating firms over the three dimensions of heterogeneity is denoted by $\Lambda(Z, n, z)$. Finally, let λ denote the vector of aggregate state variables, and $\Upsilon(\lambda'|\lambda)$ its law of motion.

Following Clementi and Palazzo (2016), firms draw a fixed cost of production c_f from a time-invariant, log-normal, distribution G^{c_f} with parameters μ_o and σ_o. A firm with permanent productivity Z exits from the market when its value, defined as the discounted sum of future expected profits, turns negative. [11].

After observing their idiosyncratic productivity draw, firms choose their optimal employment adjustment policy to maximize their value, $F(Z, z, n)$; separations happen at zero cost, whereas vacancy creation is subjected to a cost κ per vacancy. Hiring and wage bargaining take place simultaneously, and new hires become immediately productive. The mass of firms at any given point in time, N, is determined endogenously through entry and exit.

4.2.1 Incumbents

Consider a firm with permanent productivity Z, which at the beginning of a generic time-t receives an idiosyncratic productivity shock z, and has employment n. Let $F(Z, z, n)$ denote its value, $w(Z, z, n)$ its wage, $v(Z, z, n)$, the number of vacancies it posts, while $f(Z, z, n)$ the number of workers that separate from the firm at time t. Whenever it does not jeopardize understanding, and to lighten the notation, in what follows we drop the dependency of firm-specific variables from the triplet (Z, z, n). The variable β represents the stochastic discount factor of the representative household that owns firms between period t and $t + 1$, defined in section 4.3. The wage is the result of individual bargaining, described in Section 4.4. In response to a negative realization of the idiosyncratic productivity shock an incumbent firm has three options: reduce its employment, freeze it until next period, or exit from the market. The value maximization problem of an incumbent firm reads as:

$$F(Z, z, n_{-1}) = \max_{n,v} \left\{ y - nw - \kappa v + \int \max\left\{0, \tilde{F}(Z, z', n) - c_f\right\} dG^{c_f} \right\}$$

[11]The exit policy is a generalization of the modeling scheme in Hopenhayn (1992). In the seminal contribution of Hopenhayn, firms exit if their current value, given the fixed cost of production, is negative.

where $\tilde{F}(Z,z',n) = \max_n \left\{ \beta \int F(Z,z',n)dH \right\}$. The maximization is subject to the evolution of firm-level employment:

$$n = \begin{cases} n_{-1} + qv \text{ if } n > n_{-1} \\ n_{-1} - f \text{ if } n \leq n_{-1}. \end{cases}$$

As pointed out by Elsby and Michaels (2013), due to the diminishing marginal product of labor, the rents generated by new matches decrease as the size of the firms increases, that is as n increases. We can substitute for $v = \frac{(n-n_{-1})}{q}\mathbf{1}^+$ into equation 4.2.1, where $\mathbf{1}^+$ is an indicator function which equals one if $n > n_{-1}$ and zero otherwise. In other words, the indicator function takes value one just if a firm posts vacancies. As a result, the functional to be maximized can be rewritten as:

$$Zzn^{\alpha} - wn - \kappa \frac{(n-n_{-1})}{q}\mathbf{1}^+ + \int \max\left\{0, \tilde{F}(Z,z',n) - c_f\right\} dG^{c_f} \tag{3}$$

Differenciating the latter with respect to n delivers the job creation condition (JCC):

$$J(Z,z',n) = \frac{\kappa}{q}\mathbf{1}^+ \tag{4}$$

where $J(Z,z,n) = \alpha Zzn^{\alpha-1} - \frac{\partial w}{\partial n}n - w + D(Z,z',n)$ describes the marginal value of an additional worker to the firm. Adopting the notation and terminology in Elsby and Michaels (2013), we define variable $D(Z,z',n) = \frac{\partial \tilde{F}(Z,z',n)}{\partial n}$ as the marginal effect of current employment choices on the future firm's value. The latter is formally defined in Appendix B. It follows that the JCC has a standard interpretation. The optimal employment level of a firm is such that the marginal value of labor, J, equals the cost of hiring an additional worker, the right-hand side. The term $\frac{\partial w}{\partial n}n$ in the definition of the marginal value of a worker implies that the firm correctly anticipates that the bargained wage will be a function of its employment level.

4.2.2 Potential entrants

Potential entrants must pay a sunk entry cost c_e, measured in units of the final good, to draw the permanent component of their individual productivity. Firms enter the market up to the point where the sunk cost of entry is equal to the expected value of discounted future profits. Since the permanent component of idiosyncratic productivity is unknown ex-ante, entrants must compute the expected value of their discounted future profits over the distribution of permanent productivity components, G. Formally the value of entry is

$$F^e = \int \int F dG d\tilde{H}. \tag{5}$$

As in many other studies in the entry literature, we assume a one period to build, so that firms that decide to enter today will, if economically convenient, start producing tomorrow. As a result, the free-entry condition reads as:

$$\beta F^e \geq c_e \tag{6}$$

which holds with equality when the mass of potential entrants, N^e, is positive.

The right-hand side of (6) is a time-varying entry cost, characterized by the following functional form

$$c_e = \psi (N^e)^\xi \tag{7}$$

where ψ is subject to shocks: $\psi = \overline{\psi} + \zeta$, $\zeta' = \rho_A \zeta + \epsilon^A$, with $\epsilon^A \sim N(0, \sigma_A)$. Variable c_{et} is meant to capture barriers to entry for new entrants akin to those we identified in the empirical analysis.

As in Colciago and Silvestrini (2022), and Gutierrez Gallardo et al. (2019), c_e is convex ($\xi > 0$) and increasing ($\overline{\psi} > 0$) in the mass of potential entrants N^e. As a result, an increase in the mass of potential entrants generates a congestion externality, that leads to higher costs of entry. [12] The mass of firms follows the law of motion:

$$N' = \int N d\Lambda + N^e, \tag{8}$$

where Λ evolves according to the transition equation

$$\Lambda' = \int \int \int d\Lambda dG \Big(c_f | F(Z, z, n) > c_f \Big) dH(z'|z) \tag{9}$$

The variable N^e denotes the mass of *potential* entrants, which is determined by the size of the entry cost. Not all potential entrants will become producers in the next period, but

[12] The rationale is that a higher number of applications for Government licenses would lead to a longer bureaucratic process, and thus to higher costs.

just those that survive and have a high enough productivity.

4.3 Households

The economy is populated by a representative household consisting of a continuum of individuals who can be either employed or unemployed. The mass of employed workers is denoted with L, while that of the unemployed is U. Members of the household pool their income from work and non-work activities and spend it on consumption goods. The present discounted value of lifetime utility is:

$$\mathcal{U} = u(C) + \beta E \mathcal{U}' \tag{10}$$

where C denotes consumption, and the period utility is concave, so that agents are risk averse. The budget constraint of the household reads as:

$$C + B = LI + bU + \Pi + B_{-1}R - T, \tag{11}$$

where LI denotes labor income, B are private bonds in zero net supply that pay a gross return R. Summing over the firms where members of the family could be employed delivers labor income as $LI = \int wnNd\Lambda$. The product bU denotes total unemployment benefits received by the household, which are financed through lump sum taxes, T. The variable Π defines aggregate firms' profits net of entry costs, that is $\Pi = \int \pi N d\Lambda - c_e N^e$, where π denote the profits of an individual firm gross of entry costs. The Household's first-order conditions are derived in Appendix C.

4.4 Wage bargaining

In a frictional labor market the formation of an employment relationship entails a positive surplus that has to be split between the worker and the firm. Decreasing returns to scale at the firm level imply that the surplus depends on the number of workers employed at a given firm. Bargaining is conducted according to the scheme proposed by Stole and Zwiebel (1996), as in Elsby and Michaels (2013) and Sedláček (2020). This bargaining framework is equivalent to Nash bargaining, but bargaining happens over the marginal surplus. The resulting bargained wage is [13].

$$w(Z,z,n) = \eta\left[\frac{\alpha Z z n^{\alpha-1}}{1-\eta(1-\alpha)} + \beta\kappa E\beta\theta'\right] + (1-\eta)b. \tag{12}$$

The wage shares costs and benefits associated with the match according to the extent of the bargaining power, as measured by η. The worker is rewarded for a fraction η of the firm's revenues and savings of hiring costs and compensated for a fraction $1-\eta$ of the foregone unemployment benefits. Starting with Hall (2005) and Shimer (2005), the literature pointed out that search and matching models account for the cyclical properties of unemployment and vacancies when the real wage does not display sharp swings in response to shocks. This led several authors to augment the search and matching framework with a wage norm that dampens fluctuations in the real wage. We follow Sedláček (2020) and model real wage rigidity in the form of a social norm where wages in individual firms are a weighted average of the Stole-Zwiebel wage in equation 12 and its steady-state counterpart. The weight λ_w given to the steady state wage determines the degree of wage rigidity. Notice that $\lambda_w = 0$ corresponds to the case of flexible wages.

]

4.5 Aggregation, market clearing, and Equilibrium

The resource constraint of the economy can be written as:

$$C = Y - \kappa V - N\overline{c_f} - c_e N^e, \tag{13}$$

where $Y = \int y_{Z,t} N d\Lambda$ is aggregate output, $\overline{c_f}$ is an average of the fixed costs drawn by continuing businesses based on the firm size distribution, and $V = \int v N d\Lambda$ are total vacancies. Equation 13 states that aggregate output is spent on consumption, the cost of creating vacancies, fixed costs of production, and the cost of creating new firms. Notice that GDP equals aggregate output net of fixed and vacancy creation costs. Labor market clearing requires that the mass of employed members of the representative household equals the mass of workers employed at operating firms. Equilibrium requires that firms set their

[13] To lighten the reading, the derivation of the wage equation is reported in Appendix D

employment policy function according to (4); the optimal wage schedule is given by (12); labor market tightness $\theta = \frac{V}{U}$ is determined in equilibrium and taken as given by firms and the representative household; finally, the total mass of operative firms evolves according to (8); the free-entry condition (6) holds.

5 Quantitative analysis

The stationary equilibrium is solved numerically by local approximation of the value function. The solution algorithm is spelled out in Appendix E. To solve for the dynamic stochastic equilibrium, we apply the method of Reiter (2009). [14]

5.1 Calibration strategy

Since the solution to this model is not attainable in closed form, we use numerical methods to solve for the long-run stationary equilibrium and the response of the model to a shock to the entry cost. To do so, we assign empirically plausible values to the involved parameters.

The time period is a quarter. We assign to preference and technology parameters values common in the literature. The discount factor and the parameter measuring the degree of return to scale are set to $\beta = 0.99$ and $\alpha = 0.65$, respectively.

Turning to parameters belonging to the search and matching framework, we set the mass of workers, employed and unemployed, such that the steady-state labor market tightness, θ, is normalized to one. The matching elasticity is set to $\gamma = 0.72$, as in Shimer (2005). The workers' bargaining power, η, is identical to γ, a choice that would satisfy the Hosios condition in a standard search and matching model of the labor market. The value of the matching efficiency parameter μ targets a job-finding probability equal to 0.7 as in Blanchard and Galí (2010). Following Shimer (2005), the unemployment benefit, b, is such that its ratio to the average wage equals 40%. For simplicity we set $\frac{\kappa}{q}$ to one. This implies that the total cost of posting vacancies is about 1.37 percent of GDP, within the interval defined by the 2 percent targeted by Den Haan et al. (2021) and Leduc and Liu (2016) and the one percent targeted by Blanchard and Galí (2010). We set the degree of wage stickiness λ_w equal to 0.7 to reproduce the dynamics of the unemployment rate's response to the shock.

[14] We use the MATLAB code provided by Costain and Nakov (2011), and available on their web pages.

The parameters of the fixed cost distribution, μ_o and σ_o, the persistence of idiosyncratic shocks, ρ_z, and the distribution of the permanent component of idiosyncratic productivity, G, are calibrated to minimize the Euclidean distance between the model-implied distributions of the firm size, the employment shares, and the NJC rates according to size, that we extract from BDS data. BDS data contain information on establishment-level job flows and employment stocks for continuing as well as entering and exiting establishments at an annual frequency. The data can be broken down by the size of the parent firm.[15] A firm is thereby simply defined as a collection of all its establishments. We rearrange BDS data in 5 size clusters according to initial size. The first one includes new entrants, which have zero initial size. The second one refers to firms with 1 to 19 workers, cluster 3 includes firms with 20 to 99 workers, and the fourth one has firms with 100 to 499 workers. The fifth includes firms with 500 or more workers, which we define as large firms. We adopt a flexible approach to model and calibrate the permanent idiosyncratic productivity distribution G. Following Sédlaček (2020), we set four productivity types in ascendant order, associated with four different probabilities of drawing that particular type. In this way, along with the calibration of ρ_z, we can match precisely the three empirical distributions.

This calibration strategy is justified by the presence of non-linearities, making it impossible to match these parameters directly to specific moments without spillover effects on other moments. To solve this problem, we decide to target collective moments that are jointly affected by exit, firm-level employment adjustments, and the *ex-ante* distribution of entrants. Such moments coincide with the three distributions mentioned above. Notice that, by construction, this calibration allows us to approach closely a quarterly aggregate exit rate equal to 2.5% in steady state, common to many firm-dynamics models, as well as to match quite well the empirical distribution of exit rates according to size. As we will show in our counterfactual exercise, matching the distribution of exit rates according to size is the key ingredient to explain the response of employment concentration to the entry cost shock.

The standard deviation of idiosyncratic productivity shocks σ_z, is set to match an overall separation rate equal to 9%, that is the median value in the interval 8% - 10% as estimated

[15] Quarterly values of entry and exit rates, and of job flows are obtained assuming that annual values are equally spread over quarters within a year.

by Hall (1995).

Turning to the parameters which define the entry cost process, we set the elasticity of entry costs with respect to potential entrants - ξ - to 1.5 as estimated by Gutiérrez et al. (2021). Parameter ψ, determines the mass of potential entrants N^e through the free-entry condition, and through this channel it affects the overall size of the economy. However, it does not affect the distributions. For this reason, we normalize it to 1.

The standard deviation of the shocks to the entry cost, σ_A, is set to match the impact response of the entry rate to the entry cost shock that we estimated in the empirical analysis, whereas its persistence ρ_A is equal to 0.72 as in Gutiérrez et al. (2021). The calibration strategy is summarized in table 2.

Parameter/SS value	Definition	Value	Source/Target
β	Discount factor	0.99	Annual interest rate = 4%
α	Returns to scale parameter	0.65	Labor share
θ	Labor market tightness	1	Normalization, Shimer (2005)
γ	Matching elasticity	0.72	Shimer (2005)'s estimate
μ	Matching efficiency	0.7	$\phi = 0.7$, BG (2010)
η	Workers' bargaining power	$=\gamma$	Hosios condition
b	Unemployment benefit	1.22	$\frac{b}{w_{avg}} = 40\%$ Shimer (2005)
κ	Vacancy marginal cost	0.7	$\frac{\kappa}{q} = 1$
λ_w	Degree of wage stickiness	0.7	Unemployment rate's response
ξ	Elasticity of entrants	1.5	GJP (2019)
ψ	Entry cost parameter	1	Normalization
μ_o	Log-norm. par.	-8.5927	BDS distributions
σ_o	Log-norm. par.	4.53	BDS distributions
Z_j	Permanent productivity component	[1.5 2.25 4.5 9.75]	BDS distributions
$P(Z_j)$	Probability $Z = Z_j$	[0.935 0.06353 0.00127 8.16e-05]	BDS distributions
ρ_z	Persistence id shocks	0.87	BDS distributions
σ_z	Std deviation id shocks	0.075	$s^{tot} = 9\%$, Hall (1995)
σ_A	Std dev entry cost shock	0.011	Response of entry rate
ρ_A	Persistence entry cost shock	0.72	GJP (2021)

Table 2: Parameters values

5.2 Stationary distributions

In Table 3 we report the model-implied distributions of firm size, employment share, and NJC rates, which were the targets of our calibration strategy, and compare them to those extracted from BDS. The model matches the targeted moments well. Importantly, it matches the observation that firms in the size classes of 1-19 and 20-99 employees exhibit a negative NJC rate, indicating that, on average, they shrink over time.

The table also reports the model-implied distributions of the NJC rates of continuing firms, that is the NJC rates excluding job destruction due to exit of firms from the market, and the distribution of exit rates according to size. Although these distributions are not specifically targeted in our calibration strategy, the model matches them quite well. In particular, the model aligns with the observation that the negative average NJC rates for firms with fewer than 100 employees are entirely due to their high exit frequency. This exit rate is significantly higher than that of firms with over 100 employees. In the remainder, we demonstrate that matching this aspect of the data not only enhances the empirical appeal of the model, but is also crucial for explaining the response of employment concentration to TBE.

Size Class	**Firm Shares**	**Employment Shares**	**NJC rates**	**NJCR continuing firms**	**Exit rates**
Model					
0	0.0248	0.0052	2	2	0
1-19	0.8462	0.2150	-0.0198	0.008	0.0287
20-99	0.1165	0.1879	-0.0025	0.002	0.0046
100-499	0.0083	0.1484	0.0003	0.0008	0.0005
500 or more	0.0042	0.4435	0.0063	0.0007	0.0001
BDS data (quarterly)					
0	0.0267	0.0066	2	2	0
1-19	0.8517	0.1838	-0.0174	0.003	0.0205
20-99	0.1006	0.1740	-0.0017	0.006	3.83e-04
100-499	0.0168	0.1405	0.0027	0.007	3.39e-05
500 or more	0.0042	0.4950	0.0018	0.002	2.35e-06

Table 3: Stationary distributions: model vs data.

5.3 Impulse response analysis. A temporary tightening in barriers to entry

In this Section, we study the transmission of an entry cost shock in our model, which is meant to capture a temporary tightening in barriers to entry for new entrants as those we identified in the empirical analysis. Figure 7 is the model equivalent of figure 4, and displays the effects on the main macroeconomic variables and employment concentration of a one-std shock to the entry cost. The increase in entry costs makes the creation of new firms more costly. Consistently with our identification strategy of barriers to entry, the entry rate suffers a reduction with respect to its long-run value, while the entry condition implies that the average value of firms increases. As suggested by the empirical evidence employment concentration increases persistently in response to the shock, while unemployment initially decreases before overshooting its long run value.

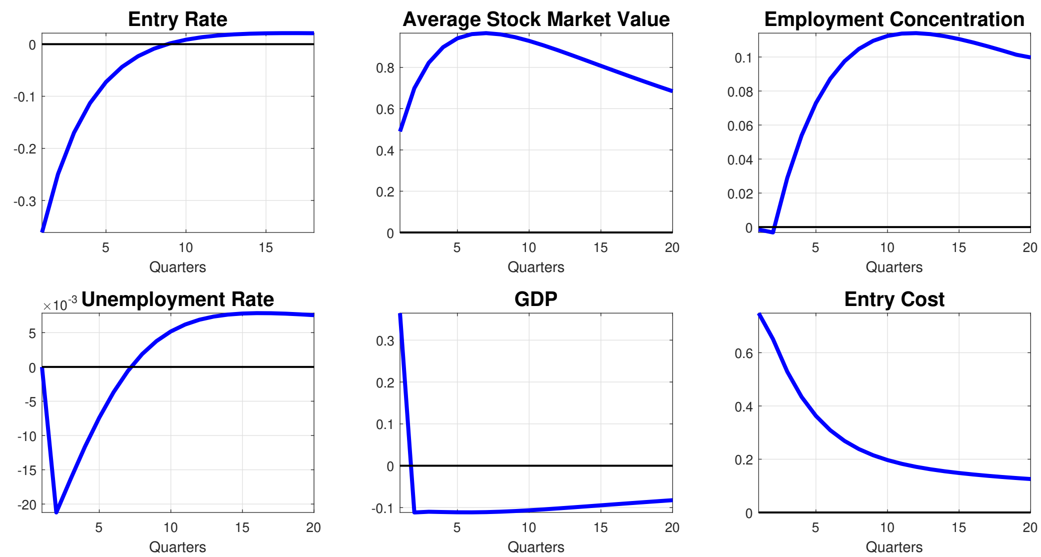

Figure 7: IRFs of the main macroeconomic variables to a temporary tightening in barriers to entry.

Dynamics of aggregate variables are more easily understood by considering the responses of job flows depicted in Figure 8, which is the model equivalent of Figure 5. Small businesses have a higher exit rate than large ones. Therefore, job creation by new businesses, which are predominantly small, plays a vital role in maintaining their employment share. Since the shock leads to a large decrease in the job creation of new entrants, it results into a decrease in the employment share of small businesses, leading to the increase in employment concentration. Incumbent firms anticipate lower wages due to lower job market tightness resulting from missing job creation by new entrants. For this reason they create more jobs. This leads to the impact decrease in unemployment. Since job creation undershoots its equilibrium value, unemployment increases before reverting to equilibrium.

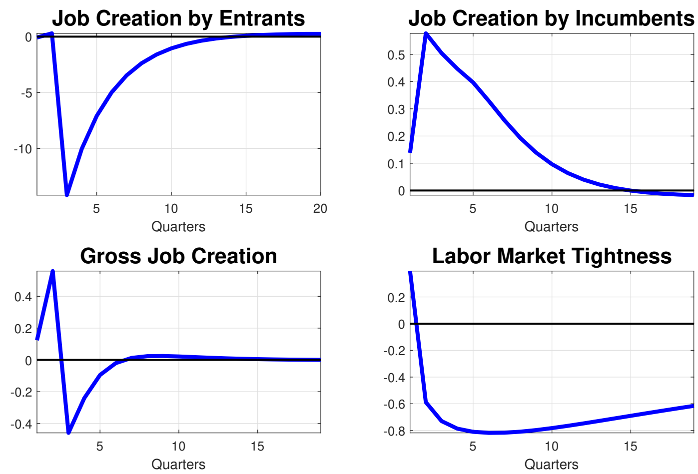

Figure 8: IRFs of job flows and labor market tightness to a temporary tightening in barriers to entry.

6 Inspecting the mechanism

In this section, we conduct two experiments aimed at enhancing our comprehension of how TBE impact unemployment and employment concentration. In the first one, we impose that firms expect labor market tightness, θ, to be unchanged in response to the shock. Dashed lines in Figure 9 refer to this counterfactual. When firms do not correctly anticipate a reduction in job market tightness unemployment increases in response to the shock. The reason is that, in this case, they do not expect a reduction in the real wage, and thus do not anticipate the higher values of additional jobs. The second experiment is a counterfactual exercise, where we impose that the exit rate is exogenous and identical across firms independently of their size. In this case, small firms do not exit from the market with higher frequency than large firms. For this reason, the reduction in job creation by new entrants does not imply an increase in employment concentration, as depicted by the dotted lines in Figure 9. The analysis underscores the importance of both macro and micro forces to understand the labor market distributional effects of barriers to entry.

7 Welfare Analysis

In this Section, we compute the welfare changes associated to TBE under two scenarios. The first one is our baseline case, while the second one is the counterfactual case where small

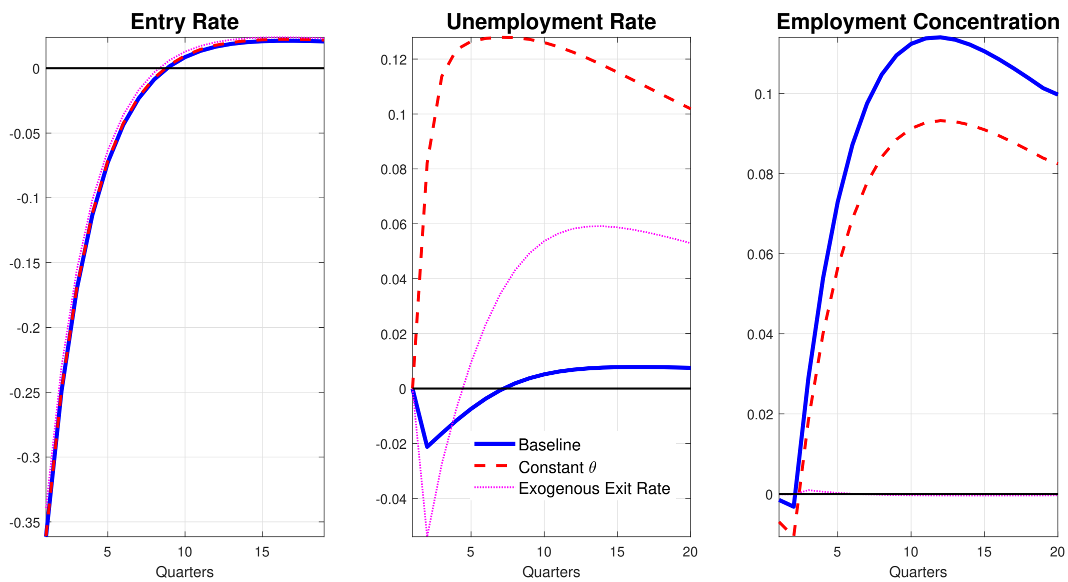

Figure 9: IRFs of the main macroeconomic variables to a temporary tightening in barriers to entry. Alternative model specifications.

and large firms exit with the same frequency. We measure welfare changes in terms of the Consumption Equivalent Variation, (CEV), defined as the value of CEV that solves:

$$E_t \sum_{k=0}^{\infty} \left\{ \beta^k u \left[C_{t+k}^{SS} (1 + CEV) \right] \right\} = E_t \sum_{k=0}^{\infty} \left\{ \beta^k u \left(C_{t+k}^{TBE} \right) \right\}$$

CEV represents the percentage variation in the level of consumption that makes households indifferent between enjoying the level of consumption in response to the shock and remaining in the steady state forever. The variable C_t^{SS} denotes the steady state level of consumption, while C_t^{TBE} represents consumption observed in response to the tightening in barriers to entry.

With a log-utility function, CEV is equal to

$$CEV = exp\left\{ (1 - \beta)(U^{TBE} - U^{SS}) \right\} - 1 \tag{14}$$

where $U^{TBE} = E_t \sum_{k=0}^{\infty} \left\{ \beta^k u \left(C_{t+k}^{TBE} \right) \right\}$, whereas $U^{SS} = \frac{\log C_{t+k}^{SS}}{1-\beta}$ is the lifetime utility the agent would get by remaining for ever at the steady state.

The CEV under the baseline scenario equals -0.0208. Not surprisingly, TBE cause a welfare cost. The reason is that the initial expansionary effect of the shock is reversed in the medium-run. Notice that the CEV under the counterfactual scenario where all firms exit the market with the same, independent of size, frequency equals -0.0115. In other words, when small firms exit with a data-consistent frequency, the welfare costs of the fluctuations generated by TBE is larger than in the case in which all firms exit with the same frequency. In the former case, the reallocation of workers from small to large firms entails a larger waste of resources, in terms of sunk entry costs and vacancy creation costs, that shrink the budget constraint of agents and thus their consumption.[16]

8 Conclusions

In this paper we provided evidence showing that temporary barriers to entry depress the job creation of new firms and boost that of incumbents, resulting in a persistent rise in employment concentration at large firms. In the short run, the reallocation process is expansionary. In the long run, missing job creation from new firms leads to a higher unemployment rate. To rationalize these empirical findings, we propose a model that integrates the theory of firm boundaries, through diminishing marginal returns, into a framework with search and matching frictions in the labor market. In the data large firms exit from the market with a much smaller frequency with respect to smaller firms. Matching this feature of the data is the key ingredient to explain the response of employment concentration in the aftermath of a temporary tightening in barriers to entry. Temporary barriers to entry generate a reallocation of workers from small to large firms. The reallocation process entails adjustment costs that weight on the welfare of agents.

[16] In the counterfactual with exogenous exit rates identical across firms, fixed costs of production are zero. For this reason, we also computed the CEV in the baseline case assuming that fixed cost of production are redistributed to households. In this case fixed cost of production disappear from the aggregate resource constraint, making it fully comparable to the counterfactual with exogenous exit rates. When fixed costs of production are redistributed, the value of CEV equals -0.025, essentially unchanged with respect to the baseline case. Thus fixed costs of production do not affect the welfare ranking between the two cases, and are not the source of welfare costs.

Appendix

A Data treatment

Variables from BDS are built as follows:

- entry and exit rates are defined as the number of - respectively - firm births and firm deaths with respect to the total number of firms operating in the current year;
- the average size of firms[17] is equal to

$$\text{AvgSize}_t = \frac{L_t}{N_t}$$

where L_t is aggregate employment and N_t is the number of firms;

- employment concentration serves as an indicator of changes in the distribution of employment across different firms. It is equal to the following ratio

$$\frac{\text{employment at large firms}}{\text{employment at all other firms}}$$

where large firms are classified as businesses with 500 employees or more[18].

The variables from FRED are either constructed or transformed according to the following rules:

- the S&P 500 index is transformed into a logarithmic scale and used to capture the average market value of firms;
- real consumption is calculated as the logarithm of the sum of personal consumption expenditures of non-durable goods and services;
- unemployment coincides with the unemployment rate.

[17] Not to be confused with the definition adopted by BDS for firm size classification according to Haltiwanger et al. (2013).

[18] The cutoff of 500 or more employees for large firms has been chosen following the classification by Fort et al. (2013). Moscarini and Postel-Vinay (2012), using establishment-level job flow data from the Business Dynamics Statistics (BDS) database choose a lower cutoff (250 or more employees). However, BDS does not allow it, since at the firm level the two contiguous classes are 100-499 and 500 or more employees.

Finally, the number of restrictions from RegData are log-transformed, and all series are stationarized through a two-sided Hodrick-Prescott filter[19].

B Value of the Marginal Worker

The value of the marginal worker defining the JCC in equation 4, can be defined as:

$$D(Z, z', n) = \int \left[\int J(Z, z', n) dH^{na}(z'|z) + \int \frac{\kappa}{q'} dH^{exp}(z'|z) \right] d\tilde{G}' \tag{15}$$

where $\tilde{G}' = G(c_f|\tilde{F}(Z, z', n) > c_f)$ is the cumulative distribution of fixed costs, conditional on the firm's survival. The conditional distributions H^{na} and H^{exp} are defined as follows:

$$\begin{cases} H^{na}(z'|z) = & H\left(z'|z, \max\{\mathbf{z}'_{Z;n'<n}\} < z' < \min\{\mathbf{z}'_{Z;n'>n}\} \right) \\ H^{exp}(z'|z) = & H\left(z'|z, z' \geq \min\{\mathbf{z}'_{Z;n'>n}\} \right) \end{cases}$$

where $\mathbf{z}'_{Z;n'<n}$ is the set of transitory idiosyncratic productivity component's values that induce any firm with permanent productivity Z and initial size n to reduce its labor force. Conversely, $\mathbf{z}'_{Z;n'>n}$ is the set of values generating an increase in the labor force of the same firm. Accordingly, H^{na} is the transitory component's cumulative distribution conditional on $z' < \min\{\mathbf{z}'_{Z;n'>n}\}$ and $z' > \max\{\mathbf{z}'_{Z;n'<n}\}$, i.e. z' strictly smaller than the lowest value of z that causes the firm to hire new workers, but strictly larger than the highest value of z that would reduce its labor force. For this reason, we label H^{na} as the cumulative distribution of z' *conditional on non-adjustment*. Conversely, H^{exp} is the transitory component's cumulative distribution conditional on z' to be greater or equal than the lowest value of z that increases the labor force of the firm (i.e. $z' \geq \min\{\mathbf{z}'_{Z;n'>n}\}$). Similarly, we define H^{exp} as the cumulative distribution *conditional on hiring*.

Therefore, the integrals inside the square brackets of equation 15 are conditional on two situations, respectively: when the firm does not adjust (first integral), and when it expands its labor force (second integral). In the first case, the future marginal value of current employment is equal J (i.e. today's marginal value) plus a continuation value D if the firm

[19] We set the smoothing parameter to 1600 for variables with quarterly frequency, whereas it is set to 600 for those with an annual frequency.

remains with the same level of employment in the future. In the second case, the future marginal value of current employment is equal to the expected future marginal cost of hiring new workers, i.e. the lower cost of posting vacancies due to the current level of employment. Both outcomes depend on future employment choices and on the idiosyncratic shocks that the firm will face.

C Household's optimization problem

In this section, we derive the FOCs of the household's problem. There is one representative household, characterized by a measure $I = L + U$ of workers, either employed (L) or unemployed (U). The household supplies inelastically workers to the labor market as in Christiano et al. (2016). Each worker is risk-averse and receives the same amount of consumption by the household through perfect insurance. Lifetime utility is maximized with respect to consumption C, state-contingent asset B, and members of the family, $n(Z, z, n_{-1})$, working in a firm with idiosyncratic state denoted by the triplet (Z, z, n_{-1}), and leisure/ non-work activities U. Therefore, the objective function of the representative household is

$$\mathbf{U}_t = E_0 \sum_{t=0}^{\infty} \beta^t u(C_t) \tag{16}$$

Given the following definitions:

- $\tilde{G}^{ex} = G(c^f | F(Z, z, n) \leq c^f)$ and $\tilde{G} = G(c^f | F(Z, z, n) > c^f)$
- $s = s(Z, z, n)$ is the endogenous, firm-specific, separation rate
- the conditional distributions H^f, H^{na} and H^{exp} are characterized by

$$\begin{cases} H^f(z|z_{-1}) = & H\left(z|z_{-1}, z \leq \max\{\mathbf{z}_{Z;n<n_{-1}}\} \right) \\ H^{na}(z|z_{-1}) = & H\left(z|z_{-1}, \max\{\mathbf{z}_{Z;n<n_{-1}}\} < z < \min\{\mathbf{z}_{Z;n>n_{-1}}\} \right) \\ H^{exp}(z|z_{-1}) = & H\left(z|z_{-1}, z \geq \min\{\mathbf{z}_{Z;n>n_{-1}}\} \right) \end{cases}$$

- $v^{exp} N^{exp} = \int \int \int v(Z, z, n) N d\Lambda$ and $\frac{q v^{exp} N^{exp}}{M} = \frac{q \int v(Z,z,n) N d\Lambda}{M}$

- $\frac{qv(Z,z,n)N(Z,z,n)}{M}$ denotes the fraction of total matches M imputed to firms denoted by the triplet (Z,z,n)[20]. If multiplied by ϕU, it represents the mass of new hires in (Z, z, n)-triplet class;

- B is a state-contingent asset exchanged by the members of the household;

- c_e is the entry cost;

- b is unemployment benefit financed through government transfers T;

- πN are dividends from each firm of mass N (that can be either an incumbent or an entrant), i.e. revenues minus labor, vacancies, and fixed costs, gross of the total entry cost $c_e N^e$,

the maximization is subject to the budget constraint:

$$C + B = \int wnN d\Lambda + bU + \int \pi N d\Lambda - c_e N^e + B_{-1}R - T, \tag{17}$$

the aggregate unemployment law of motion

$$U = \int\int\int s n_{-1} N_{-1} d\Lambda_{-1} d\tilde{G} dH^f(z|z_{-1}) + \int\int\int n_{-1} N_{-1} d\Lambda_{-1} d\tilde{G}^{ex} dH(z|z_{-1}) + (1-\phi)U_{-1}, \tag{18}$$

where the second term on the right hand side measures the mass of firms exiting the market (i.e. which value net of fixed costs is negative); the law of motion of workers employed in contracting firms:

$$n^f N^f = \int\int\int (1-s) n_{-1} N_{-1} d\Lambda_{-1} d\tilde{G} dH^f(z|z_{-1}), \tag{19}$$

where the superscript f denotes firms that shed workers; the law of motion of workers employed by firms that do not adjust their labor force:

$$n^{na} N^{na} = \int\int\int n_{-1} N_{-1} d\Lambda_{-1} d\tilde{G} dH^{na}(z|z_{-1}), \tag{20}$$

[20]In fact $q_t v_{jt} = m_{jt}$ corresponds to the number of firm-specific matches.

where the superscript na indicates firms that do not adjust their labor force; the employment law of motion for workers employed in expanding firms[21]:

$$n^{exp}N^{exp} = \int\int\int n_{-1}N_{-1}d\Lambda_{-1}d\tilde{G}dH^{exp}(z|z_{-1}) + \frac{qv^{exp}N^{exp}}{M}\phi U_{-1} \tag{21}$$

and finally to the aggregate labor supply constraint:

$$\int nNd\lambda = L \tag{22}$$

The first-order condition (FOC) of consumption is

$$\lambda = u(C) \tag{23}$$

where λ is the shadow value of consumption.

The FOC of the state-contingent asset B is

$$\frac{1}{R} = \beta\frac{\lambda'}{\lambda} \tag{24}$$

providing the usual Euler equation for consumption.

Given the previous set of equations, the household chooses the optimal amount of labor supply - i.e. number of workers - to each firm by maximizing (16) with respect to n. In the following, for ease of notation, we suppress the dependency on the triplet (Z, z, n), and we use $H^{(i)'} = H^{(i)}(z'|z)$. The corresponding FOC is

$$\begin{aligned} W^{(i)} = \lambda w^{(i)} + \beta\Bigg\{\int\Bigg[\int(1-s')W^{(f)'}dH^{f'} + \int W^{(na)'}dH^{(na)'}(z'|z)+ \\ + \int W^{(exp)'}dH^{(exp)'} + \Gamma'\int s'dH^{(f)'}\Bigg]d\tilde{G}' + \Gamma'\int\int dHd\tilde{G}^{(ex)'}\Bigg\} \end{aligned} \tag{25}$$

Firm-level index $(i) = \{f, na, exp\}$ denotes the current employment adjustment policy at the individual firm (either firing, non-adjustment, or expanding) depending on the state of the firm. Γ is the shadow value of non-work activities, whereas $\{W^{(f)}, W^{(n)a}, W^{(exp)}\}$ are the shadow values of workers employed in either firing, non-adjusting or expanding firms. All of these values are firm-specific, and the wage w is dependent on each firm's idiosyncratic state

[21]Notice that effective entrants always fall in this category.

(Z, z, n_{-1}).

In equation 25 each worker is confronted with three distinct values based on the current state and the anticipated wage $w^{(i)}$ in the future:

- $W^{(f)}$ - the value of employment when the firm finds it optimal to downsize, but the given worker is not dismissed;
- $W^{(na)}$ - the value of employment when the firm maintains the current number of workers;
- $W^{(exp)}$ - the value of employment when the firm hires new workers.

Also, the household chooses the allocation of its members to non-work activities denoted by U. The corresponding FOC is

$$\Gamma = b\lambda + \beta\left[(1-\phi')\Gamma' + \int\int\int \frac{q'v'N'}{M'}\phi' W^{(exp)\prime} d\Lambda' d\tilde{G}' dH'\right] \tag{26}$$

Equation 26 represents the value of unemployment, incorporating both the expected value of being hired by any firm and the expected value of remaining unemployed, which are taken into account by each unemployed worker in their decision-making process.

The household's marginal surplus from a match is equal to the difference between the shadow value of a worker employed at each firm ($W^{(i)}$) and the shadow value of unemployment (Γ), namely

$$H = W^{(i)} - \Gamma. \tag{27}$$

D Wage Bargaining

The optimal wage schedule is determined through Nash bargaining between firms and workers[22]. Each firm and its workers maximize the joint surplus with respect to the wage w

$$\max_{w} J^{1-\eta}\left(\frac{H}{\lambda}\right)^{\eta} \tag{28}$$

where the household's marginal value from a match with firm j is expressed in utils.

[22]This Appendix follows the approach in Elsby and Michaels (2013)

The first-order condition reads as

$$\eta J = (1-\eta)\frac{H}{\lambda} \tag{29}$$

Substituting 27 into 29 yields

$$W^{(i)} - \Gamma = \frac{\eta}{(1-\eta)} J\lambda$$

Taking the expectations of the previous equation, notice that, if the firm is hiring, then from the JCC

$$W^{(exp)'} - \Gamma' = \frac{\eta}{(1-\eta)}\frac{\kappa}{q'}\lambda' \tag{30}$$

whereas if it is separating from some of its workers

$$W^{(f)'} - \Gamma' = 0 \tag{31}$$

and finally in case of non-adjustments

$$W^{(na)'} - \Gamma' = \frac{\eta}{1-\eta} J'\lambda' \tag{32}$$

Let us consider the equation for Γ (26) separately. By substituting (30) into (26), the value of unemployment in (26) becomes

$$\Gamma = b\lambda + \beta\left[(1-\phi')\Gamma' + \int\int\int \frac{q'v'N'}{M'}\phi'\left(\Gamma' + \frac{\eta}{1-\eta}\frac{\kappa}{q'}\right) d\Lambda d\tilde{G}' dH'\right]$$

which, by noting that $\int qvN d\Lambda = M$, can be expressed as follows

$$\Gamma = \lambda b + \beta\Gamma' + \beta\frac{\eta}{1-\eta}\phi'\lambda'\frac{\kappa}{q'} \tag{33}$$

Therefore, to define the household's marginal surplus from a match $H = W^{(i)} - \Gamma$, let subtract (33) from (25). The result is

$$H = \lambda(w^{(i)} - b) + \beta \Bigg\{ \int \Bigg[\int (1-s')W^{(f)'} dH^{(f)'} + \int W^{(na)'} dH^{(na)'} + \\ + \int W^{(exp)'} dH^{(exp)'} + \Gamma' \int s' dH^{(f)'} \Bigg] d\tilde{G}' + \Gamma' \int \int dH d\tilde{G}^{(ex)'} + \\ - \Gamma' - \frac{\eta}{1-\eta} \lambda' \phi' \frac{\kappa}{q'} \Bigg\} \tag{34}$$

Notice that

- $\int dH^{(f)} + \int dH^{(na)} + \int dH^{(exp)} = \int dH = 1;$
- $\int d\tilde{G} + \int d\tilde{G}^{(ex)} = 1;$
- $W^{(f)} = \Gamma$ from (31).

Therefore, by substituting 30, 31 32, and 33 into 34, H can be re-written as

$$H = \lambda(w^{(i)} - b) + \beta \Bigg\{ \int \Bigg[\int W^{(f)'} dH^{(f)'} + \int W^{(na)'} dH^{(na)'} + \\ + \int W^{(exp)'} dH^{(exp)'} - \int s'(W^{(f)'} - \Gamma') dH^{(f)'} \Bigg] d\tilde{G}' + \\ \Gamma' \int \int dH' d\tilde{G}^{(ex)'} + \\ - \Gamma' \Bigg(\int \int dH' d\tilde{G}^{(ex)'} + \int \int dH' d\tilde{G}' \Bigg) + \\ - \frac{\eta}{1-\eta} \phi' \lambda' \frac{\kappa}{q'} \Bigg\}$$

$$H = \lambda(w^{(i)} - b) + \beta \Bigg\{ \\ \int \Bigg[\int W^{(f)'} dH^{(f)'} + \int W^{(na)'} dH^{(na)'} + \int W^{(exp)'} dH^{(exp)'} \Bigg] d\tilde{G}' + \\ - \Gamma' \int \Bigg[\int dH^{(f)'} + \int dH^{(na)'} + \int dH^{(exp)'} \Bigg] d\tilde{G}' + \\ - \frac{\eta}{1-\eta} \phi' \lambda' \frac{\kappa}{q'} \Bigg\}$$

$$
\begin{aligned}
H =&\lambda(w^{(i)} - b) + \beta\Bigg\{ \\
&\int \Bigg[\int (W^{(f)'} dH^{(f)'} - \Gamma') + \int (W^{(na)'} - \Gamma') dH^{(na)'} + \int (W^{(exp)')} - \Gamma') dH^{(exp)'} \Bigg] d\tilde{G}' + \\
&- \frac{\eta}{1-\eta} \phi' \lambda' \frac{\kappa}{q'} \Bigg\}
\end{aligned}
$$

$$
\begin{aligned}
H =&\lambda(w^{(i)} - b) + \beta\lambda' \Bigg\{ \\
&\frac{\eta}{1-\eta} \int \Bigg[\int J' dH^{(na)'} + \int \frac{\kappa}{q'} dH^{(exp)'} \Bigg] d\tilde{G}' + \\
&- \frac{\eta}{1-\eta} \phi' \frac{\kappa}{q'} \Bigg\}
\end{aligned}
$$

Hence, $\frac{H}{\lambda}$ - i.e. the household's marginal surplus from a match expressed in utils - can be expressed as

$$
H = w^{(i)} - b + \beta \Bigg\{ \frac{\eta}{1-\eta} \int \Bigg[\int J' dH^{(na)'} + \int \frac{\kappa}{q'} dH^{(exp)'} \Bigg] d\tilde{G}' - \frac{\eta}{1-\eta} \phi' \frac{\kappa}{q'} \Bigg\}
$$

where we substitute $\beta = \frac{u'(C')}{u'(C)} = \frac{\lambda'}{\lambda}$, i.e. the firms' stochastic discount factor.

By combining the JCC given by

$$
J = \alpha Z z n^{\alpha - 1} - \frac{\partial w^{(i)}}{\partial n} n - w^{(i)} + \beta \int \Bigg[\int J' dH^{(na)'} + \int \frac{\kappa}{q'} dH^{(exp)'} \Bigg] d\tilde{G}'
$$

with equation (D) in the first-order condition from wage bargaining $\frac{\eta}{(1-\eta)} J = \frac{H}{\lambda}$, we obtain

$$
\begin{aligned}
&\frac{\eta}{1-\eta} \Bigg[\alpha Z z n^{\alpha - 1} - \frac{\partial w^{(i)}}{\partial n} n - w^{(i)} + \beta \int \Bigg(\int J' dH^{(na)'} + \int \frac{\kappa}{q'} dH^{(exp)'} \Bigg) d\tilde{G}' \Bigg] = \\
&w^{(i)} - b + \beta \Bigg[\frac{\eta}{1-\eta} \int \Bigg(\frac{\kappa}{q'} \int dH^{(exp)'} + \int J' dH^{(na)'} \Bigg) d\tilde{G}' - \phi' \frac{\kappa}{q'} \Bigg]
\end{aligned}
$$

$$\frac{\eta}{1-\eta}\left[\alpha Zzn^{\alpha-1}-\frac{\partial w^{(i)}}{\partial n}n-w^{(i)}+\right]=w^{(i)}-b-\beta\phi'\frac{\kappa}{q'}$$

Notice that we can suppress $(i) = \{f, na, exp\}$, since the wage depends on the firm-level employment level but not on the current employment adjustment policy at the firm - i.e. either firing, freezing, or hiring more workers.

This provides the differential equation:

$$w=\eta\left[\alpha Zzn^{\alpha-1}-\frac{\partial w}{\partial n}n+\beta\kappa\beta\theta'\right]+(1-\eta)b$$

that can be solved to obtain the wage equation in the text, that is

$$w=\eta\left[\frac{\alpha Zzn^{\alpha-1}}{1-\eta(1-\alpha)}+\beta\kappa\beta\theta'\right]+(1-\eta)b. \tag{35}$$

E Numerical solution

The steady-state is solved numerically by local approximation of the value function F_{jt}. The algorithm proceeds as follows:

]the idiosyncratic state $\{Z_j, z_{jt}, n_{jt-1}\}$ is discretized on a 3-dimensional grid. Specifically, we set 4 nodes for Z_j, 19 for z_{jt}[23] and 80 for n_{jt-1}; then, we find a first solution of the problem by iterating on the Bellman equation; if the solution does not hit the boundaries of the employment grid, continue; otherwise, enlarge the grid and come back to the previous point; for each idiosyncratic productivity's value, locally regress the objective function of the problem only on the employment grid nodes immediately before and after the solution found in the previous step; the regressors are employment, employment squared, and a constant. Specifically

- – given the objective function $g_z(n)$, consider $[g_z(n_{k-1}),\ g_z(n_k),\ g_z(n_{k+1})]$ such that $n_{k-1} \leq n_k \leq n_{k+1}$ and n_k is the discrete maximizer of g_z on the grid $[n_{k-1},\ n_k,\ n_{k+1}]$;

[23]We use the Rouwenhorst's method to discretize AR(1) process.

– compute the OLS coefficients of

$$g_z(n) = \beta_0 + \beta_1 n + \beta_2 n^2$$

by using the three nodes n_{k-1},n_k and n_{k+1} from the previous point;

– take the first derivative of the interpolated g_z with respect to n and find the value of n that maximizes g_z by solving the first-order condition

$$\tilde{n} = -\frac{\beta_1}{2\beta_2}$$

– calculate the objective function implied by $\tilde{n}$:

$$\tilde{g_z} = \beta_0 + \beta_1 \tilde{n} + \beta_2 \tilde{n}^2$$

- approximate F_j with $\tilde{g_z}$ computed for the firm with initial size equal to n_j;
- iterate until convergence of the value function.

As for solving the dynamic stochastic equilibrium, we follow the method of Reiter (2009)[24]: stochastic aggregate dynamics are computed by linearization for each grid point around the steady state. In this way the Bellman equation is treated not as a function but as a system of difference equations.

The model is represented by a system of non-linear equations:

$$E_t \mathbf{F}_t \left(\mathbf{X}_t, \mathbf{X}_{t+1}, \log A_t, \log A_{t+1} \right) = 0 \tag{36}$$

where $\mathbf{X}_t$ comprises all model endogeneous variables, both firm-level and aggregate, and A_t represents an aggregate shock. In steady state equation 36 reads. At the steady state, equation 36 reads

$$E_t \mathbf{F} \left(\mathbf{X}, \mathbf{X}, 0, 0 \right) = 0 \tag{37}$$

By computing the Jacobian of 36 evaluated at the steady state equilibrium, for sufficiently

[24]We use the MATLAB code developed by Costain and Nakov (2011).

small shocks the model can be approximated linearly as

$$E_t \mathcal{A}\big(\mathbf{X}_{t+1} - \mathbf{X}\big) + \mathcal{B}\big(\mathbf{X}_t - \mathbf{X}\big) + \mathcal{C} \log A_{t+1} + \mathcal{D} \log A_t \tag{38}$$

where

- $\mathcal{A} = \frac{\partial \mathbf{F}_t}{\partial \mathbf{X}_{t+1}}$
- $\mathcal{B} = \frac{\partial \mathbf{F}_t}{\partial \mathbf{X}_t}$
- $\mathcal{C} = \frac{\partial \mathbf{F}_t}{\partial \log A_{t+1}}$
- $\mathcal{D} = \frac{\partial \mathbf{F}_t}{\partial \log A_t}$

This form allows the model to be solved through the QZ decomposition method outlined by Klein (2000). In this way, we avoid any bounded rationality assumption as in Krusell and Smith (1998)'s method.

F Consistency between the empirical strategy and model outcomes

In this section we use our model economy to simulate the effects of exogenous shocks that are typically considered in the literature. The aim is to show that, among the shocks we consider, just the entry cost shock leads to a negative correlation between the rate of entry of new firms and stock market values. In other words, just an entry cost shock breaks the link between the entry rate and the discounted value of future profits. We assume that the size of shocks is 1 per cent of the steady state value of the variable/parameter subject to the shock. The persistence of all shocks equals that of the entry cost shock.

Figure 10 displays IRFs to a shock to fixed costs of production. To be specific we consider an unexpected increase in the mean of the distribution from which fixed costs are drawn. The entry rate and the stock market value move together, while unemployment increases persistently.

Figure 11 displays IRFs to a shock to the cost of creating vacancies, κ. As in the previous case, the shock entails positive comuvement between the entry rate and the stock market index, together with an immediate surge in unemployment.

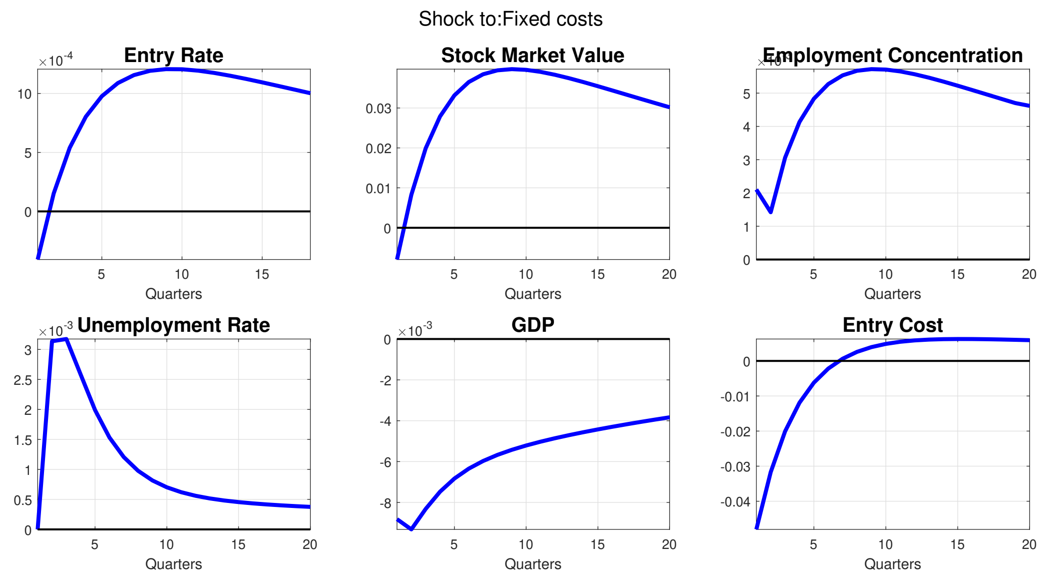

Figure 10: DSGE response to fixed costs' shock.

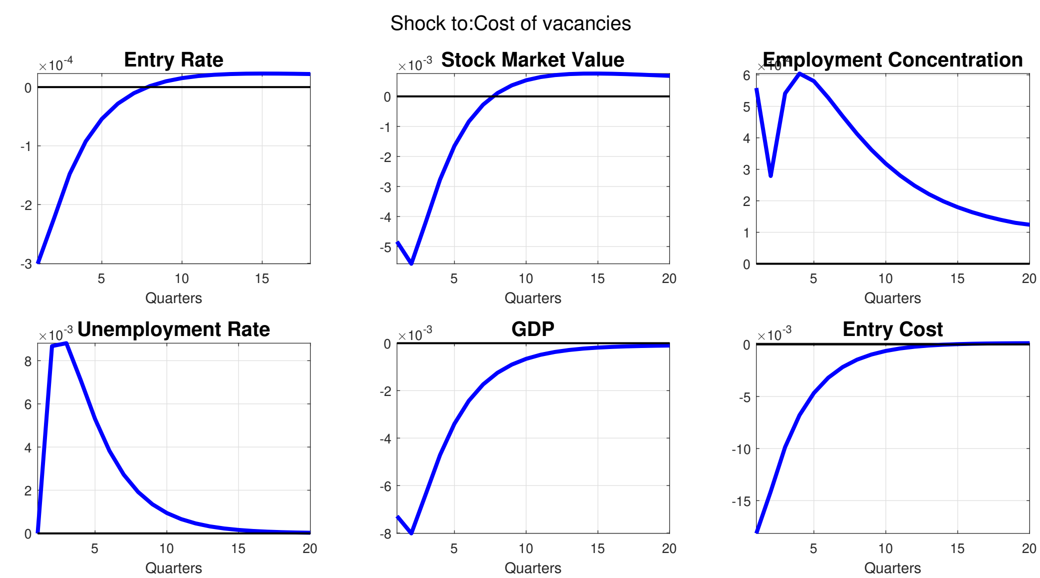

Figure 11: DSGE response to a vacancy cost's shock.

Finally, we perturbed the model with two technology shocks: one exclusively on the technology of incumbents (figure 12), the other on aggregate productivity (13). In both cases the IRFs of the entry rate and the stock market index display a positive correlation. The increase in the entry rate in response to technology shocks is in line with both the evidence we propose below and with the existing literature.

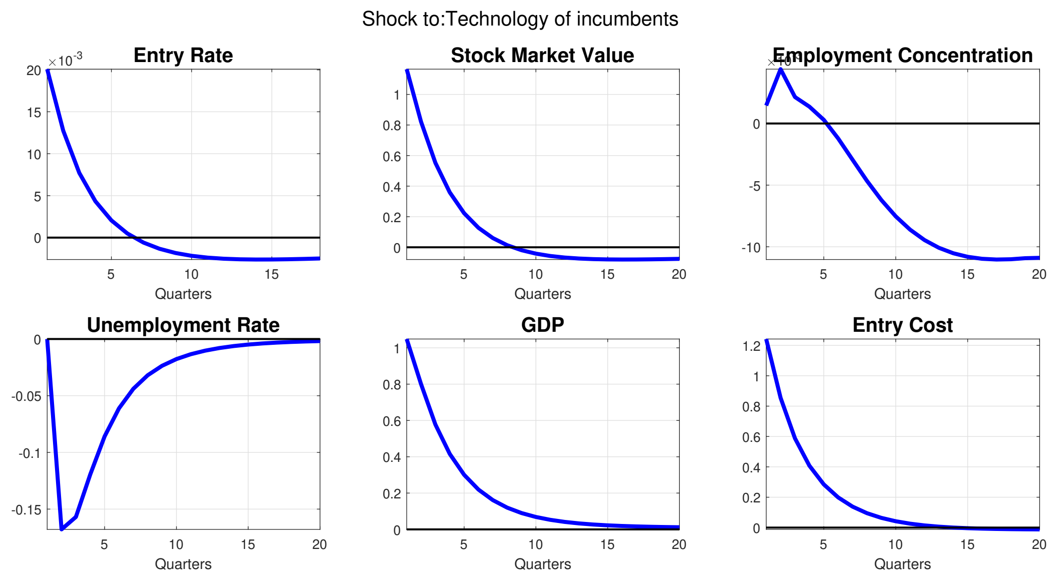

Figure 12: DSGE response to technology of incumbents' shock.

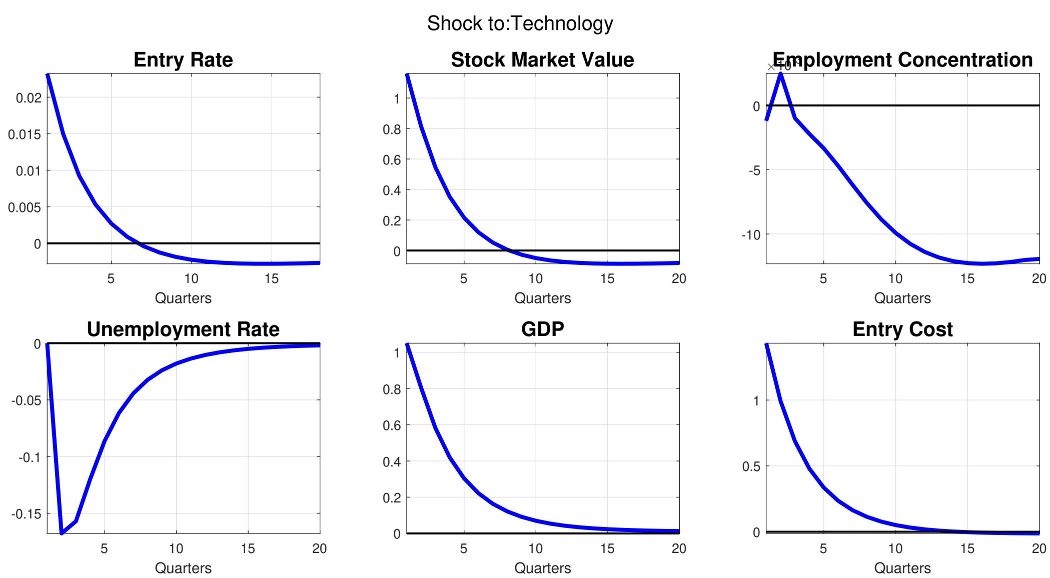

Figure 13: DSGE response to a technology shock.

G The role of wage stickiness

In this section we show that the degree of wage stickiness is crucial to replicate the estimated response of unemployment of a TBE shock. Figure **??** displays IRFs of the main aggregates to a TBE shock under flexible wages and compares them to those obtained under th baseline calibration. When wages are flexible, the unemployment rate remains persistently below its pre-shock level in response to the shock. This is not consistent with the empirical analysis, which suggests that the unemployment rate overshoots its pre-shock level before reverting to equilibrium.

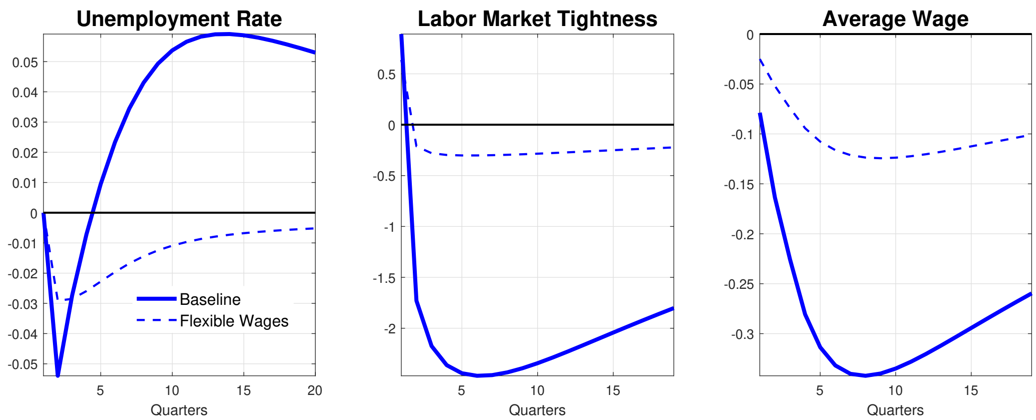

Figure 14: Comparison between flexible and sticky wages.

Figure 15 shows that a degree of wage stickiness larger than that selected in the baseline calibration, 0.9 in this example, counterfactually leads to a surge in unemployment in response to the shock.

Figure 15: DSGE response with higher degree of stickiness ($\lambda_w = 0.9$).

H BVAR: technology shock

In this subsection we assess the impact of a positive technology shock on the entry rate. The shock is identified through a set of sign restrictions - as shown in table 4 - to maintain comparability with the narrative of increasing entry barriers' identification.

Variable	Sign	Quarters
Labor Productivity	+	1-4
GDP	+	1-8

Table 4: Sign restrictions to identify a positive technology shock.

Results are in figure 16. An increase in technology rises the productivity of labor, as well as aggregate output and the average profitability of firms (i.e. the stock market index). Contrary to a positive shock to entry barriers, the number of new firms relative to incumbents increases due to the rise in average profitability. As a consequence, the entry rate increases. New jobs are created, reducing the unemployment rate, whereas there is no appreciable effect on employment concentration at large firms.

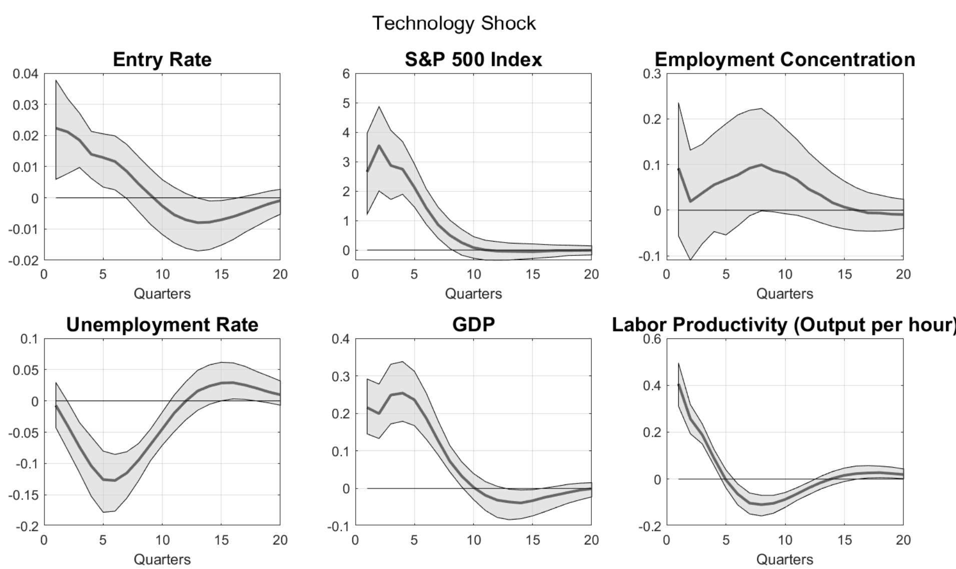

Figure 16: IRFs to a positive technology shock (68% credible band in shaded area).

References

Al-Ubaydli, O. and McLaughlin, P.: 2014, A new way to measure industry-level regulation.

Barattieri, A., Cacciatore, M. and Ghironi, F.: 2021, Protectionism and the business cycle, *Journal of International Economics* **129**, 103417.

Bartelsman, E., Scarpetta, S. and Schivardi, F.: 2005, Comparative analysis of firm demographics and survival: evidence from micro-level sources in oecd countries, *Industrial and corporate change* **14**(3), 365–391.

Bessen, J. E.: 2016, Accounting for rising corporate profits: Intangibles or regulatory rents?, *Boston Univ. School of Law, Law and Economics Research Paper* (16-18).

Bilal, A., Engbom, N., Mongey, S. and Violante, G. L.: 2022, Firm and worker dynamics in a frictional labor market, *Econometrica* **90**(4), 1425–1462.

Bilbiie, F. O., Ghironi, F. and Melitz, M. J.: 2012a, Endogenous Entry, Product Variety, and Business Cycles, *Journal of Political Economy* **120**(2), 304–345.
URL: *https://ideas.repec.org/a/ucp/jpolec/doi10.1086-665825.html*

Bilbiie, F. O., Ghironi, F. and Melitz, M. J.: 2012b, Endogenous entry, product variety, and business cycles, *Journal of Political Economy* **120**(2), 304–345.

Blanchard, O. and Galí, J.: 2010, Labor markets and monetary policy: A new keynesian model with unemployment, *American economic journal: macroeconomics* **2**(2), 1–30.

Cacciatore, M. and Fiori, G.: 2016, The macroeconomic effects of goods and labor markets deregulation, *Review of Economic Dynamics* **20**, 1–24.

Ciccone, A. and Papaioannou, E.: 2007, Red tape and delayed entry, *Journal of the European Economic Association* **5**(2-3), 444–458.

Clementi, G. L. and Palazzo, B.: 2016, Entry, exit, firm dynamics, and aggregate fluctuations, *American Economic Journal: Macroeconomics* **8**(3), 1–41.

Colciago, A. and Silvestrini, R.: 2022, Monetary policy, productivity, and market concentration, *European Economic Review* **142**, 103999.

Coles, M. G. and Mortensen, D. T.: 2016, Equilibrium labor turnover, firm growth, and unemployment, *Econometrica* **84**(1), 347–363.

Covarrubias, M., Gutiérrez, G. and Philippon, T.: 2020, From good to bad concentration? us industries over the past 30 years, *NBER Macroeconomics Annual* **34**(1), 1–46.

Crouzet, N. and Eberly, J.: 2021, Intangibles, markups, and the measurement of productivity growth, *Journal of Monetary Economics* **124**, S92–S109.

Davis, S. J.: 2017, Regulatory complexity and policy uncertainty: headwinds of our own making, *Becker Friedman Institute for Research in economics working paper* (2723980).

Den Haan, W. J., Freund, L. B. and Rendahl, P.: 2021, Volatile hiring: uncertainty in search and matching models, *Journal of Monetary Economics* **123**, 1–18.

Elsby, M. W. and Gottfries, A.: 2022, Firm dynamics, on-the-job search, and labor market fluctuations, *The Review of Economic Studies* **89**(3), 1370–1419.

Elsby, M. W. L. and Michaels, R.: 2013, Marginal jobs, heterogeneous firms, and unemployment flows, *American Economic Journal: Macroeconomics* **5**(1), 1–48.

Etro, F. and Colciago, A.: 2010, Endogenous market structures and the business cycle, *The Economic Journal* **120**, 1201–1233.

Fattal-Jaef, R. N.: 2022, Entry barriers, idiosyncratic distortions, and the firm size distribution, *American Economic Journal: Macroeconomics* **14**(2), 416–468.

Goldschlag, N. and Tabarrok, A.: 2018, Is regulation to blame for the decline in american entrepreneurship?, *Economic Policy* **33**(93), 5–44.

Gourio, F., Messer, T. and Siemer, M.: 2016, Firm entry and macroeconomic dynamics: a state-level analysis, *American Economic Review* **106**(5), 214–218.

Grullon, G., Larkin, Y. and Michaely, R.: 2019, Are US industries becoming more concentrated?, *Review of Finance* **23**, 697–743.

Gutiérrez, G., Jones, C. and Philippon, T.: 2021, Entry costs and aggregate dynamics, *Journal of Monetary Economics* **124**, S77–S91.

Gutierrez Gallardo, G., Jones, C. and Philippon, T.: 2019, Entry costs and the macroeconomy, *NBER Working Paper* (w25609).

Hall, R. E.: 2005, Employment fluctuations with equilibrium wage stickiness, *American economic review* **95**(1), 50–65.

Haltiwanger, J., Jarmin, R. S. and Miranda, J.: 2013, Who creates jobs? small versus large versus young, *Review of Economics and Statistics* **95**(2), 347–361.

Hamano, M. and Zanetti, F.: 2017, Endogenous product turnover and macroeconomic dynamics, *Review of Economic Dynamics* **26**, 263–279.

Hawkins, W. B.: 2011, Do large-firm bargaining models amplify and propagate aggregate productivity shocks?, *Unpublished paper.[586, 614, 617]* .

Hopenhayn, H. A.: 1992, Entry, Exit, and Firm Dynamics in Long Run Equilibrium, *Econometrica* **60**(5), 1127–1150.
URL: *https://ideas.repec.org/a/ecm/emetrp/v60y1992i5p1127-50.html*

Jaimovich, N. and Floetotto, M.: 2008, Firm dynamics, markup variations, and the business cycle, *Journal of Monetary Economics* **55**, 1238–1252.

Kaas, L. and Kircher, P.: 2015, Efficient firm dynamics in a frictional labor market, *American Economic Review* **105**(10), 3030–3060.

Karahan, F., Pugsley, B. and Şahin, A.: 2019, Demographic origins of the startup deficit. Unpublished Manuscript.

Klapper, L., Laeven, L. and Rajan, R.: 2006, Entry regulation as a barrier to entrepreneurship, *Journal of financial economics* **82**(3), 591–629.

Leduc, S. and Liu, Z.: 2016, Uncertainty shocks are aggregate demand shocks, *Journal of Monetary Economics* **82**, 20–35.

Lewis, V.: 2009, Business cycle evidence on firm entry, *Macroeconomic Dynamics* **13**(5), 605–624.

Mortensen, D. T. and Pissarides, C. A.: 1994, Job creation and job destruction in the theory of unemployment, *The Review of Economic Studies* **61**(3), 397–415.
URL: *http://dx.doi.org/10.2307/2297896*

Moscarini, G. and Postel-Vinay, F.: 2013, Stochastic search equilibrium, *Review of Economic Studies* **80**(4), 1545–1581.

Rossi, L.: 2019, The overshooting of firms' destruction, banks and productivity shocks, *European Economic Review* **113**, 136–155.

Schaal, E.: 2017, Uncertainty and unemployment, *Econometrica* **85**(6), 1675–1721.

Sedláček, P.: 2020, Lost generations of firms and aggregate labor market dynamics, *Journal of Monetary Economics* **111**, 16–31.

Shimer, R.: 2005, The cyclical behavior of equilibrium unemployment and vacancies, *American Economic Review* **95**, 25–49.

Siemer, M.: 2014, Firm entry and employment dynamics in the great recession.

Sterk, V., Sedláček, P. and Pugsley, B.: 2021, The nature of firm growth, *American Economic Review* **111**(2), 547–79.

Stole, L. A. and Zwiebel, J.: 1996, Intra-firm bargaining under non-binding contracts, *The Review of Economic Studies* **63**(3), 375–410.

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