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Sharon Belenzon
Victor Manuel Bennett
Andrea Patacconi

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ABSTRACT

Academics, the media, and policymakers have all raised concerns about the implications of human workers being replaced by machines or software. Few have discussed the implications of the reverse: firms' ability to replace capital with workers. We show that this flexibility can help new firms overcome uncertainty and increase entrepreneurial entry. We develop a simple real options model where permissive labor regulations allow firms to take advantage of capital-labor substitutability by replacing 'rigid' capital with 'flexible' labor. The model highlights institutional, technological, and organizational preconditions to using this flexibility. Using a large and comprehensive dataset on entry by standalone firms and group affiliates, we provide evidence in support of the model.

Sharon Belenzon
Fuqua School of Business
Duke University
100 Fuqua Drive
Durham, NC 27708
and NBER
sharon.belenzon@duke.edu

Victor Manuel Bennett
Duke University
Fuqua School of Business
vmb10@duke.edu

Andrea Patacconi
Norwich Business School
University of East Anglia
Norwich, NR4 7TJ
United Kingdom
A.Patacconi@uea.ac.uk

1 Introduction

The possibility of firms replacing workers with technology has recently received a lot of attention from academics, the media, and policymakers. The bulk of this conversation has been about the potential impact on jobs and employees' wages (e.g. Autor et al., 2003; Graetz & Michaels, 2018; Acemoglu & Restrepo, 2018; Felten et al., 2019) or the possibility that increased returns to scale will lead to fewer, bigger, and more powerful firms (e.g. Autor et al., 2017).

To date, little attention has been paid to the reverse possibility: that workers can replace capital. We suggest that this possibility actually has important strategic implications. Specifically, we suggest that this substitutability can increase entry by new firms by helping them cope with uncertainty.

Potential entrepreneurs may be dissuaded from entering an uncertain market if they have to make major sunk investments (Myers, 1977; Dixit, 1989, 1992; Dixit & Pindyck, 1994; Kogut, 1991; Miller & Folta, 2002; Bloom, 2009; Trigeorgis & Reuer, 2017). Scholars describe this as the threshold return or "hurdle" rate justifying investment being higher if the investment cannot be recovered or are costly to terminate.

However, entrepreneurs may tolerate uncertainty if they can easily scale operations up or down. A flexible labor market that allows "labor on demand", for example, can reduce the downside risk of entry. Rigid inputs like a factory built to specifications, on the other hand, exacerbate the cost of uncertainty.

We suggest that the ability to substitute labor and capital allows firms to take advantage of whichever input is more flexible.[1]

Not all firms are equally able to take advantage of capital-labor substitutability, though. Access to at least one flexible input is necessary to benefit. We show that firms in countries with permissive labor laws are more responsive to capital-labor substitutability. This effect is driven by standalone firms. Multi-unit organizations instead can use their internal markets to redeploy underused inputs, which gives them an alternative way to cope with input rigidity and uncertainty.

Specifically, we show evidence consistent with standalone entrants using exploratory labor-intensive strategies taking advantage of labor flexibility to cheaply test the market before committing to large capital expenditures. Because capital investment is often highly specific and irreversible, at least in the early stages of production, firms may substitute "rigid" but potentially more efficient capital with more "flexible" labor. The relationship between uncertainty and factor flexibility was first studied by Rothschild & Stiglitz (1971)[2] and there are a number of well-known examples of experimental entry with labor-intensive production actually occurring, with a plan to later convert to more efficient capital-intensive production. For example, Chinese manufacturer BYD was able to enter the capital-intensive battery industry with a relatively labor-intensive production process. Once the firm understood demand, it began investing in physical capital to get more efficient (Huckman & MacCormack, 2006). Online

[1]For example, the Financial Times suggested that "The jobs-rich, investment-lite nature of the UK economy reflects a shift in behaviour by companies. Some are concluding that it is easier to add jobs that can be cut rather than make irreversible investments in capital equipment."(Financial Times, 2019).

[2]Rothschild & Stiglitz (1971) examine, among other things, how demand uncertainty affects input choices (in particular, capital-labor ratios) when capital cannot be varied in the short run but labor can.

question-answering service Aardvark famously began testing demand for its product by having people manually answer questions with the intent to develop machine-learning algorithms to scale the process and automatically answer questions if—and only if—demand was proven (Eisenmann et al., 2011).

An alternative strategy to cope with uncertainty is to rely on internal market flexibility. Internal market flexibility refers to the ability of multi-unit organizations such as conglomerates and corporate groups to redeploy production inputs from units where they are no longer needed to units where they are needed. For instance, as a response to declining demand and increasing competitive pressure in the early 1990s, Volkswagen relocated employees across plants and geographical locations to avoid dismissals (Kothen et al., 1999). Internal market flexibility may thus be a source of competitive advantage for multi-unit organizations, particularly when markets are rigid and uncertainty pervasive (Foote & Folta, 2003; Belenzon & Tsolmon, 2016; Cestone et al., 2016; Kim & Kung, 2016; Sakhartov & Folta, 2014; Lieberman et al., 2017).

To fix ideas, we build a simple model of investment under uncertainty where both these strategies—exploratory and internal market flexibility—play an important role. The model makes predictions concerning both the rate and mode of entry, and relates these predictions to institutional, technological, and organizational factors. In particular, we show that the exploratory strategy of entering with inefficiently high levels of labor and low levels of capital is valuable especially to standalone (single-unit) firms, and when substituting capital with labor is relatively easy, from a technological standpoint. If demand is proven, standalones begin to invest more in capital and gradually become more capital-intensive. By contrast, multi-unit organizations cope with rigidities and uncertainty by relying on internal market flexibility. They make little use of the exploratory, labor-intensive strategy. They start relatively capital-intensive, and hence their capital-labor ratios change little over their lifecycle.

The main contribution of this paper is to bring these predictions to the data. We operationalize the flexibility of labor with OECD measures of employment protection law rigidity (EPL) and the substitutability of labor and capital with estimates from Chirinko & Mallick (2017). Consistent with the predictions of the model, we find that (i) firm entry is highest when labor is flexible and (ii) that effect is moderated by the substitutability of labor for capital. Moreover, (iii) when factors are substitutable and labor is flexible, firms enter with lower capital-labor ratios and then substitute labor for capital as they age and uncertainty is resolved, indicative of an exploratory strategy. Also consistent with the predictions of the model, (iv) entry by group affiliates, which can redeploy inputs internally, is less affected by labor rigidity, factor substitutability, and uncertainty, (v) group affiliates are on average more capital-intensive than standalone firms, and (vi) their capital-labor ratios change less over their lifecycle.

The paper makes several empirical contributions to real options theory and the strategy literature. Much of the literature on entry in strategy and economics models the choice of a potential market entrant as a comparison of the expected benefits of entry with the expected costs of entry. A growing literature, however, suggests that knowing precisely one's own potential profitability is impossible because of the complexity of what determines profitability (e.g., Kerr et al., 2014) and having to learn about one's own fit with the market (Jovanovic, 1982). If that is the case, rather than generating a full plan for market entry to maximize expected profit, firms may enter as part of an "experiment". As conceptualized in the search literature (e.g., Levinthal & March, 1993), entrants try out strategies, learn from them, and adjust. This idea is captured in the popular press through suggestions that entrants begin "lean" (Ries, 2011), entering with a "minimum viable product" and adapting to new information as it arises.

A well-known problem is that, when the choice of inputs is at least partly irreversible, the cost of terminating an "experiment" is higher, and this can hinder investment and entry. Our specific theoretical contribution is to highlight technological and organizational factors that moderate the relationship between uncertainty, irreversibility, and investment/entry. In particular, we provide initial empirical demonstration of the importance of factor substitutability and internal markets in allowing organizations to undertake "cheap experiments". The real options literature also largely focuses on explaining *rates* of investment and entry in an industry. The present paper provides a more comprehensive view, for we also analyze modes of entry (labor- vs. capital-intensive production strategies) and the comparative advantage of different organizational forms (standalones vs. corporate groups).

Industry life cycle models such the as the Abernathy-Utterback model (Utterback & Abernathy, 1975; Abernathy & Utterback, 1978) and Klepper (1996) focus on patterns of entry, exit, and R&D investment as an industry evolves. These models suggests that firms will become more capital-intensive over time as fears of displacement by new products subside, scale economies become more important, and attention shifts to production process efficiency. Our model differs from industry life cycle models because our focus is on technology choices over a *firm's* life cycle. In particular, our model predicts differential adjustment by new firms relative to incumbents at any given stage of the industry life cycle.

Bloom et al. (2007) and Stein & Stone (2013) are recent empirical studies that demonstrate the adverse effects of uncertainty on a number of firm policies including spending on physical assets, R&D, hiring, and advertising campaigns. Bornhäll et al. (2017) examine the effects of a sudden change in labor regulation in Sweden, and show that employment protection law can act as a growth barrier for small firms.[3] Uncertainty and irreversibility have also been shown to be important determinants of firms' entry and exit decisions (O'Brien et al., 2003; O'Brien & Folta, 2009; Folta & O'Brien, 2004; Ghosal, 1996, 2009). Several papers highlight the importance of manufacturing or operations flexibility (Jain et al., 2013; Kulatilaka, 1988, 1993; Kogut & Kulatilaka, 1994; Goyal & Netessine, 2007). Beyond case studies, however, the evidence on these issues is limited (Fisher & Ittner, 1999; Beach et al., 2000; Gopal et al., 2013). We provide large-scale evidence that the ability to switch to a more flexible, labor-intensive production strategy promotes business creation.

Regarding organizational form, real options theory stresses the benefits of collaborative ventures in providing flexible arrangement for dealing with uncertainty (Kogut, 1991; Chi & Maguire, 1996; Chi, 2000; Kouvelis et al., 2001; Folta & Miller, 2002; Vassolo et al., 2004; Reuer & Tong, 2010). The present paper emphasizes the flexibility of multi-unit organizations originating from their internal markets, rather than the option to expand or acquire embedded in collaborative ventures. In that respect, the present paper shares similarities with work in international business stressing the flexibility of multinational organizations to shift production across plants and countries as economic conditions change (e.g., Kogut

[3]Other papers documenting the effects of labor rigidities on firm entry and size include Davis & Henrekson (1999), Davidsson & Henrekson (2002), and Autor et al. (2007).

& Kulatilaka, 1994; Folta et al., 2016). Our evidence suggests that internal market flexibility matters in explaining differential rates and modes of entry by standalones and group affiliates.

The rest of the paper is organized as follows. Section 2 develops a simple real options model that highlights how the choice among production strategies is affected by institutional, technological, and organizational factors. This section develops the key hypotheses that are tested in the empirical analysis. Section 3 presents the data, while Section 4 presents the results. Section 5 summarizes the key contributions of the paper to strategy research and concludes.

2 Model

In this model we examine how the ability of a prospective firm to flexibly adjust its initial input choices affects its propensity to enter a market and production strategy. The main finding from our analysis is that, when inputs are subject to very different adjustment costs, then a firm can find it optimal to enter with a production strategy that is biased towards the more flexible input, even if this input-biased production strategy involves inefficiencies. Multi-unit organizations, however, may be able to avoid such inefficient technological choices, thanks to their ability to redeploy even rigid inputs within their boundaries comparatively cheaply.

Though the model is more general, in outlining the empirical implications of the model, we assume that capital is always more rigid, while labor may or may not be rigid. Thus, our empirical focus is on the trend toward more flexible labor. Assuming that capital is rigid is probably a fair assumption for now, but may not be so in the future. For example, Bennett & Hall (2019) suggest that softwarization leads to patterns consistent with increasing capital flexibility. Thus, the generality of the theoretical model, where either input can be the more flexible one, may prove valuable for future research as well.

3 Economic environment

We consider a model where demand is initially uncertain and a firm that enters produces for two periods. In the first period, the firm makes an initial choice of inputs, produces, and learns about demand. In the second period, the firm adjusts its choice of inputs and produces again. We are interested in situations where the firm's choice of inputs is partially irreversible or "rigid", meaning that a subsequent decision to reduce the amount of input may be subject to adjustment costs. For instance, in the case of labor inputs, partial irreversibility may originate from severance payments, unemployment benefits or by less tangible costs such as loss of morale for the remaining workers. In the case of capital inputs, transaction costs or investment specificity may constrain a firm's ability to downsize, as the selling price of capital is typically lower than the buying price.

We assume that the firm produces using two inputs, capital K and labor L. To capture partial irreversibility in the choice of inputs, we posit that if labor is reduced by one unit from period 1 to period 2, then the firm incurs an adjustment cost c_L. Similarly, if capital is reduced by one unit from period 1 to period 2, then the firm incurs an adjustment cost c_K. For simplicity, we assume that c_L and c_K can only take two values: 0 or $c > 0$. We say that labor is flexible if $c_L = 0$ and rigid if $c_L = c$. Similarly, we say that capital is flexible if $c_K = 0$ and rigid if $c_K = c$. Thus, we consider four possible scenarios: $(c_K, c_L) = (0, 0)$, $(c_K, c_L) = (c, 0)$, $(c_K, c_L) = (0, c)$ and $(c_K, c_L) = (c, c)$. These scenarios are illustrated in Figure 1.

[Insert Figure 1 here]

Output can be produced using two different technologies. $T_1(k_1, l_1) = \min\{k_1, l_1\}$ is a Leontief or perfect complements technology where capital k_1 and labor l_1 must be used together in fixed proportions (one unit of capital with one unit of labor). $T_2(k_2, l_2) = \frac{\alpha}{2}(k_2 + l_2)$ is a linear or perfect substitutes technology where capital k_2 and labor l_2 can be freely substituted at a constant rate (in our case, one-for-one). The firm can produce some output using one technology, and some output using the other technology. Thus, the firm's production function is:

$$
\begin{aligned}
q\left(k_1, l_1, k_2, l_2\right) &= T_1(k_1, l_1) + T_2(k_2, l_2) \\
&= \min\{k_1, l_1\} + \frac{\alpha}{2}(k_2 + l_2)
\end{aligned}
\tag{1}
$$

where $K = k_1 + k_2$ is the total amount of capital used in production and $L = l_1 + l_2$ is the total amount labor used. The parameter α is a measure of the efficiency of T_2 relative to T_1, and we assume $\alpha \in [0, 1)$.

In choosing whether to produce with T_1 or T_2, the firm faces a trade-off between efficiency and input flexibility. T_2 has an advantage over T_1 in terms of input flexibility because T_2 allows the firm to use different combinations of capital and labor, not just fixed proportions as T_1. Thus, any cost asymmetry or friction that hinders the use of one input relative to the other will tend to favor the use of T_2.

On the other had, technology T_1 can enjoy an efficiency advantage. If the firm employs one unit of capital and one unit of labor, it can produce one unit of output using T_1, but only $\alpha < 1$ units of output using T_2. If α is sufficiently small, only the perfect complements technology T_1 (with elasticity of substitution $\sigma = 0$) will be used in the optimum.

Because high values of α make the perfect substitutes technology T_2 more attractive, and the perfect complements technology T_1 less attractive, we can also associate higher values of α with higher observed levels of the elasticity of substitution between capital and labor. Indeed, plants using the high elasticity of substitution technology T_2 ($\sigma = +\infty$) will be more common when α is large, and plants using the low elasticity of substitution technology T_1 ($\sigma = 0$) will be more common when α is small.

To simplify the analysis, we assume that the rental price of capital r and the wage rate w are equal ($r = w$) and we normalize them to 1. Together, $r = w$ and $\alpha < 1$ imply that technology T_1 with a balanced combination of capital and labor ($k_1 = l_1$) is the least expensive way to produce one unit of output. For this reason, we will often refer to T_1 as the efficient, input-balanced technology.

We write p to denote the price of output and assume $p \geq 2\,(= r + w)$, so that the firm can make a nonnegative profit.

3.1 Timing

The timing of the model is as follows.

At period 0 (the entry phase), the firm chooses whether to enter or not. If it does not enter, it makes zero profits and the game ends. If it enters, it pays a fixed entry cost F and demand Q for the firm is realized. Demand is high, $m + \Delta/2$, with probability $1/2$, and low, $m - \Delta/2$, with probability $1/2$. $\Delta \in [0, 2m]$ is a parameter capturing the magnitude of the uncertainty shock (a mean preserving spread of the product demand distribution). Demand for the firm's output stays the same (high or low) in period 1 and 2.[4]

In period 1 (the learning phase), the firm selects an initial investment plan (k_1, l_1, k_2, l_2) without knowing if demand is high or low. The firm produces using (k_1, l_1, k_2, l_2), demand is observed, and period-1 profits accrue. Quantity sold is the minimum between $q\,(k_1, l_1, k_2, l_2)$ and realized demand. Thus, period-1 profits are $p \min\{q\,(k_1, l_1, k_2, l_2)\,, m + \Delta/2\} - r[k_1 + k_2] - w[l_1 + l_2]$ if demand is high, and $p \min\{q\,(k_1, l_1, k_2, l_2)\,, m - \Delta/2\} - r[k_1 + k_2] - w[l_1 + l_2]$ if demand is low.

In Period 2 (the post-learning phase), the firm can update its initial investment plan depending on observed demand. Let $\left(k_1'^H, l_1'^H, k_2'^H, l_2'^H\right)$ be the updated investment plan when demand is high, and $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right)$ the updated investment plan when demand is low.[5] Capital adjustment costs are $c_K \max\{k_1'^H + k_2'^H - k_1 - k_2, 0\}$ if demand is high, and $c_K \max\{k_1'^L + k_2'^L - k_1 - k_2, 0\}$ if demand is low. Labor adjustment costs are similarly defined.[6] The firm produces using the updated investment plan and period-2 profits accrue (these include adjustment costs). $\beta \in [0, 1]$ is the discount factor between period 2 and period 1.[7]

3.2 Production strategies

Because our assumptions imply that the most efficient way to produce one unit of output is to use technology T_1 with one unit of capital and labor, in the optimum the quantity $m - \Delta/2$ demanded for sure in both periods will be produced using T_1. The only interesting question is therefore how the firm will serve the uncertain residual demand Δ. We distinguish three possible production strategies that the firm may use in the learning phase, conditional on entry.

Starting small. The firm does not produce in period 1 beyond the quantity $m - \Delta/2$ demanded for sure. That is, the firm selects $(k_1, l_1, k_2, l_2) = (m - \Delta/2, m - \Delta/2, 0, 0)$. A firm that starts small plans

[4] In reality, even incumbents face demand uncertainty. This formulation is meant to suggest that entrants face more demand uncertainty.

[5] We assume that the firm observes whether demand is high or low regardless of the amount of output that the firm produces. This is a reasonable assumption if uncertainty captures the effects of macroeconomic shocks (e.g., the impact of Brexit on British businesses) or the evolution of a particular industry. It is also a reasonable assumption if the demand for a particular product can be gauged through interactions with existing customers, since at least quantity $m - \Delta/2$ is always produced, conditional on entry.

[6] These specifications imply that capital or labor used with technology T_1 can easily be redeployed for use with technology T_2, and vice versa. This assumption can easily be relaxed without changing the results of the paper.

[7] There is no discounting between period 1 and period 0.

to grow if demand is proven high, but can remain small without incurring adjustment costs if demand is proven low.

Starting large and efficient. The uncertain residual demand Δ is served using T_1. That is, the firm selects $(k_1, l_1, k_2, l_2) = (m + \Delta/2, m + \Delta/2, 0, 0)$. Intuitively, a firm that starts large and efficient is taking a gamble. If demand is proven high, the firm makes a large profit because Δ is produced in both periods at the lowest possible cost. However, if demand is proven low, the firm experiences overcapacity and may incur large adjustment costs.

Exploratory (capital- or labor-intensive). The uncertain residual demand Δ is served using the perfect substitutes technology T_2. The firm can start either capital-intensive, $(k_1, l_1, k_2, l_2) = (m - \Delta/2, m - \Delta/2, \frac{2}{\alpha}\Delta, 0)$, or labor-intensive, $(k_1, l_1, k_2, l_2) = (m - \Delta/2, m - \Delta/2, 0, \frac{2}{\alpha}\Delta)$. Intuitively, the firm hires the factor that is more flexible to serve the uncertain demand Δ. For instance, if labor is the most flexible input, the firm uses only labor to produce Δ: $k_2 = 0$, $l_2 = \frac{2}{\alpha}\Delta$. The advantage is that, if demand turns out to be low, the firm can fire labor at little cost. The disadvantage is that, in period 1, Δ is not produced at the lowest possible cost (because a balanced input combination with T_1 is more efficient).[8]

In addition to these basic production strategies, the firm could also use "hybrid" strategies where, for instance, only a fraction of the uncertain demand is served or the firm produces Δ using both T_1 and T_2. While we allow for these hybrid strategies in the analysis below, because of the linearity of our problem they generically will not be optimal.

3.3 Analysis

We begin by assuming that in period 0 the firm pays the fixed cost F and enters the market. Thus, our focus will be on production strategies, conditional on entry.

We distinguish between two types of input rigidity: costly adjustment and irreversibility. Suppose the firm wants to reduce labor in period 2 (the case of capital is analogous). If $c < 1$, then the cost of firing workers is less than the cost of keeping them for one more period, because $w = 1$. Thus, the firm will fire the workers it does not need (the *costly adjustment case*). However, if $c \geq 1$, the firm will not reduce labor in period 2, because adjustment costs are too high (the *input irreversibility case*). Thus, without loss of generality, we can restrict attention to adjustment costs such that $c \in [0, 1]$ in the following. $c = 0$ corresponds to the full flexibility benchmark. $c \in (0, 1)$ refers to the costly adjustment case. $c = 1$ refers to the irreversibility care. Adjustment costs cannot be higher than 1 because the firm has always the option to retain inputs in period 2.

Lemma 1 characterizes the firm's optimal production strategies when adjustment costs are symmetric: $c_K = c_L$ (Scenarios 1 and 4 in Table 1).

[8] In principle, it could also be that, once a firm has started with T_2 and a very labor-intensive strategy, it does not find it optimal to switch to T_1 and a more balanced input mix, because this would involve significant labor adjustment cost. However, this cannot happen in the optimum. The reason is that the labor-intensive strategy is only selected when labor is flexible, and in that case $c_L = 0$. Thus, very low adjustment costs in the input flexibility case allow us to rule out some cases. However, our results would qualitatively hold even if this assumption was relaxed.

Lemma 1 (Scenarios 1 and 4). *Suppose adjustment costs are symmetric, $c_K = c_L = c \in [0,1]$, and the firm enters in period 0.*

(i). *If $p < 4 + 2\beta c$, then in period 0 the firm starts small: $(k_1, l_1, k_2, l_2) = (m - \Delta/2, m - \Delta/2, 0, 0)$. In period 1, production is adjusted depending on the realized state of demand. If demand is low the firm remains small: $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right) = (m - \Delta/2, m - \Delta/2, 0, 0)$. If demand is high, the firm grows and becomes large and efficient: $\left(k_1'^H, l_1'^H, k_2'^H, l_2'^H\right) = (m + \Delta/2, m + \Delta/2, 0, 0)$.*

(ii). *If $p \geq 4 + 2\beta c$, then in period 0 the firm starts large and efficient: $(k_1, l_1, k_2, l_2) = (m + \Delta/2, m + \Delta/2, 0, 0)$. In period 1, production is adjusted depending on the realized state of demand. If demand is low and $c < 1$ the firm downsizes: $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right) = (m - \Delta/2, m - \Delta/2, 0, 0)$. If demand is high (or $c = 1$), the firm remains large and efficient: $\left(k_1'^H, l_1'^H, k_2'^H, l_2'^H\right) = (m + \Delta/2, m + \Delta/2, 0, 0)$.*

The intuition for these results is simple. As mentioned above, because the minimum amount of output $m - \Delta/2$ is always demanded, this output is optimally produced using the efficient, input-balanced technology T_1. Thus, $k_1 \geq m - \Delta/2$ and $l_1 \geq m - \Delta/2$.

The firm must also decide how to serve the residual uncertain demand Δ. Lemma 1 states that in period 1 the residual demand Δ is either not served (the firm starts "small") or is fully served using the efficient technology T_1 (the firm starts "large and efficient"). The advantage of the starting small strategy is that, in period 2 (the post-learning phase), the firm can tailor production to the realized state of demand, without having to incur adjustment costs. The firm can remain small if demand is low, and can grow if demand is high. The drawback is that demand may not be fully served in period 1 (the learning phase) if it happens to be high. Conversely, the starting large and efficient strategy allows the firm to fully serve demand in period 1 if it is high. However, if demand is low, the firm will experience overcapacity and may have to incur large adjustment costs.

The firm is more likely to start small if output price p is low and the future is important (β large). In this case, the lower revenues associated with not fully serving demand in period 1 are less salient. The firm is also more likely to start small if adjustment costs c are large. This captures a core intuition of real options theory: under conditions of uncertainty, rigidities tend to hamper investment and growth.

The key feature of Lemma 1 is that, when adjustment costs are symmetric, the exploratory (capital- or labor-intensive) strategy is never used: $k_2 = l_2 = 0$. There is no reason to substitute a balanced, cost-minimizing combination of inputs $k_1 = l_1$ with either a capital-intensive or a labor-intensive production strategy when inputs are equally rigid. Indeed, even adjustment costs are lower with efficient, input-balanced technology T_1 than with T_2. In the former case, in fact, adjustment costs per unit of output are $2c$ (the firm must reduce both k_1 and l_1 by one unit); with T_2, adjustment costs are $(2/\alpha)c$, which is bigger than $2c$ (because $2/\alpha$ inputs must be used to produce one unit of output).

However, as Lemma 2 below shows, a capital- or labor-intensive exploratory strategy can be optimal when adjustment costs are asymmetric. Lemma 2 focuses on the case where labor is flexible but capital is rigid (Scenario 3). In this case, it can be optimal to test demand with a strategy that takes advantage of labor flexibility. The case when capital is flexible but labor is rigid (Scenario 2) is completely analogous and thus omitted.

Lemma 2 (Scenario 3). *Suppose labor is flexible but capital is rigid:* $c_L = 0$, $c_K = c \in (0, 1]$. *Suppose also the firm enters in period 0.*

(i). *If* $p < \min\{\frac{4}{\alpha}, 4+\beta c\}$, *then in period 0 the firm starts small:* $(k_1, l_1, k_2, l_2) = (m-\Delta/2, m-\Delta/2, 0, 0)$. *In period 1, production is adjusted depending on the realized state of demand. If demand is low the firm remains small:* $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right) = (m - \Delta/2, m - \Delta/2, 0, 0)$. *If demand is high, the firm grows and becomes large and efficient:* $\left(k_1'^H, l_1'^H, k_2'^H, l_2'^H\right) = (m + \Delta/2, m + \Delta/2, 0, 0)$.

(ii). *If* $\frac{4}{\alpha} < 4 + \beta c$ and $p \geq \frac{4}{\alpha}$, *then in period 0 the firm selects the exploratory* labor-intensive strategy: $(k_1, l_1, k_2, l_2) = (m - \Delta/2, m - \Delta/2, 0, \frac{2}{\alpha}\Delta)$. *In period 1, production level is adjusted depending on the realized state of demand. If demand is low the firm downsizes by firing the* l_2 *workers:* $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right) = (m - \Delta/2, m - \Delta/2, 0, 0)$. *If demand is high, the firm maintains its production level but switches to a more efficient and capital-intensive production strategy:* $\left(k_1'^H, l_1'^H, k_2'^H, l_2'^H\right) = (m + \Delta/2, m + \Delta/2, 0, 0)$.

(iii). *If* $\frac{4}{\alpha} \geq 4 + \beta c$ *and* $p \geq 4 + \beta c$, *then in period 0 the firm starts large and efficient:* $(k_1, l_1, k_2, l_2) = (m + \Delta/2, m + \Delta/2, 0, 0)$. *In period 1, production is adjusted depending on the realized state of demand. If demand is low, the firm downsizes:* $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right) = (m - \Delta/2, m - \Delta/2, 0, 0)$ *if* $c < 1$, *or* $\left(k_1'^L, l_1'^L, k_2'^L, l_2'^L\right) = (m+\Delta/2, m-\Delta/2, 0, 0)$ *if* $c = 1$. *If demand is high, the firm remains large and efficient:* $\left(k_1'^H, l_1'^H, k_2'^H, l_2'^H\right) = (m + \Delta/2, m + \Delta/2, 0, 0)$.

When adjustment costs are asymmetric, it can be optimal to test demand with a capital- or labor-intensive exploratory strategy. For instance, when labor is the more flexible input, as in Proposition 2, the firm may find it optimal to produce the uncertain output Δ using T_2 with only labor: $k_2 = 0$ and $l_2 = \frac{2}{\alpha}\Delta$. Compared to the efficient technology T_1, producing with T_2 is more expensive but, because T_2 makes greater use of the more flexible input (in this case, labor), adjustment costs are lower. Indeed, with T_2 adjustment costs per unit of output are $\frac{2}{\alpha}c_L = 0$, whereas with T_1 they are $c_K + c_L = c$.

Of course, when capital is the more flexible input (Scenario 2), an entirely symmetric situation arises, and the firm can find it optimal to produce Δ using the perfect substitutes technology T_2 with only capital: $k_2 = \frac{2}{\alpha}\Delta$ and $l_2 = 0$.

3.4 Testable predictions

Several testable predictions follow from our analysis. We begin by examining the effects of greater labor flexibility on the entry and production decisions of standalone firms. Then, we analyze the benefits of internal market flexibility in large, multi-unit organizations.

3.4.1 The effects of labor flexibility on entry and production strategy

In the following, we take as our starting point the case where both capital and labor are rigid (Scenario 4). Then greater labor flexibility means that labor adjustment costs c_L drop from $c > 0$ to 0, while capital adjustment costs c_K stay at c.

Because some costs are lower, it is clear that firm's profits conditional on entry are weakly higher under flexible labor than under rigid labor. Thus, the firm is more likely to pay F and enter when labor is more flexible.[9]

Lower labor adjustment costs increase the firm's profits holding production strategy constant, for instance if the firm always selects the starting large and efficient strategy (case (ii) in Proposition 1 and case (iii) in Proposition 2). However, lower labor adjustment costs can also increase firm's profits by allowing the firm to change its production strategy, specifically by switching to the exploratory, labor-intensive strategy (case (ii) in Proposition 2). This second benefit is large when the perfect substitutes technology T_2 is not too inefficient; that is, when it is relatively inexpensive to substitute capital with labor (α large).

Hypothesis 1 (Entry). *Entry is more likely when labor is flexible. The effect of greater labor flexibility on entry is larger when substituting capital with labor is easier.*

By comparing Propositions 1 and 2, it is clear that the exploratory labor-intensive strategy is only selected when labor is flexible and the perfect substitutes technology T_2 is not too inefficient (α large). Thus, firms may be expected to exhibit higher labor-capital ratios when labor is flexible and it is relatively easy to substitute capital with labor.

Hypothesis 2 (Labor-capital ratios). *Firms' labor-capital ratios are higher when labor is flexible and substituting capital with labor is easy.*

Propositions 1 and 2 can also be used to characterize how labor-capital ratios evolve over a firm's lifecycle. Proposition 1 predicts that, when labor and capital are equally rigid, the firm will only use the efficient, input-balanced technology T_1, both in period 1 and 2. Thus, while the firm may increase or decrease its output over time depending on demand, its labor-capital ratio will remain roughly constant.

By contrast, when labor is more flexible than capital (Proposition 2), the firm may initially test demand with an exploratory, labor-intensive strategy (case (ii)). If demand turns our to be low, the firm will reduce its labor inputs in period 2. If demand turns out to be high, the firm will upgrade its technology and produce Δ using T_1 and a balanced input mix. In either case, the firm will transition more from a relatively labor-intensive production strategy in period 1 (the learning phase), to a more capital-intensive strategy in period 2 (the post-learning phase).

Hypothesis 3 (Labor-capital ratios over a firm's lifecycle). *If labor and capital are equally rigid, labor-capital ratios remain approximately constant over a firm's lifecycle. When labor is flexible but*

[9] This and other implications of the model stated as empirical hypotheses below can easily be formally proven using the model.

capital is rigid, firms start relatively labor-intensive but, as they learn about demand, they switch to a more capital-intensive production strategy.

In all scenarios, the quantity $m - \Delta/2$ demanded for sure is produced with the efficient, input-balanced technology. With rigid capital, however, the uncertain demand Δ can be produced using the exploratory labor-intensive strategy. Thus, when demand is more uncertain (as measured by Δ), firms' labor-capital ratios tend to be higher (assuming that capital is always rigid).

Hypothesis 4 (Uncertainty and labor-capital ratios). *When demand is more uncertain, firms display higher labor-capital ratios.*

3.4.2 The benefits of internal market flexibility

Next, we examine how the entry and production strategies of multi-unit organizations differ from those of standalone firms. For concreteness and to better link the theoretical analysis to the empirical part, we focus on one particular type of multi-unit organization—the corporate group.[10]

An important advantage of multi-unit organizations, relative to standalone firms, is that they enjoy the benefits of internal market flexibility. They can redeploy inputs such as capital and labor from units where they are no longer needed to units where they are needed if (if the units are sufficiently similar to use each others' inputs). This suggests that, for group affiliates, the adjustment costs c of reducing capital and labor are significantly lower than for standalone firms, because excess resources can be internally redeployed.[11][12]

A key implication of lower adjustment costs is that, compared to standalone firms, group affiliates are less likely to select an exploratory strategy. Suppose for instance that capital is rigid but labor is flexible. As Proposition 2(ii) shows, the exploratory labor-intensive strategy is only selected if $\frac{4}{\alpha} < 4 + \beta c$. As c decreases, this condition is less likely to hold, and hence the exploratory labor-intensive strategy is less likely to be selected. Intuitively, because group affiliates can cheaply redeploy excess resources internally, rigidities in external capital and labor markets have little bearing on their production strategies. Group affiliates behave as if external markets were approximately flexible (c_L and c_K both close to zero). Note in fact that, as c goes to zero, all our four scenarios converge to Scenario 1 where both inputs are flexible.[13]

Because group affiliates can cheaply redeploy underused capital or labor when demand is low, their incentives to enter new markets are greater than those of standalone firms. Their entry decisions are also less likely to be affected by factors such as uncertainty, input rigidities and factor substitutability, because

[10]Note that the corporate group is not the only multi-unit organization that benefits from internal flexibility. Indeed, Penrose (1960) and Ahuja & Novelli (2016) make the case that even stand-alone firms can benefit from flexibility if they enter new industries.

[11]When inputs are flexible, we assume that adjustment costs are zero both for group affiliates and standalone firms.

[12]This assumption presumes some degree of diversification and lack of correlation in input needs among the units of the group. Investigating these issues is an important direction for future work.

[13]Indeed, Propositions 1 and 2 are identical when $c = 0$ (in particular, case (ii) of Proposition 2 never arises because $\frac{4}{\alpha} > 4$).

internal market flexibility reduces the costs associated with uncertainty and external market rigidities. Lastly, because group affiliates seldom select the labor-intensive exploratory strategy, they tend to be more capital-intensive than standalones, and their capital-labor ratios tend to change less over their lifecycle.

Hypothesis 5 (Entry of group affiliates). *Compared to standalones, entry by group affiliates is less affected by labor rigidity, factor substitutability and uncertainty.*

Hypothesis 6 (Labor-capital ratios of group affiliates). *Group affiliates are on average more capital-intensive than standalones, and their labor-capital ratios change less over their life cycle.*

Data

We construct our sample from the Bureau van Dijk's (BvDEP) ORBIS ownership and financial database, which provides wide and representative coverage of both private and public European companies. BvDEP standardizes financial items across the various countries' filing regulations and captures a wide range of firm sizes. Figure 2 shows the number of entrants throughout the sample by country.

[Insert Figure 2 here]

We augment the ORBIS data with data from external sources as described below.

In building our panel, we use yearly publications of ORBIS from 2002 to 2012. For each publication year, we code firms as entrants if their date of incorporation is the same as the publication year. All other firms are classified as incumbents. A unit of observation in our analysis is a country-industry-year triplet.

Table 1 presents summary statistics. The average number of firms in a country-industry-year triplet is 2,051, of which 82 are entrants. We distinguish between two types of entrant: those that are affiliated with corporate groups (defined as in Belenzon & Berkovitz, 2010) and standalones with no equity ties to other firms. 12 percent of entrants are affiliates; this rate is stable across industries.

[Insert Table 1]

Employment protection laws. Our measure of a country's employment protection laws, EPL, is the OECD employment dismissal protection index for the 2003-2010 period (OECD, 2013). This index measures cross-country differences in the difficulty of dismissing workers. It is computed as the average of five equally weighted dimensions, each ranging from 0 to 6: definition of justified or unfair dismissal (*REG5*), length of trial period (*REG6*), compensation following unfair dismissal (*REG7*), possibility of reinstatement following unfair dismissal (*REG8*), and maximum time to make a claim of unfair dismissal (*REG9*). EPL varies significantly across countries, even within the OECD. For example, Belgium and Portugal, which have comparable financial development as measured by the ratio of the total stock market value traded in the country to the country's GDP—.57 and .65 on average over this period, respectively—have dramatically different levels of employment protection—1.31 and 4.5 on average across this period, respectively.[14]

Factor substitutability. The parameter α in our model measures the efficiency of the high elasticity of substitution (high σ) technology, relative to the low elasticity of substitution (low σ) technology. In high α industries a larger proportion of output is likely to be produced with high σ production methods, and hence we can proxy α with measures of factor substitutability σ at the industry level. Industries with high substitutability are those in which laborers can be replaced by machinery, or vice versa. Road paving is an example of a task with high substitutability. Law and oil refining, by contrast, have low substitutability, with the former requiring labor that is irreplaceable by capital and the latter requiring capital that is irreplaceable by labor.

Because factor substitutability has important implications for growth and income distribution, a large literature has developed on how to estimate it (Chirinko, 2008). The standard approach leans heavily on an assumed but rather general production function, which implies a rate of investment in the two factors by a profit-maximizing firm investing in capital to make the relative price of capital equal its marginal product. The empiricist then calibrates this model using data on the capital-to-output ratio and price of capital.

Our industry-level factor substitutability estimates are from Chirinko & Mallick (2017), who use a low-pass filter to isolate long-run components of data described in Jorgenson et al. (2000). A full description of the process for producing these estimates is available in Chirinko & Mallick (2017). One virtue of these estimates is that the technique is particularly well suited to identifying heterogeneity in factor substitutability across industries, rather than creating a single economy-wide estimate.[15]

Corporate group affiliation. Research suggests that one of the virtues of corporate group membership is access to internal labor markets (Belenzon & Tsolmon, 2016) and internal capital markets (Belenzon et al., 2013) as substitutes for weak domestic markets. Entering firms that are affiliated with groups are therefore likely to behave differently from standalone entrants. To distinguish between standalone and group-affiliated firms, we use data from the ownership section of ORBIS.

Following Belenzon et al. (2013), we define a corporate group as a collection of at least two legally distinct firms of which one is a controlling ultimate shareholder of the other or others. Firms are classified as group affiliates if any of the following are true: (a) the firm has a controlling parent company (it is

[14] Some employment protection laws only apply to firms above a certain size. An example of a threshold is in France at 10 employees, where employers must pay monthly rather than quarterly social security obligations, transport aid, and a higher training tax (Garicano et al., 2016). Similarly, some employment protection laws (EPLs) in Sweden only affect firms that employ more than ten employees (Bornhäll et al., 2017).

Employment protection laws that only affect very large firms should tend to reduce our estimated coefficients on EPL. If entrants did not expect to grow beyond some minimum threshold, size contingent EPLs should have no effect on their entry decisions. Thus, if anything, our specifications tend to bias our results against finding any significant finding.

[15] In Appendix Table A3 we verify that our results are robust to the use of estimates of factor substitutability from alternate sources. These alternate estimates are from Griliches & Ringstad (1971) and Young (2013), who estimates factor substitutability from first order conditions in a Constant Elasticity of Substitution (CES) production function using data on 35 industries at roughly the 2-digit SIC level between 1960 and 2005. The estimates from Chirinko & Mallick (2017) are our preferred estimates given the recency of the data and the superior industry coverage.

a subsidiary), (b) it is a parent company of another firm (it has a subsidiary), or (c) it has the same controlling shareholder as at least one other firm. We classify firms as standalone if they have no equity ties to other firms or if their ownership information is missing. In the ORBIS data, this is operationalized by defining firms as affiliates if their independence score is a C or D. This operationalization is conservative as some nongroup affiliates may be able to benefit from flexibility and transfer factors between markets. Also, some groups will have businesses that are not able to use each others' inputs or face a high cost of doing so Sakhartov (2017). These two facts bias us against finding results.

Uncertainty. Our uncertainty measure is the media Economic Policy Uncertainty Index from Baker et al. (2016). The index is computed as a function of the number of terms in local newspapers that indicate economic policy uncertainty.

Industry controls

Industry capital intensity. We calculate capital intensity as the log ratio of assets over employees over the period 2002-2012 using the complete Amadeus database. Firm-year ratio values are averaged at the 4-digit NAICS level.

External capital dependence. The ability to substitute labor for capital is conceptually orthogonal to the need for capital. To identify the effect of σ separately from the need for capital, we include controls for two industry-level measures of need for capital described in Rajan & Zingales (1998). The first is *external capital dependence*, defined as $\frac{\text{Cap Ex+Cash Flow from Operations}}{\text{Cap Ex}}$ and computed using all US Compustat firms over the period 2003-2010.[16]

Industry Chinese import intensity. To account for competitive threats from external sources, we control for Chinese import intensity measured at the industry-country-year level computed following the procedure detailed in Bloom et al. (2016).

Innovation. One can imagine that an industry's level of innovativeness could be correlated with both entry and the difficulty of substituting labor for capital. To absorb the effects of industry innovativeness that don't operate through factor substitutability, we control for it using two measures. *Industry R&D intensity* is R&D spending over sales. For each industry, we compute the average ratio of R&D expenditures to sales from Compustat firms prior to the beginning of our sample to avoid contaminating our results with shocks that can affect both the incentives to invest in R&D and entry rates. The correlation between σ and R&D intensity is 0.21; that is, more R&D-intensive industries are associated with a greater ease of substituting capital with labor. *Industry patent intensity* is defined as the ratio of total number of USPTO patents to R&D stock and is computed for US Compustat firms over the period 2003-2010. The correlation between patent intensity and σ is -0.29. That is, stronger protection of intellectual property rights is associated with a greater difficulty in substituting capital with labor (and vice versa).

[16]In the Compustat data, we measure cash flow from operations as the sum of APALCH, INVCH, OANCF, and RECCH.

Analysis

The unit of observation is the country-industry-year triplet and the dependent variable is the natural log of 1 plus the number of firms incorporated in each year-country-industry. Our sample is an unbalanced panel of 126 four-digit industry NAICS codes in 19 countries over the period 2003-2010. Based on these, the total number of observations—country-industry-year combinations—where there is at least one active firm is 20,894.

Our empirical approach is to compare the difference-in-differences between entry into industries with different levels of factor substitutability σ in countries with different levels of EPL rigidity. Table 2 illustrates our empirical approach, using comparisons of mean rates of entry. This table includes examples of industries with high and low elasticity of substitution and the percentage of entrants for each industry for countries with high and low EPL. The table illustrates the expected higher entry rate for low-EPL countries as well as the expected effect of EPL being larger for high-σ industries. With this simple comparison, our predictions are borne out.

[**Insert Table 2 here**]

Next, we turn to non-parametric tests of our predictions of firms' experimentation. The model described the exploratory strategy as entering with a more labor-intensive production process, but suggested that this might be less efficient in the long run. This thinking yielded the following predictions. On average, entrants will enter with lower capital-to-labor ratios. That effect will be less pronounced in high EPL countries and will be more pronounced in high-σ settings, where firms are able to replace labor with capital. Table 3 presents the results of the non-parametric tests for experimentation. As in Table 2, Column (1) corresponds to a simple difference-in-differences comparison. We find that the magnitude of the difference in capital intensity between entrants and incumbents is notably higher in low-σ industries. We add a third difference in Column (4) that compares the difference-in-differences between strong and weak EPL regimes. We find that the difference between incumbents and entrants is attenuated in strong-EPL countries.

[**Insert Table 3 here**]

Finally, we test the prediction from Hypothesis 5 that entry by corporate affiliates is less affected by labor rigidity, factor substitutability and uncertainty. Table 4 presents raw percentages of firms that are entrants by different categories. Comparing across categories, we can see that the percentage of corporate group affiliated entrants varies much less than that of standalone entrants both across levels of σ and levels of uncertainty. For example, comparing the difference between calls (1).A and 2.(A), which represents the increase in entry attributable to σ in high uncertainty environments is an increase of about 43 percent. The difference between (3).A and (4).A, on the other hand, corresponds to a smaller decrease of about 10 percent.

[**Insert Table 4 here**]

From the nonparametric tests, we proceed to multivariate regression tests. Our baseline econometric specification is:

$$\ln(Entrants)_{ijt} = \alpha_1 EPL_i + \alpha_2 \sigma_i \times EPL_{jt} + \alpha_3 \sigma_i + \varphi_j + \tau_t + \epsilon_{ijt} \tag{2}$$

where i denotes four-digit industry NAICS, j denotes country, and t denotes time. φ_j and τ_t are complete sets of country and year dummies, respectively, and ϵ_{ijt} is an *iid* error term. Because including dummies at the industry level would wash out the effect of σ, we include controls at the industry level. The most basic of these, present in all of our specifications, is a baseline control for the size of the industry in the country. Because there are time-invariant features of an industry that would make it larger but are unrelated to σ, we include a control for the log of 1 plus the number of firms in the country-industry in year t-1.

Hypothesis 1 predicts that entry will decrease with rigid labor ($\hat{\alpha}_1 < 0$). In Table 5 column (1), we see this prediction is borne out. Hypothesis 1 also predicts that this effect is amplified by factor substitutability ($\hat{\alpha}_2 < 0$). That prediction is borne out in column (2) and shown to be robust to replacing the elasticity of substitution measure with industry fixed effects (column(3)), interaction controls (column (4)), and replacing the country EPL score with country fixed effects (column(5)). Columns (6) and (7) repeat the model but with only standalone or group affiliates counted in the dependent variable, respectively. These results suggest that effect of σ is much greater for standalone than group-affiliated firms, as is the interaction of σ with EPL. While the marginal effect of EPL seems similar for standalone and group affiliates, when we compute the marginal effect including the interaction at the σ sample average, we find that the effect is greater for standalones[17] than group-affiliates[18], as predicted.

[Insert Table 5 here]

Next, we move to predictions about the capital-labor ratio. The samples used in Table 6 include only the year of entry for each firm, to investigate their capital-labor ratio at entry. Hypothesis 2 predicts that the labor-intensive strategy will be less likely under labor rigidity. In Table 6 column (1) we can see that under high EPL—rigid labor, firms are more likely to enter with greater capital balances. Hypothesis 2 also predicts that use of the exploratory strategy will be increasing in factor substitutability, which we also see in column (1). We can also see in the higher labor balance associated with higher σ. We see in column (2) that the tendency to the exploratory strategy is greatest under both flexible labor and substitutable factors. Column (3) shows that this effect is robust to inclusion of country dummies instead of just the EPL score.

In columns (4) and (5) we divide the sample into standalone and group-affiliated firms. Comparing the coefficients on σ shows that its effect is primarily driven by standalone firms.

[Insert Table 6 here]

[17] $-0.29 + 0.22 \times -0.674 = -0.438$

[18] $-0.306 + 0.22 \times -0.041 = -0.315$

Table 7 includes all years of data, instead of just the entry year, for firms that entered at the beginning of the sample, in 2002 or 2003. This allows us to observe these new firms as they grow. We add an interaction of σ with firm age to show how firms exploit factor substitutability as they grow. This allows us to test the prediction of Hypothesis 3 that firms will be more likely to begin with the labor-intensive strategy, but will gradually adopt more capital-intensive production to become efficient once demand is realized. From column (1) we see that firms seem to enter with more labor-intensive production in high σ settings, but the interaction with age shows that they become more capital intensive as they age. In column (2) we show that this effect is robust to inclusion of firm fixed effects.

Hypothesis 6 predicts that group affiliates are on average more capital-intensive than standalone firms, and their capital-labor ratios change less over their life cycle. We observe the average effect in comparing the sample averages of columns (3) and (4), which show higher capital intensity for group affiliates on average. We observe the effect over time by comparing the coefficient on the $\sigma\times$ age interaction between those two columns. What we see is that standalone firms begin with lower levels of capital, but ramp up more over time when factors are substitutable.

Hypothesis 4 predicts that the labor-intensive production technology will be more prevalent when uncertainty is high. In columns (5) and (6) we divide the sample by level of media uncertainty using the data from Baker et al. (2016). Comparing the sample averages in columns (5) and (6), we can see that on average firms facing lower uncertainty have more capital-intensive production. Comparing the interaction of elasticity of substitution and firm age, we see that when labor and capital are exchangeable, firms in high uncertainty areas gradually increase their capital intensiveness. Firms in the low uncertainty areas show little evidence of substituting over time.

[**Insert Table 7 here**]

Concluding remarks

Markets for many production inputs, including labor, are becoming more flexible. In many countries, employment protection rights have been reduced and it is now far easier to use temporary contracts. Online intermediaries such as TaskRabbit, Tispr, UpWork, and Wonolo are also making it easier to match tasks that firms want to perform with independent, "on-demand" contractors willing to perform them. The rise of this "gig" or "freelancer" economy is widely regarded as one of the most important current workplace trends (e.g., Economist, 2014; Forbes, 2016a,b). Furthermore, platforms to provide computing on demand, like Amazon Web Service and Microsoft Azure, are making some capital expenditures more flexible.

The increasing flexibility of inputs is also likely to affect the organization of production in profound ways. Building on real options theory, the present paper investigates, both theoretically and empirically, the impact of greater input flexibility on one fundamental strategic issue—the propensity to start a business. Real options theory suggests that business creation is hampered when investment is irreversible and uncertainty is pervasive (Myers, 1977; Dixit, 1989, 1992; Dixit & Pindyck, 1994; Kogut, 1991; Miller &

Folta, 2002; Bloom, 2009; Trigeorgis & Reuer, 2017). The threshold return or "hurdle" rate that justifies an investment is higher if the investment cannot be recovered or can only be terminated at a cost if conditions turn out to be less favorable than initially thought.

We present a model of a prospective firm's decision to enter an industry under uncertainty. Building on real options theory, our model formalizes how uncertainty interacting with irreversibility of decisions can be a major barrier to entry. This paper contributes by proposing an answer to the question of how firms overcome this barrier. We suggest that prospective firms may be able to follow two strategies to overcome rigidity of input choices. One is to temporarily substitute rigid inputs with less rigid inputs, even if it is inefficient, while they realize uncertain demand. A second is to enter as an affiliate of a larger organization which can transfer resources between divisions.

Several papers stress the importance of manufacturing or operations flexibility. By starting small and preserving an option to grow, a firm can gain valuable information about market demand, especially in the initial stages of a product life cycle (McDonald & Siegel, 1986; Bollen, 1999; Ries, 2011). A flexible technology also helps the firm serve customers early on when demand is more uncertain, while postponing more specialized investment for later. Operations flexibility includes the ability to quickly and inexpensively change product mix, input combinations, or the location of production facilities (Kulatilaka, 1993; Kogut & Kulatilaka, 1994; Goyal & Netessine, 2007). With ever-increasing product variety and shorter product life spans, flexibility–particularly in the introduction of new products–is becoming a crucial source of competitive advantage (Gopal et al., 2013). The present paper highlights the role of factor substitutability in reducing the adverse effects of input rigidity and allowing firms to cheaply carry out "experiments".

The literature on entrepreneurial experimentation (e.g., Thomke, 2003; Manso, 2011; Kerr et al., 2014; Nanda & Rhodes-Kropf, 2016) also notes that, because most experiments fail, organizations and new products should be designed so that they can fail as inexpensively as possible. A crucial parameter in the calculus of whether to experiment or not is the cost of experimentation. Thomke (2003), in particular, notes that new technologies, including computer modeling and simulation, have dramatically reduced the cost of experimentation, thus radically changing the economics of experimentation. The paper suggests that legislative reforms and technological innovation, by making labor markets more flexible, may also have had a positive impact on experimentation and entrepreneurship[19]. This positive effect will, of course, have to be weighed against the potential drawbacks of labor flexibility, such as job insecurity (Davis, 2016).

Labor is not the only input that is becoming more flexible. Companies such as Amazon, Microsoft and Salesforce.com are making software, databases, platforms and infrastructure a scalable, cloud-based "service". To the extent that these services can be used to substitute for either labor or capital (or both), the model suggests that cloud computing may have a large effect on business creation. This effect may be large not just when demand is uncertain, but also when demand is cyclical or just temporary.

Organization structure can also help mitigate rigidities in input markets and encourage experimentation. The rise in collaborative ventures and strategic alliances can, to some extent, be attributed to the

[19] Foote & Folta (2003) is a very relevant paper, as it deals with the increasingly important phenomenon of temporary workers (and hence flexible labor) from a real options perspective.

ability of these organizations to postpone commitment and flexibly deal with uncertainty (e.g., Kogut, 1991; Folta & Miller, 2002). The second strategy we highlight—internal market flexibility—provides a potential reason for why another organizational form, the corporate group, is so widespread. Groups are able to deal with uncertainty better than standalone firms thanks to the flexibility provided by their internal markets.

The strategy literature also highlights the ability of multinational corporations (MNC) to deal with uncertainty, but largely focuses on their ability to flexibly move production across borders in response to changing economic conditions, such as fluctuations in exchange rates (Kogut & Kulatilaka, 1994). We emphasize the flexibility to change inputs and the flexibility to redeploy resources across units more generally, which may or may not involve moving production across borders (Folta et al., 2016). Consistent with this, Kim and Hung (2017) find that, after an increase in uncertainty, firms using less redeployable capital reduce investment more.

The model brings to the real options and entrepreneurial experimentation literatures the particular feature of predicting dynamic entry strategies where firms begin with one labor-capital mixture and adjust as demand is revealed. In this sense, it shares the flavor of industry lifecycle models in which economies of scale become endogenously more important over time and attention shifts to the efficiency of the production process (Klepper, 1996). While those models predict an evolution of strategies across an industry over the industry lifecycle, our model predicts heterogeneous strategies across firms within an industry based on their age. Empirically, we include industry-fixed effects in our specifications (which should absorb industry maturity given the short time dimension in our data) and show that labor-to-capital ratio is different for new entrants than incumbents. Rothschild & Stiglitz (1971), Holthausen (1976), Hartman (1976), and Ghosal (1991) also study the relationship between demand uncertainty and input choices. Holthausen (1976), for example, shows that risk-averse firms tend to use a production process with low fixed costs and high variable costs and use expected capital-labor ratios less than the efficient ratio. This meshes well with our findings but, again, our focus is on how different levels of input rigidities affect production and input choices, not on levels of risk aversion.

Finally, the paper contributes to the literature on rigidities and performance. Summarizing this vast literature is well outside the scope of this paper. Broadly speaking, however, it has two main strands. Archetypical studies in the first strand discuss how particular firm rigidities impact firm performance. For example, Bennett & Pierce (2016) suggest that agency problems associated with multi-divisional firms keep divisions from being able to reconfigure themselves to deter entrants. Christensen & Bower (1996) suggest that large successful firms are unable to reconfigure themselves to face new business models because they are overly structured to responding to the needs of existing customers, rather than potential customers. The second strand investigates what firms can do to make themselves less rigid. This can include establishing R&D capacity to be able to understand new technologies as they arise (Cohen & Levinthal, 1990) or mixing inexperienced employees who have not yet formed rigid routines with experienced staff (Lawrence, 2018). Broadly, the ability to reconfigure the firm has been given the name "dynamic capabilities" (Teece et al., 1997). We complement this research by describing a new feature of firm rigidities: their ability to affect experimentation and, by extension, entry.

The paper has a number of limitations. The model is very simple and hence abstracts from several important factors such as multiple periods, switching costs, and the effects of competition on technology choice (Bollen, 1999; Smit & Trigeorgis, 2017; Kulatilaka, 1988). The simplicity of the model, however, allows us to transparently illustrate the key relationships investigated in the data.

Regarding the empirical part, the results provide robust correlations motivated by theoretical analysis but fall short of proving causality. In particular, the negative correlation between firm entry and employment protection legislation could be driven by a number of country-level factors that are not captured by control variables. The interaction effects and the firm lifecycle results provide additional evidence in support of specific mechanisms, but further research, perhaps relying on a natural experimental setting such as that in Bornhäll et al. (2017), is certainly needed.

To conclude, we present a simple model of entry and investment under uncertainty. We examine two strategies that prospective firms may use to overcome rigidity of input choices. One is to temporarily substitute rigid capital with less rigid labor. The second is to enter as an affiliate of a larger organization. As political and technological changes make workers more likely to be available "on demand", our model suggests that capital irreversibility will become a less binding barrier in industries (i) where labor and capital are substitutable and (ii) entry by standalone (single-unit) firms is predominant.

References

Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. *Technology review*, *80*(7), 40–47.

Acemoglu, D., & Restrepo, P. (2018). The Race between Man and Machine: Implications of Technology for Growth, Factor Shares, and Employment. *American Economic Review*, *108*(6), 1488–1542.

Ahuja, G., & Novelli, E. (2016). Incumbent responses to an entrant with a new business model: resource co-deployment and resource re-deployment strategies. In *Resource redeployment and corporate strategy*, (pp. 125–153). Emerald Group Publishing Limited.

Autor, D., Dorn, D., Katz, L. F., Patterson, C., & Van Reenen, J. (2017). The Fall of the Labor Share and the Rise of Superstar Firms. *NBER Working Paper*.

Autor, D. H., Kerr, W. R., & Kugler, A. D. (2007). Does employment protection reduce productivity? evidence from us states. *The Economic Journal*, *117*(521).

Autor, D. H., Levy, F., & Murnane, R. J. (2003). The Skill Content of Recent Technological Change: An Empirical Exploration. *The Quarterly Journal of Economics*, *118*(4), 1279–1333.

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, *131*(4), 1593–1636.

Beach, R., Muhlemann, A. P., Price, D. H., Paterson, A., & Sharp, J. A. (2000). Manufacturing operations and strategic flexibility: survey and cases. *International Journal of Operations & Production Management*, *20*(1), 7–30.

Belenzon, S., & Berkovitz, T. (2010). Innovation in business groups. *Management Science*, *56*(3), 519–535.

Belenzon, S., Berkovitz, T., & Rios, L. A. (2013). Capital markets and firm organization: How financial development shapes european corporate groups. *Management Science*, *59*(6), 1326–1343.

Belenzon, S., & Tsolmon, U. (2016). Market frictions and the competitive advantage of internal labor markets. *Strategic Management Journal*, *37*(7), 1280–1303.

Bennett, V. M., & Hall, T. A. (2019). Industry software availability and entry. *Duke University Working Paper*.

Bennett, V. M., & Pierce, L. (2016). Motivation matters: Corporate scope and competition in complementary product markets. *Strategic Management Journal*, *37*(7), 1304–1315.

Bloom, N. (2009). The impact of uncertainty shocks. *Econometrica*, *77*(3), 623–685.

Bloom, N., Bond, S., & Van Reenen, J. (2007). Uncertainty and investment dynamics. *Review of Economic Studies*, *74*(2), 391–415.

Bloom, N., Draca, M., & Van Reenen, J. (2016). Trade induced technical change? the impact of chinese imports on innovation, it and productivity. *The Review of Economic Studies*, *83*(1), 87–117.

Bollen, N. P. (1999). Real options and product life cycles. *Management Science*, *45*(5), 670–684.

Bornhäll, A., Daunfeldt, S.-O., & Rudholm, N. (2017). Employment protection legislation and firm growth: evidence from a natural experiment. *Industrial and Corporate Change*, *26*(1), 169–185.

Cestone, G., Fumagalli, C., Kramarz, F., & Pica, G. (2016). Insurance between firms: The role of internal labor markets.

Chi, T. (2000). Option to acquire or divest a joint-venture. *Strategic Management Journal*, *21*, 665–687.

Chi, T., & Maguire, D. (1996). Collaborative ventures and value of learning: integrating the transaction cost and strategic option perspectives on the choice of market entry modes. *Journal of International Business Studies*, *27*, 285–307.

Chirinko, R. S. (2008). σ: The long and short of it. *Journal of Macroeconomics*, *30*(2), 671–686.

Chirinko, R. S., & Mallick, D. (2017). The Substitution Elasticity, Factor Shares, and the Low-Frequency Panel Model. *American Economic Journal: Macroeconomics*, *9*(4), 225–53.

Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *Strategic management journal*, *17*(3), 197–218.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*(1), 128.

Davidsson, P., & Henrekson, M. (2002). Determinants of the prevalance of start-ups and high-growth firms. *Small Business Economics*, *19*(2), 81–104.

Davis, G. F. (2016). *The Vanishing American Corporation: Navigating the Hazards of a New Economy*. Berrett-Koehler.

Davis, S. J., & Henrekson, M. (1999). Explaining national differences in the size and industry distribution employment. *Small Business Economics*, *12*(1), 59–83.

Dixit, A. (1989). Entry and exit decisions under uncertainty. *Journal of Political Economy*, *97*, 620–638.

Dixit, A. (1992). Investment and hysteresis. *Journal of Economic Perspectives*, *6*, 107–132.

Dixit, A., & Pindyck, R. (1994). *Investment under Uncertainty*. Princeton, NJ: Princeton University Press.

Economist (2014). Workers on tap. the on-demand economy. *The Economist*.
URL `http://www.economist.com/news/leaders/21637393-rise-demand-economy-poses-difficult-questio`

Eisenmann, T. R., Wagonfeld, A. B., & Barley, L. (2011). Aardvark. *Harvard Business School Entrepreneurial Management Case*, (811-064).

Felten, E. W., Raj, M., & Seamans, R. C. (2019). The Variable Impact of Artificial Intelligence on Labor: The Role of Complementary Skills and Technologies. *NYU Working Paper*.

Financial Times (2019). Behind the façade, the UK economy is faltering.
URL `https://www.ft.com/content/64163322-38f3-11e9-b72b-2c7f526ca5d0`

Fisher, M. L., & Ittner, C. D. (1999). The impact of product variety on automobile assembly operations: Empirical evidence and simulation analysis. *Management science*, *45*(6), 771–786.

Folta, T. B., Helfat, C. E., & Karim, S. (2016). Examining resource redeployment in multi-business firms. In *Resource Redeployment and Corporate Strategy*, (pp. 1–17). Emerald Group Publishing Limited.

Folta, T. B., & Miller, K. D. (2002). Real options in equity partnerships. *Strategic Management Journal*, *23*(1), 77–88.

Folta, T. B., & O'Brien, J. P. (2004). Entry in the presence of dueling options. *Strategic Management Journal*, *25*(2), 121–138.

Foote, D. A., & Folta, T. B. (2003). Temporary workers as real options. *Human Resource Management Review*, *12*(4), 579–597.

Forbes (2016a). 10 workplace trends you'll see in 2017. *Forbes*.
URL https://www.forbes.com/sites/danschawbel/2016/11/01/workplace-trends-2017/

Forbes (2016b). The rise of the freelancer economy. *Forbes*.
URL https://www.forbes.com/sites/brianrashid/2016/01/26/the-rise-of-the-freelancer-economy/

Garicano, L., Lelarge, C., & Van Reenen, J. (2016). Firm size distortions and the productivity distribution: Evidence from france. *The American Economic Review*, *106*(11), 3439–3479.

Ghosal, V. (1991). Demand uncertainty and the capital-labor ratio: Evidence from the us manufacturing sector. *The Review of Economics and Statistics*, (pp. 157–161).

Ghosal, V. (1996). Does uncertainty influence the number of firms in an industry? *Economics letters*, *50*(2), 229–236.

Ghosal, V. (2009). *The Effects of Uncertainty and Sunk Costs on Firms' Decision-Making: Evidence from Net Entry, Industry Structure and Investment Dynamics*, (pp. 167–182). Heidelberg: Physica-Verlag HD.

Gopal, A., Goyal, M., Netessine, S., & Reindorp, M. (2013). The impact of new product introduction on plant productivity in the north american automotive industry. *Management Science*, *59*(10), 2217–2236.

Goyal, M., & Netessine, S. (2007). Strategic technology choice and capacity investment under demand uncertainty. *Management Science*, *53*(2), 192–207.

Graetz, G., & Michaels, G. (2018). Robots at Work. *Review of Economics and Statistics*, *100*(5), 753–768.

Griliches, Z., & Ringstad, V. (1971). *Economies of scale and the form of the production function: An econometric study of Norwegian manufacturing establishment data*.

Hartman, R. (1976). Factor demand with output price uncertainty. *The American Economic Review*, (pp. 675–681).

Holthausen, D. M. (1976). Input choices and uncertain demand. *The American Economic Review*, (pp. 94–103).

Huckman, R. S., & MacCormack, A. D. (2006). Byd company, ltd.

Jain, A., Jain, P., Chan, F. T., & Singh, S. (2013). A review on manufacturing flexibility. *International Journal of Production Research*, *51*(19), 5946–5970.

Jorgenson, D. W., Stiroh, K. J., Gordon, R. J., & Sichel, D. E. (2000). Raising the speed limit: US economic growth in the information age. *Brookings papers on economic activity*, (pp. 125–235).

Jovanovic, B. (1982). Selection and the Evolution of Industry. *Econometrica*, *50*(3), 649–670.

Kerr, W. R., Nanda, R., & Rhodes-Kropf, M. (2014). Entrepreneurship as experimentation. *Journal of Economic Perspectives*, *28*(3), 25–48.

Kim, H., & Kung, H. (2016). The asset redeployability channel: How uncertainty affects corporate investment. *The Review of Financial Studies*, *30*(1), 245–280.

Klepper, S. (1996). Entry, Exit, Growth, and Innovation over the Product Life Cycle. *American Economic Review*, *86*(3), 562–583.

Kogut, B. (1991). Joint-ventures and the option to expand and acquire. *Management Science*, *37*, 19–33.

Kogut, B., & Kulatilaka, N. (1994). Operating flexibility, global manufacturing, and the option value of a multinational network. *Management science*, *40*(1), 123–139.

Kothen, C., McKinley, W., & Scherer, A. G. (1999). Alternatives to organizational downsizing: A german case study. *M@n@gement*, *2*(3), 263.

Kouvelis, P., Axarloglou, K., & Sinha, V. (2001). Exchange rates and the choice of ownership structure of production facilities. *Management Science*, *47*(8), 1063–1080.

Kulatilaka, N. (1988). Valuing the flexibility of flexible manufacturing systems. *IEEE Transactions on engineering management*, *35*(4), 250–257.

Kulatilaka, N. (1993). The value of flexibility: the case of a dual-fuel industrial steam boiler. *Financial management*, (pp. 271–280).

Lawrence, M. (2018). Taking stock of the ability to change: The effect of prior experience. *Organization Science*, *29*(3), 489–506.

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, *14*(S2), 95–112.

Lieberman, M. B., Lee, G. K., & Folta, T. B. (2017). Entry, exit, and the potential for resource redeployment. *Strategic management journal*, *38*(3), 526–544.

Manso, G. (2011). Motivating innovation. *The Journal of Finance*, *66*(5), 1823–1860.

McDonald, R., & Siegel, D. (1986). The value of waiting to invest. *The Quarterly Journal of Economics*, *101*(4), 707–727.

Miller, K. D., & Folta, T. B. (2002). Option value and entry timing. *Strategic Management Journal*, *23*(7), 655–665.

Myers, S. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, *5*, 147–175.

Nanda, R., & Rhodes-Kropf, M. (2016). Financing entrepreneurial experimentation. *Innovation Policy and the Economy*, *16*(1), 1–23.

O'Brien, J., & Folta, T. (2009). Sunk costs, uncertainty and market exit: A real options perspective. *Industrial and Corporate Change*, (p. dtp014).

O'Brien, J. P., Folta, T. B., & Johnson, D. R. (2003). A real options perspective on entrepreneurial entry in the face of uncertainty. *Managerial and Decision Economics*, (pp. 515–533).

OECD (2013). OECD indicators of employment protection.
URL `http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm`

Penrose, E. T. (1960). The growth of the firma case study: the hercules powder company. *Business History Review*, *34*(1), 1–23.

Rajan, R. G., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, *88*(3), 559–586.

Reuer, J. J., & Tong, T. W. (2010). Discovering valuable growth opportunities: An analysis of equity alliances with ipo firms. *Organization Science*, *21*(1), 202–215.

Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Random House LLC.

Rothschild, M., & Stiglitz, J. E. (1971). Increasing risk II: Its economic consequences. *Journal of Economic Theory*, *3*(1), 66–84.

Sakhartov, A. V. (2017). Economies of scope, resource relatedness, and the dynamics of corporate diversification. *Strategic Management Journal*, *38*(11), 2168–2188.

Sakhartov, A. V., & Folta, T. B. (2014). Resource relatedness, redeployability, and firm value. *Strategic management journal*, *35*(12), 1781–1797.

Smit, H. T., & Trigeorgis, L. (2017). Strategic npv: Real options and strategic games under different information structures. *Strategic Management Journal*, *38*(13), 2555–2578.

Stein, L. C. D., & Stone, E. C. (2013). The effect of uncertainty on investment, hiring, and R&D: Causal evidence from equity options. Working paper.

Teece, D. J., Pisano, G. P., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, *18*(7), 509–533.

Thomke, S. H. (2003). *Experimentation matters: unlocking the potential of new technologies for innovation*. Harvard Business Press.

Trigeorgis, L., & Reuer, J. J. (2017). Real options theory in strategic management. *Strategic Management Journal*, *38*(1), 42–63.

Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega*, *3*(6), 639–656.

Vassolo, R. S., Anand, J., & Folta, T. B. (2004). Non-additivity in portfolios of exploration activities: A real options-based analysis of equity alliances in biotechnology. *Strategic Management Journal*, *25*(11), 1045–1061.

Young, A. (2013). Us elasticities of substitution and factor-augmentation at the industry level. *Macroeconomic Dynamics*, *17*, 861–897.

Tables and Figures

Figure 1: Possible scenarios

	$c_L = 0$	$c_L = c$
$c_K = 0$	Scenario 1: Both capital and labor are flexible	Scenario 2: Capital is flexible but labor is rigid
$c_K = c$	Scenario 3: Capital is rigid but labor is flexible	Scenario 4: Both capital and labor are rigid

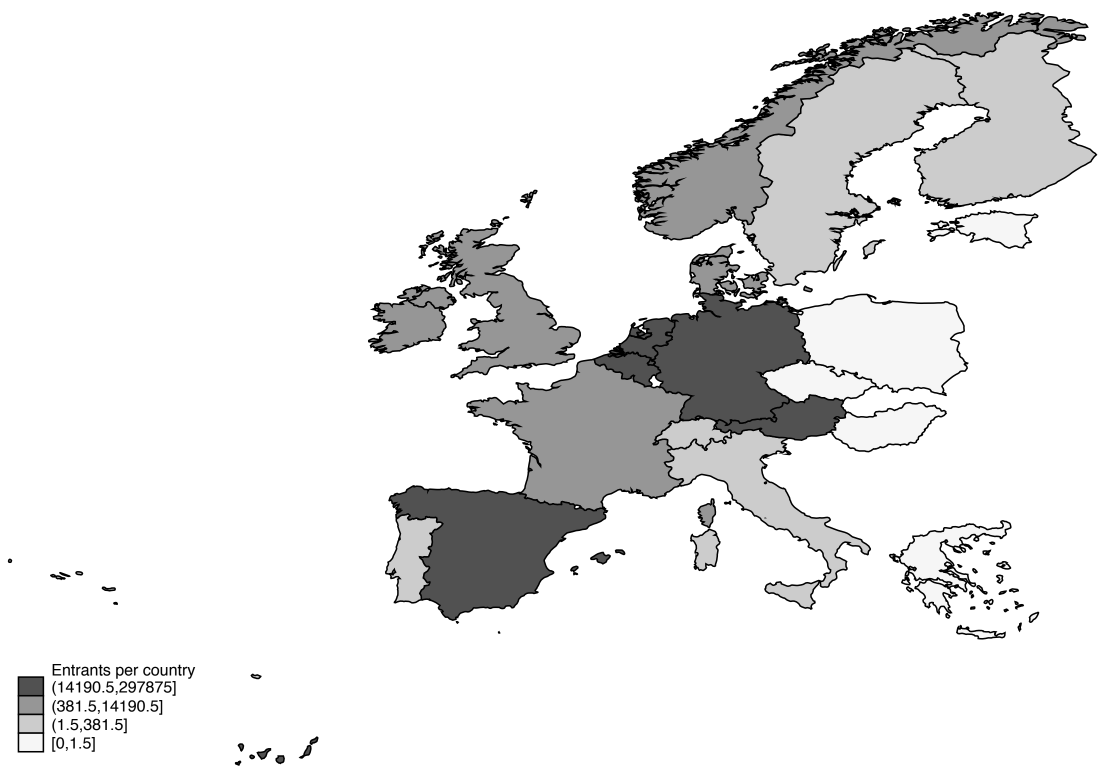

Figure 2: Entrants by country in sample

Table 1. Summary Statistics for Main Variables

Variable	Obs.	Mean	Std. Dev.	Distribution 10th	50th	90th
Panel A: Industry-country-year information						
Elasticity of substitution (σ)	20,894	0.22	0.10	0.10	0.22	0.37
Number of entrants	20,894	82	748	0	1	87
Number of standalone entrants	20,894	48	410	0	1	47
Number of group affiliate entrants	20,894	34	429	0	0	27
Total number of firms	20,894	2,051	10,331	5	208	4,045
Employment protection index	20,894	2.5	0.6	1.5	2.4	3.1
Flexibility in hiring and firing workers	20,894	2.8	1.0	1.3	3.0	4.0
Rigidity of wage setting	20,894	4.3	0.9	3.2	4.5	5.1
Dismissal procedures	20,192	2.0	0.9	1.0	1.8	2.8
Industry uncertainty	15,193	0.15	0.07	0	0.13	0.22
Industry financial dependence	20,894	1.19	2.06	0	0.61	2.37
Industry external capital dependence	20,894	-0.01	5.82	-10	0	8.45
Chinese import penetration	20,894	0.06	0.07	0	0.03	0.14
Industry R&D intensity	20,894	0.03	0.10	0	0	0.05
Industry patent intensity	20,894	0.22	1.26	0	0	0.04
EPL country	20,894	2.4	0.6	1.4	2.4	3.0
EPL component measures						
Mean length of notice for severance	20,894	2.0	1.0	1.0	1.8	2.8
Mean difficulty of dismissal	20,894	2.8	1.0	1.3	3.1	4.3
Mean procedural inconvenience	20,894	2.6	0.7	1.5	2.5	3.5
Alternate Elasticity of substitution (σ) measures						
Young (2013)	16,661	0.47	0.12	0	0.44	0.61
Griliches et al. (1971)	10,456	1.07	0.24	1	0.99	1.43
GDP	20,894	35,303.83	7,847.66	26,209	34,924	43,669.03
Unemployment rate	20,894	7.22	2.79	4	7.53	10.50
Uncertainty in the media	9,364	104.63	10.61	91.89	102.42	124.63
Panel B: firm-level information (firm-year) for firms incorporated in the first year of the sample (2003)						
Assets ('000)	692,561	4,746	156,841	54	312	2,546
Employees	692,561	31	1,859	1	3	19
Assets per employee ('000)	692,561	157	182	20	89	395
Firm age	47,132,167	4	2	1	4	7

Notes: This table provides summary statistics on the main variables used in the analysis. In Panel A the unit of observation is a naics4-year-country triplet, and in Panel B the unit of observation is a firm-year pair. Monteray values are in USD.

Table 2. Percentage of Entrants in High- and Low-σ Industries by EPL

	(1)	(2)	(3)
	Countries with low EPL	Countries with high EPL	(1) minus (2)
Panel A: Examples of high-σ industries (% of entrants)			
Waste Management and Remediation Services (562)	1.2	0.1	1.1
Utilities (221)	6.5	2.8	3.7
Highway, Street, and Bridge Construction (2373)	3.5	0.1	3.4
Professional, Scientific, and Technical Services (541)	2.2	0.2	2.0
Transportation Equipment Manufacturing (336)	0.9	0.1	0.8
Panel B: Examples of low-σ industries (% of entrants)			
Food Manufacturing (311)	0.6	0.2	0.4
Plastics and Rubber Products (326)	0.5	0.1	0.4
Printing and Related Support Activities (323)	0.7	0.1	0.6
Paper Manufacturing (322)	0.4	0.1	0.3
Apparel Manufacturing (315)	0.7	0.1	0.6
Textile Mills (313)	0.3	0.0	0.3
Leather and Allied Product Manufacturing (316)	0.6	0.0	0.6

Notes: This table presents patterns of entry in selected industries with high (top quartile) and low (lowest quartile) elasticity of substitution, in countries with high (above median) and low (below median) EPL. Columns 1 and 2 present the percentage of entrants by industry and country. Column 3 presents the difference between the percentage of entrants in countries with low and high EPL.

Table 3. Non-Parametric Relationship of Assets per Employee with σ and EPL

	Entrants' assets per employee minus incumbents' assets per employee			Difference by EPL
	(1)	(2)	(3)	(4)
Industry elasticity of substitution (σ):	All countries	Weak EPL countries	Strong EPL countries	(2) minus (3)
A. 1st tertile	-44,729	-29,908	-30,324	416
B. 2nd tertile	-55,553	-58,224	-58.182	-42
C. 3rd tertile	-74,668	-81,880	-58,457	-23,423
D. (C) minus (A)	-29,939	-51,972	-28,223	-23,749

Notes: This table presents differences in assets per employee for entrants *vs.* incumbent firms by σ and EPL. Row D is the difference by high and low σ in the difference in assets per employee between entrants and incumbents. Our theory predicts the difference in assets per employee to rise with σ. Our theory predicts that D would be larger for weak EPL countries.

Table 4. Non-Parametric Relationship of share of entrants with uncertainty, σ, and EPL

	(1)	(2)	(3)	(4)
	Standalone entry		Group affiliate entry	
Uncertainty	High σ (>median)	Low σ (≤median)	High σ (>median)	Low σ (≤median)
A. Below median (inclusive)	0.030	0.043	0.040	0.036
B. Above median	0.061	0.052	0.038	0.040

Notes: This table presents difference in entry rates by standalone and group affiliated firms across industry σ and country EPL by uncertainty levels. Our theory predicts that higher uncertainty would raise entry rates by standalone firms when σ is high.

Table 5. Effect of Factor Substitutability and Employment Protection on Entry

Dependent variable: ln(No. entrants/Total number of firms)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Baseline	σ-EPL interaction	Industry FEs	Interaction controls	Country FEs	Entry by standalone firms	Entry by group affiliates
Industry elasticity of substitution × EPL		-0.724	-0.761	-1.107	-0.722	-0.674	-0.041
		(0.286)	(0.265)	(0.313)	(0.237)	(0.268)	(0.159)
Industry elasticity of substitution (σ)	0.913	2.663	-	-	-	2.364	0.847
	(0.167)	(0.695)				(0.640)	(0.432)
Country EPL	-0.679	-0.522	-0.504	-0.420	-	-0.290	-0.306
	(0.038)	(0.08)	(0.061)	(0.073)		(0.062)	(0.044)
Industry elasticity of substition × ln(GDP)				-2.117	1.392		
				(1.028)	(0.487)		
Industry elasticity of substition × Unemployment rate				-0.077	-0.023		
				(0.043)	(0.034)		
ln(GDP)	0.593	0.570	0.841	1.359	4.157	0.754	-0.893
	(0.146)	(0.146)	(0.128)	(0.290)	(0.350)	(0.137)	(0.061)
Unemployment rate	-0.004	-0.004	0.008	0.025	0.104	0.003	-0.032
	(0.006)	(0.006)	(0.005)	(0.106)	(0.010)	(0.006)	(0.003)
Industry capital intensity	0.008	0.007				0.009	0.013
	(0.009)	(0.010)				(0.009)	(0.006)
Industry external capital dependence	0.009	0.009				0.007	-0.001
	(0.003)	(0.003)				(0.003)	(0.002)
Industry chinese import	-0.764	-0.750				-1.056	1.119
	(0.361)	(0.358)				(0.373)	(0.294)
Industry R&D Intensity	-0.026	-0.029				-0.034	0.016
	(0.005)	(0.005)				(0.005)	(0.003)
Industry patent intensity	0.150	0.151				0.128	0.001
	(0.023)	(0.023)				(0.021)	(0.013)
ln(1+Firms in country-NAICS4)$_{t-1}$	-0.487	-0.487	-0.524	-0.522	-0.490	-0.540	-0.054
	(0.009)	(0.009)	(0.009)	(0.009)	(0.014)	(0.009)	(0.005)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4-digit industry dummies	No	No	Yes	Yes	Yes	No	No
Country dummies	No	No	No	No	Yes	No	No
S.E. clustered at Country × NAICS4	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.561	0.561	0.588	0.589	0.674	0.598	0.119
Observations	18,221	18,221	18,221	18,221	18,221	18,221	18,221

Note: This table examines the effect of industry elasticity of substitution and country employment protection laws (EPL) on entry. Higher EPL values indicate that employment protection is more strict. Unit of observation is country-NAICS4-year triplet over the sample period 2003-2010.

Table 6. Factor Substitution and Capital Intensity

Dependent variable: ln(Assets/Employees)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Entry year	σ-EPL interaction	Country FEs	Standalones	Group affiliates
Industry elasticity of substitution (σ)	-0.639	-1.558	-1.867	-3.744	-0.988
	(0.037)	(0.307)	(0.305)	(0.464)	(0.396)
EPL	0.345	0.261	-	-	-
	(0.015)	(0.031)			
Industry elasticity of substitution × EPL		0.311	0.409	0.98	0.150
		(0.102)	(0.101)	(0.158)	(0.128)
ln(Employees)	-0.085	-0.085	-0.124	-0.331	-0.046
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)
ln(GDP)	3.514	3.52	0.551	1.473	-0.948
	(0.051)	(0.051)	(0.234)	(0.288)	(0.339)
Unemployment rate	0.024	0.024	0.024	0.018	0.018
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Year dummies	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	Yes	Yes
Firm FEs	No	No	No	No	No
Assets/Employee sample average ('000)	110	110	110	100	120
Year dummies	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	Yes	Yes	Yes
Firm FEs	No	No	No	No	No
Observations	172,814	172,814	172,814	90,516	82,298
R-squared	0.06	0.06	0.09	0.11	0.11

Note: This table examines the relationship between σ and EPL with assets intensity and how this relationship changes as firms mature. Columns 1-5 include only the year of entry.

Table 7. Factor Substitution and Capital Intensity Over Time

Dependent variable: ln(Assets/Employees)						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	σ-Age interaction	Within-firm	Standalones	Group affiliates	High media uncertainty (highest quartile)	Low media uncertainty (lowest quartile)
Industry elasticity of substitution × Firm age	0.136	0.067	0.092	0.030	0.121	-0.005
	(0.008)	(0.006)	(0.008)	(0.009)	(0.023)	(0.052)
Industry elasticity of substitution (σ)	-0.994	-	-	-	-	-
	(0.245)					
EPL	0.253	-	-	-	-	-
	(0.025)					
Industry elasticity of substitution × EPL	0.198	-	-	-	-	-
	(0.082)					
ln(Employees)	-0.088	-0.614	-0.655	-0.576	-0.526	-0.781
	(0.003)	(0.003)	(0.004)	(0.005)	(0.013)	(0.016)
Firm age	0.024					
	(0.006)					
ln(GDP)	2.444	2.154	2.428	2.059	3.06	2.317
	(0.041)	(0.067)	(0.089)	(0.092)	(0.258)	(0.428)
Unemployment rate	0.002	0.015	0.016	0.014	0.039	0.023
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.009)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	No	Yes	Yes	Yes	Yes	Yes
Country dummies	No	-	-	-	-	-
Assets/Employee sample average ('000)	160	160	140	180	154	159
Observations	692,561	692,561	692,561	692,561	153,442	128,539
R-squared	0.06	0.89	0.88	0.89	0.93	0.98

Note: This table examines the relationship between σ and EPL with assets intensity and examine the how relationship changes as firms mature. The sample includes only firms that were incorporated in the first year of our sample (2003) and tracks how their capital intensity changes as they mature.