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A Spanner in the Works: Restricting Labor Mobility and the Inevitable Capital-Labor Substitution*

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Abstract

We model an environment with overlapping generations of labor to show that policies restricting labor mobility increase a firm's monopsony power and labor turnover costs. Subsequently, firms increase capital expenditure, altering their optimal capital-labor ratio. We confirm this by exploiting the statewide adoption of the inevitable disclosure doctrine (IDD), a law intended to protect trade secrets by restricting labor mobility. Following an IDD adoption, local firms increase capital expenditure (capital-labor ratio) by 3.5 percent (5.5 percent). This result is magnified for firms with greater human capital intensity. Finally, IDD adoptions do not spur investment in either R&D or growth options as intended.

Keywords: Labor Mobility, Capital-Labor Ratio, Inevitable Disclosure Doctrine

JEL Codes: G31, J42

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"*He should have had sense enough to see that he was throwing a spanner into the works.*" – Right Ho, Jeeves by P.G.Wodehouse

1 Introduction

Over the years, firms have had access to numerous policies that restrict labor mobility (e.g., non-compete agreements and the inevitable disclosure doctrine) to protect their trade secrets and spur innovation. However, more recently we have witnessed significant opposition to such policies.[1] In this paper, we study the distortions created by policies restricting labor mobility and how firms respond by altering their optimal choice of labor and capital in their production process.

The effect of labor mobility on a firm's production process is ambiguous. An increase in labor mobility could result in a firm's loss of skilled labor to rival firms. This can be particularly detrimental if employees have access to trade secrets. Subsequently, turnover of skilled workers may reduce the effectiveness of existing capital and may require an adjustment to the underlying production process. In this case, firms may replace existing capital, invest in new capital, or choose to do nothing. Nonetheless, when an increase in labor mobility results in a reduction of skilled labor, the firm's capital-labor ratio increases. In contrast, an increase in labor mobility may also increase the available labor pool for firms because they may be able to poach skilled labor from rivals. This increased supply of labor could reduce the cost of labor, resulting in a shift toward labor, reducing the capital-labor ratio. This latter shift will be especially dependent on firm-specific labor skills that act as a fixed cost, limiting labor mobility. In general, improvements in labor mobility will facilitate inter-firm labor reallocations after productivity shocks.

We examine policies that curb workers' mobility in a manner that varies by state and time to determine how these policies affect firms' and workers' optimal choices. First, we consider a two-sector overlapping generations model in which infinitely lived firms operate either in a restricted

[1] See White House Report (2016) and US Department of Treasury Report (2016).

or unrestricted labor market. We calibrate model parameters using Census and Compustat data. When worker mobility is restricted in one sector, there is a key trade-off facing firms in the low-labor-mobility sector. Early-career workers demand a labor market premium to join the restricted sector, because in the subsequent period, firms use their monopsony power over current employees, putting downward pressure on late-career wages. Consequently, hiring early-career workers creates a real option for less expensive late-career labor. As a result, firms not only change their labor force composition toward less experienced workers, but also increase their capital-labor ratio due to their increased labor turnover costs.

Second, we empirically test the model's implications. We treat the adoption of the "inevitable disclosure doctrine (IDD)" by a state supreme court as an exogenous shock to labor mobility in the state. The IDD is a legal doctrine imposed by state courts under which a firm can protect its trade secrets by preventing employees with access to trade secrets from working for rival firms. It can be enforced without a non-compete or non-disclosure agreement and even when the rival firm is located in a different state. In short, the adoption of the IDD by a state protects the trade secrets of firms headquartered in the state by restricting the mobility of employees with trade secrets.[2]

Our empirical results corroborate the model's implications. After the adoption of an IDD, firms in the IDD state increase their capital expenditure by 3.5 percent, on average. As a result, the capital-labor ratio increases by 5.5 percent, on average. Further, increases in capital expenditure are concentrated in the industries most affected by the IDD adoption (high-human capital and low labor intensity). In particular, after an IDD adoption, capital expenditures increase by 5 percent and 4.7 percent on average in high-human capital and low-labor intensive industries, respectively. As a result, capital-labor ratios increase by 7.6 percent and 7.2 percent, respectively. Finally, our results show a negative but not statistically significant impact of the IDD adoption on employment. We hypothesize that the weak result on employment is due to the contrast between the model's long-run, steady-state perspective, compared to our shorter-term

[2]Klasa et al. (2018) confirm this by showing that recognition of the IDD by a state reduces the relative mobility of employees in managerial (or related) roles to rival firms.

empirical analysis. Due to the usual low labor-turnover rates (Li et al., 2022), combined with further restrictions on mobility due to IDD adoption, it might not be surprising that a longer horizon is needed to detect the effect of IDD adoption on employment. That is, due to large labor adjustment costs (Cooper and Haltiwanger, 2006), capital expenditures react quicker to news in order to smooth investment.

Replacing labor with capital is costly. Therefore, we next turn our attention to understanding how firms finance a greater capital-labor ratio following a decline in labor mobility. We find that when states adopt the IDD, local firms finance capital structure adjustments by issuing long-term debt. We consider three arguments that support the firm's decision to increase leverage following state adoption of the IDD. First, a conservative capital structure shields workers from unemployment risk prior to IDD adoption (Agrawal and Matsa (2013)). Although it is true that the IDD has a greater impact on high-skill workers, who are least likely to face unemployment, potential job losses are also more costly for this subset of workers (see Braga (2018)). Therefore, a decline in a firm's use of high-skill workers may reduce financial constraints and allow an equilibrium increase in financial leverage. Second, a conservative capital structure allows a firm the financial slack necessary to respond to competitive threats resulting, for example, from the potential loss of trade secrets to rivals (Klasa et al. (2018)). Subsequently, when a state adopts the IDD and enhances the protection of trade secrets, firms in the state increase financial leverage relative to rival firms. Finally, exposure to automation technologies has a positive impact on a firm's financial leverage (Qiu et al. (2020)). So when states adopt the IDD and firms replace labor with greater automation, worker bargaining power is reduced. As a result, firms have a reduced need to hedge against employee departures and will increase their optimal financial leverage. However, our empirical work shows that these leverage-related results are not robust to new methodologies that correct for "forbidden comparisons" made by the traditional methodology. Consequently, while the initial empirical results are in line with what was previously found in the literature, we should highlight that they may be affected by the traditional methodology shortcomings.

We consider two alternative interpretations of the IDD's impact on firm behavior. First, given that the IDD is intended to restrict labor mobility to protect trade secrets, local firms with trade secrets might respond by investing in innovation through increased R&D expenditure. However, we find no evidence consistent with this hypothesis. Second, when states adopt the IDD to protect the trade secrets of local firms, firms with trade secrets should face fewer competitive threats from rivals and have greater growth prospects. Again, we do not find evidence consistent with this mechanism.

In summary, we show that a decline in labor mobility triggered by a state adopting the IDD results in local firms substituting labor with capital. We also find that labor and human capital intensities play an important role in explaining the dynamics of the change in capital-labor ratios. The IDD primarily affects the mobility of high-skill workers. Consequently, we show a complementary but different pattern of substitution than the existing automation literature (Acemoglu and Autor, 2011). Our results are perhaps also related to the literature on the flattening of the firm (Rajan and Wulf, 2006) and how investment in capital can affect corporate structure and hierarchy (Bloom et al., 2014).

The paper is divided into 8 sections. Section 2 provides our model of labor mobility. Section 3 details the IDD and its recognition or abolition across US states over time. In Section 4 we describe the data. Section 5 provides our methodology, and Section 6 provides our main empirical results. Section 7 provides robustness checks related to alternative hypotheses, as well as alternative methodologies. Finally, Section 8 summarizes our results. Proofs of all lemmas and theorems are in the Online Appendix Section B.

2 Model

2.1 Environment

Time is discrete and the horizon is infinite. We assume an economy with two types of agents: workers and firms. Workers are risk neutral and live for 2 periods. Workers are young in their first period, and old in their second period of life.[3] In each period, there is a measure $\overline{L}$ of workers, half young and half old. At the end of the period, old workers exit the economy and are replaced by young workers. Similarly, workers who were young in the current period become old in the next period. Young workers discount the future at rate $\delta \in (0, 1)$. We assume that, apart from the age structure, workers are *ex ante* homogeneous and inelastically supply a measure 1 of labor per period. However, old workers face a sector-switching cost denoted by s.[4] This cost is unknown even to the worker in the first period of life, implying that all workers are *ex ante* identical. Instead, all workers are assigned a switching cost that is randomly distributed according to a Uniform distribution with support $[\underline{s}, \bar{s}]$, $\underline{s} > 0$, and $\bar{s} > 2\underline{s}$.[5] For simplicity, we assume neither population growth nor a savings technology.

Firms are risk neutral and infinitely lived. Similar to workers, firms discount the future at rate $\delta \in (0, 1)$. Firms are split across two sectors: I and N, representing the IDD and non-IDD sectors. Both sectors produce the economy's numeraire output (with price normalized to 1). As a result, sectors are distinct only due to potentially different institutional settings. For simplicity, we assume that there are fixed measures N_I and N_N of firms in sectors I and N, respectively. In the Appendix Section A, we relax this assumption, showing how these measures are determined in equilibrium through firms' entry and exit decisions. Firms use capital and labor in their production process. We assume a competitive market in which all firms are *ex ante* price takers in both markets. Moreover, both sectors are small open economies in the market for capital. Consequently, the rental price of capital r_t at time t is taken as given and determined outside our model. Furthermore, we assume that firms can freely rent capital. As a result, capital is not a state variable. Finally, we assume the following production technology $F(k_t, l_t)$ for both sectors:

$$F(k_{j,t}, l^Y_{t,j}, l^O_{t,j}) = A\left\{k^{\alpha}_{j,t} + \left[\sigma(l^Y_{j,t})^{\rho} + (1-\sigma)(l^O_{j,t})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}} \tag{1}$$

[3]For consistency with the overlapping generations literature, we denote early- and late-career workers as "young" and "old," respectively (see, for example, Weil (2008)).

[4]This switching cost is similar to the approach presented by Wildasin and Wilson (1996).

[5]This restriction on $\bar{s}$ is a sufficient but not necessary condition in one of our results.

where $k_{j,t}$ is the measure of capital a firm in sector j uses to produce at time t. Similarly, $l^Y_{j,t}$ and $l^O_{j,t}$ are the measure of young and old workers that a firm in sector j uses to produce at time t, respectively. The labor productivity of young and old workers in the firm is given by σ and (1-σ), respectively. Moreover, as pointed out by Krusell et al. (2000), σ is the parameter that governs the income shares of young and old workers. We assume that α, β, and $\rho \in (0, 1)$ and $\beta < \alpha$. As a result, capital and labor are substitutes.

We consider an unexpected change in the institutional setting through the adoption of an IDD that prevents workers currently employed in the I sector from switching employers within the sector. Nevertheless, these workers are still able to switch employers across sectors. Workers currently employed in the N sector are able to costlessly switch employers within sector N, and are also able to switch employers across sectors, with a sector-switching cost of s.

Once an IDD is introduced, firms in the I sector see an increase in their market power over their current employers. Thus, due to the labor mobility restrictions faced by these workers, firms in sector I face a labor supply of old workers that differs across employers. As a result, I firms can set the wage for these mobility-restricted workers, $w^{O,R}_{I,t}$, at any period t. We assume a lack of commitment by firms, so firms cannot set a given wage contract ahead of time.

To stress the resultant long-run equilibria, we focus on steady-state equilibria before and after the introduction of the IDD in our theoretical presentation.

We detail the firms' and workers' problems below. Further details are presented in Online Appendix Section A. All proofs are presented in the Online Appendix Section B.

2.2 Equilibrium Before an IDD Is Implemented

We begin by considering the economy before an IDD is adopted (with no restrictions on labor mobility between sectors I and N). In this case, all firms are price takers in labor markets for both young and old workers and have no market power over either group.

2.2.1 Worker's problem

The worker's problem is similar to standard approaches, with the addition of sector-switching costs. We begin by considering the problem of an old worker.

Old Worker's Problem: Consider the old worker's decision about whether to remain or switch sectors. At the beginning of the second period, a worker realizes her switching cost s, which is not observed by employers. Consequently, an old worker in period t who has a switching cost s would prefer to stay in sector I if $w^O_{I,t} > w^O_{N,t} - s$. As a result, we have a threshold $s_{I_t \to N_t}$ for the switching cost defined by:

$$s_{I_t \to N_t} = w^O_{N,t} - w^O_{I,t}, \tag{2}$$

such that, for $s \leq w^O_{N,t} - w^O_{I,t}$ the worker would prefer to switch sectors. In contrast, if $s > w^O_{N,t} - w^O_{I,t}$, the worker would stay in sector I. Similarly, the switching-cost threshold for an old worker to switch from the N sector to the I sector is given by:

$$s_{N_t \to I_t} = w^O_{I,t} - w^O_{N,t}. \tag{3}$$

Young Worker's Problem: Consider the problem of a young worker deciding which sector to join. Because switching costs are not observed until the second period and workers are risk-neutral, we consider the expected returns. The expected value of joining the I sector is:

$$\begin{cases} w^Y_{I,t} + \delta w^O_{I,t+1} & \text{if} \quad w^O_{N,t+1} - w^O_{I,t+1} \leq \underline{s} \\ w^Y_{I,t} + \delta \left\{ w^O_{I,t+1} + \frac{\left(w^O_{N,t+1} - w^O_{I,t+1} - \underline{s}\right)^2}{2(\bar{s} - \underline{s})} \right\} & \text{if} \quad \underline{s} < w^O_{N,t+1} - w^O_{I,t+1} < \bar{s} \\ w^Y_{I,t} + \delta \left[w^O_{N,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right] & \text{if} \quad w^O_{N,t+1} - w^O_{I,t+1} \geq \bar{s} \end{cases} \tag{4}$$

where the first condition in (4) shows the case in which the wage gap between sectors I and N for older workers is small enough that all workers who started their careers in sector I prefer staying in the sector. Similarly, in the third condition, the wage gap is sufficiently large that all workers prefer switching from sector I to sector N in the second period. Finally, in the second condition in (4), the wage gap is such that for some realizations of the switching cost, the worker would prefer staying, but for others, it is optimal to switch sectors. Since young workers do not know the realized switching cost yet, they take into account the expected value. Following the same rationale, the value of joining the N sector is:

$$\begin{cases} w^Y_{N,t} + \delta\, w^O_{N,t+1} & \text{if} \quad w^O_{I,t+1} - w^O_{N,t+1} \leq \underline{s} \\ w^Y_{N,t} + \delta \left\{ w^O_{N,t+1} + \frac{\left(w^O_{I,t+1} - w^O_{N,t+1} - \underline{s}\right)^2}{2(\bar{s} - \underline{s})} \right\} & \text{if} \quad \underline{s} < w^O_{I,t+1} - w^O_{N,t+1} < \bar{s} \\ w^Y_{N,t} + \delta \left[w^O_{I,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right] & \text{if} \quad w^O_{I,t+1} - w^O_{N,t+1} \geq \bar{s}. \end{cases} \tag{5}$$

2.2.2 Firm's problem

Because workers can freely switch firms within sectors, we consider firms as price takers. Given the problem is symmetric for firms in the I and N sectors, we consider a generic problem for an arbitrary firm in sector $j \in \{I, N\}$. For simplicity, we initially disregard the feasibility constraints, imposing them in equilibrium. As a result,

$$\max_{k_{j,t}, l^Y_{j,t}, l^O_{j,t}} \sum_{t=0}^{\infty} \delta^t \left\{ A \left\{ k^\alpha_{j,t} + \left[\sigma (l^Y_{t,j})^\rho + (1-\sigma)(l^O_{t,j})^\rho \right]^{\frac{\alpha}{\rho}} \right\}^{\frac{\beta}{\alpha}} - r_t k_{j,t} - w^Y_{j,t} l^Y_{j,t} - w^O_{j,t} l^O_{j,t} \right\} \tag{6}$$

Although the problem is dynamic, due to a lack of commitment and the lack of a state variable, we can solve the problem period-by-period. We present all derivations in the Online Appendix Section A. Considering the class of steady-state equilibria, i.e., long-run equilibria in which neither prices nor quantities change over time, we are able to show the following result:

Proposition 1. *There is no steady-state equilibrium with a positive outflow of old workers from either sector.*

Consequently, the only steady-state equilibrium has prices and quantities that are equal across sectors before the IDD.

2.3 Equilibrium After an IDD Is Implemented

We now consider the equilibrium after an IDD is adopted. Firms in the I sector now have market power over their current workers. Consequently, we assume that firms in the I sector can set the wage of workers who were employed at the firm when young. That is, firms set the wage of workers who are barred from working for an I sector competitor.

2.3.1 Worker's problem

The worker's problem is similar to the earlier pre-IDD problem in Section 2.2.1. The key difference is that, because of mobility restrictions facing workers who spent their youth in the I sector, old workers who spent their youth in the I sector face a different I sector wage ($w_{I,t}^{O,R}$) than old workers who spent their youth in the N sector and decided to move to sector I ($w_{I,t}^{O}$). For old workers who spent their youth in the I sector, in order to continue in sector I, these workers must remain at the same firm that employed them when young. This restriction gives the current employer market power in setting wages. As a result, $w_{I,t}^{O,R}$ is likely smaller than $w_{I,t}^{O}$. Furthermore, the threshold for a worker to move from sector I to N in period t is given by $s_{N_t \to I_t} = w_{I,t}^{O} - w_{N,t}^{O}$, and the threshold for moving from sector N to I is $s_{I_t \to N_t} = w_{N,t}^{O} - w_{I,t}^{O,R}$.

Consequently, when a young worker is deciding which sector to join, the worker must take into account the subsequent impact on labor mobility. As a result, the worker's lifetime expected utility in joining sector I is:

$$\begin{cases} w_{I,t}^{Y} + \delta\, w_{I,t+1}^{O,R} & \text{if} \quad w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \leq \underline{s} \\ w_{I,t}^{Y} + \delta \left[w_{I,t+1}^{O,R} + \frac{\left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R} - \underline{s}\right)^2}{2(\bar{s} - \underline{s})} \right] & \text{if} \quad \underline{s} < w_{N,t+1}^{O} - w_{I,t+1}^{O,R} < \bar{s} \\ w_{I,t}^{Y} + \delta \left[w_{N,t+1}^{O} - \frac{(\bar{s} + \underline{s})}{2} \right] & \text{if} \quad w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \geq \bar{s} \end{cases} \tag{7}$$

Notice that the expression in (7) is quite similar to the one presented in (4) with the key distinction that $w_{I,t+1}^{O,R}$ replaces $w_{I,t+1}^{O}$. Nonetheless, the value of joining the N sector continues to be represented by (5). Based on these equations, we can show the following result:

Proposition 2. *In an economy with two operating sectors, we must have* $w^Y_{I,t} \geq w^Y_{N,t}$.

Thus, young workers seek a wage premium to join sector I because they are susceptible to the incumbent employer's market power if they realize a high sector-switching cost. As a result, the introduction of an IDD in sector I increases the firms' cost of hiring young workers, even though they can exercise market power over their current employees due to their lower mobility. This result is similar in spirit to a social-stigma effect in which workers in unethical employment positions require a wage premium due to weakened future employment prospects, and the distastefulness of the position (Novak and Bilinski (2018)).

2.3.2 Firm's problem

Once an IDD is adopted, the problem for N and I sector firms differ. The problem for N sector firms remains unchanged, but the I sector firm's problem changes significantly. First, because the firm has market power over its current employees due to the IDD, the measure of young workers with the firm becomes a state variable in the firm's problem. Second, the I sector firm can now set the wages of young workers employed at the firm.

N Sector Firm: As before, the N sector firm's problem is given by:

$$\max_{k_{N,t}, l^Y_{N,t}, l^O_{N,t}} \sum_{t=0}^{\infty} \delta^t \left\{ A \left\{ k^\alpha_{N,t} + \left[\sigma(l^Y_{N,t})^\rho + (1-\sigma)(l^O_{N,t})^\rho\right]^{\frac{\alpha}{\rho}} \right\}^{\frac{\beta}{\alpha}} - r_t k_{N,t} - w^Y_{N,t} l^Y_{N,t} - w^O_{N,t} l^O_{N,t} \right\}. \quad (8)$$

Although the problem remains dynamic, again, due to a lack of commitment and the lack of a state variable, we can solve the problem period-by-period.

I Sector Firms: In this case, the I sector firm has some monopsony power over its current workers because it is able to set workers' wages when they are old. As a result, the firm's

problem becomes:

$$\max_{\left\{k_{I,t},l^Y_{I,t},w^{O,R}_{I,t},l^{O,N}_{I,t}\right\}} \sum_{t=0}^{\infty} \delta^t \left\{ \begin{array}{c} A\left\{k^\alpha_{I,t} + \left[\sigma\left(l^Y_{I,t}\right)^\rho + (1-\sigma)\left(\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}} l^Y_{I,t-1} + l^{O,N}_{I,t}\right)^\rho\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}} \\ -r_t k_{I,t} - w^Y_{I,t} l^Y_{I,t} - w^{O,R}_{I,t}\left(\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}}\right) l^Y_{I,t-1} - w^O_{I,t} l^{O,N}_{I,t} \end{array} \right\}$$

subject to:

$$0 \leq l^Y_{I,t} \leq \frac{\overline{L}}{2} \qquad (C.1)$$

$$k_{I,t} \geq 0 \qquad (C.2)$$

$$0 \leq l^{O,N}_{I,t} \leq L^Y_{N,t-1} \qquad (C.3)$$

$$\max\{\underline{w}, w^O_{N,t} - \bar{s}\} \leq w^{O,R}_{I,t} \leq w^O_{N,t} - \underline{s} \qquad (C.4)$$

where $l^{O,N}_{I,t}$ is the measure of workers who were previously employed in the N sector. Moreover, depending on the wage set by the firm for its current employees ($w^{O,R}_{I,t}$), a share $\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}}$ of the current employees $l^Y_{I,t-1}$ would decide to remain at the firm, yet others would prefer switching to the N sector.[6] Given Inada conditions, restrictions ($C.2$), $l^Y_{I,t} > 0$, and $w^{O,R}_{I,t} > \max\{\underline{w}, w^O_{N,t} - \bar{s}\}$ are trivially satisfied. We also assume (and later verify) that $l^Y_{I,t} \leq \frac{\overline{L}}{2}$ and $l^{O,N}_{I,t} \leq L^Y_{N,t-1}$ are non-binding. Consequently, the only restrictions we need to check are $w^{O,R}_{I,t} \leq w^O_{N,t} - \underline{s}$ and $l^{O,N}_{I,t} \geq 0$.

We present our derivations in the Online Appendix Section A. Based on the results presented, we can show the following proposition:

Proposition 3. *In a steady-state equilibrium with two active sectors, we must have:*

- *No outflow of old workers from sector N.*
- *A positive outflow of old workers from sector I.*

Consequently, in the steady-state equilibrium, firms in the I sector pay a surplus to young workers in order to lure them to the sector, while also exercising market power over old captive

[6] Notice that there is some abuse of notation here, because we should have $\min\left\{1, \max\left\{\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}}, 0\right\}\right\}$ as the share of $l^Y_{I,t-1}$ that stays in the firm in period t.

workers with high sector-switching costs. Moreover, workers who spent their youth in the I sector and realized a low sector-switching cost switch to sector N, avoiding the lower wages due to the market power of I sector firms.

In order to characterize the impact of IDDs on optimal capital and labor quantities, we present a quantitative exercise showing the impact of the IDD adoption on equilibrium prices and quantities given in our model once we calibrate the parameters based on the available data for the US economy.

2.4 Quantitative Exercise

We implement the short-run no-entry equilibrium. That is, we consider an equilibrium without allowing for the entry or exit of firms in either market. Table 1 presents the calibrated parameter values. In Appendix Section B, we discuss how parameters are determined from the data. We consider each period to be 20 years. We present this quantitative exercise as an illustration of our stylized model to stress key features given reasonably calibrated parameters. We do not have access to employer-employee matched data to control for worker and firm fixed effects.

We consider two steady states: pre- and post-IDD adoption. Results are presented in Table 2. As expected by the results presented in Section 2.2, before an IDD, both sectors are identical.[7] Once an IDD is adopted in sector I, we observe significant changes. First, there is an increase in sector I's investment in capital. In particular, I sector firms increase their capital by 1.2 percent, while N sector firms reduce their capital by 1.4 percent. Second, the overall demand for workers is reduced in the typical I sector firm (-3.1 percent). In contrast, labor demand at the typical N sector firm increases by 3.5 percent. Interestingly, changes in overall demand mask significant changes in demand for young versus old workers in the two sectors. Demand for young workers in sector I increases by 25.5 percent, while demand for old workers declines

[7] Moreover, given that we set $\sigma = 0.5$, there is no difference in productivity across age groups. One reason for this is that we are working with wage residuals from a regression that controls for education, industry, and experience, as well as an individual worker's characteristics (gender, race, ethnicity, and marital status). Consequently, differences in productivity across groups are on average small. Thus, wage is constant across sectors as well as across age groups.

by 31.7 percent. The opposite occurs in sector N, with the demand for young and old workers changing by -27.5 percent and $+34.5$ percent, respectively. Intuitively, hiring young workers in sector I is more expensive but brings the added benefit of having monopsony power over those workers later in their careers. This added benefit compensates the firm for the higher wages paid to young workers in sector I in equilibrium. In contrast, old workers who started their careers in sector I and faced a low switching cost optimally switch sectors, increasing the share of the old labor force in sector N. Finally, with respect to compensation, notice that once an IDD is adopted, although average compensation falls in both sectors, it only marginally declines in sector N (-0.92 percent), while it drops significantly in sector I (-3.8 percent). Again, average compensation somewhat masks significant differences across worker types. Compensation for old workers falls significantly, in particular in sector I. In contrast, average compensation for young workers increases, in particular due to the wage premium paid by sector I firms once an IDD is passed. Moreover, given the small decline in average wages jointly with the rise in labor demand, the wage bill for N sector firms actually increases by 2.7 percent, while the wage bill for I sector firms declines by 6.9 percent. Because we focus on wage residuals after controlling for most observable worker characteristics (available at Census-ACS data), remaining wage differentials are potentially understated.

[Insert Table 1 about here]

[Insert Table 2 about here]

Finally, profits are somewhat higher in the I sector.[8]

3 Institutional Background of the IDD

Firms spend significant financial and labor resources on legally acquiring trade secrets to gain an advantage over rival firms. Therefore, it is natural for them to seek protection against the

[8] As a robustness check, we ran several alternative calibrations. From all results presented, only the ranking of profits seems to depend on the chosen parameters. The net effect of the trade-off between labor market power over current employees versus higher labor costs for new hires has an ambiguous impact on profits.

misappropriation of their secrets. The protection of trade secrets is primarily governed by state law in the US. According to the Uniform Trade Secrets Act (UTSA), a trade secret is any information that derives its economic value from secrecy and is subject to significant efforts to prevent its disclosure to rival firms. The misappropriation of such trade secrets can occur under two conditions. One, when rival firms employ improper means such as theft or breach of duty, and two, when the trade secrets of a firm are disclosed without their consent.[9]

The inevitable disclosure doctrine is enforced by state courts and is intended to protect firms headquartered in the state from the misappropriation of their trade secrets. For the IDD to be adopted in a state, a firm first has to file a lawsuit with the state court citing the threat of misappropriation of its trade secrets. The firm would have to argue that new employment of its employee would inevitably lead to disclosure of its trade secrets and cause irreparable harm. It is important to note that the firm does not have the burden of proving any wrongdoing by the employee. State courts can decide whether to restrict the worker's responsibilities at the rival firm or prevent employment altogether.

When the IDD is adopted by a state court, the doctrine enhances the protection of trade secrets for all firms headquartered in the state, and not just the firm that initiated the lawsuit. The IDD enhances the protection of trade secrets for firms in the state by reducing the risk of losing employees with access to trade secrets to rival firms (in any state).[10] In short, in protecting trade secrets, the IDD reduces the labor mobility of employees with access to trade secrets.

The IDD is not the only way to protect a firm's trade secrets. Firms with trade secrets often enter into employment contracts with a non-disclosure agreement (NDA) or a covenant not to compete (CNC). Klasa et al. (2018) highlight three main advantages of the IDD over employment contracts with an NDA or CNC. First, there is a difference in scope. Although NDAs and CNCs can be enforced within a specific area (e.g., within a city, a county, or a 10- to 50-mile radius around the former employer), the IDD has broader coverage, including states

[9]Breach of duty occurs when a persons conduct fails to meet an applicable standard of care.

[10]Malsberger (2010) and Garmaise (2011) show that for any lawsuit related to an employment contract, the relevant jurisdiction is the state where the employee's former employer is located. Therefore, the IDD prevents employees with trade secrets from working for rival firms in other states as well.

that have not adopted the IDD. Second, the IDD can be enforced if there is a future threat that the NDA will be violated. Because firms do not have the burden of proving an actual violation, this significantly reduces the burden of proof and enhances the enforceability of an NDA or CNC agreement. Finally, the IDD can be enforced even in the absence of NDAs or CNCs.

4 Data

We begin the process of compiling our data set by creating a list of states that have adopted, rejected, or reversed the IDD. We do this by following prior studies (Klasa et al. (2018)) and hand-collecting the legal cases that address the IDD in each state in the US. We then scour each case and identify the precedent-setting cases for adoption, rejection, or reversal of the IDD. We define a precedent-setting case as the earliest case related to adoption, rejection, or reversal. These cases are important because they determine the essential standards that subsequent cases respect and follow.

In Figure 1, we classify states into four categories according to their history of IDD adoptions and rejections: states that adopt and later reject the IDD, states that adopt and currently recognize the IDD, states that reject the IDD without ever adopting, and states in which the courts never expressed an IDD opinion. Interestingly, there also appears to be a tendency to support the IDD in the midwestern US and a tendency to acceptance followed by rejection in the southeastern US.

[Insert Figure 1 about here]

Table 3 shows the timing of these IDD decisions. Most adoptions occur in the 1980s and especially the 1990s, with rejections most commonly in the late 2000s and 2010s. Although IDD adoptions exceed rejections (21 versus 16), since 2000, IDD rejections have dramatically exceeded adoptions (15 versus 3).

[Insert Table 3 about here]

Firm-level financial and accounting data are collected from the CRSP Compustat merged database.[11] We keep only firms incorporated in the US. We also follow standard practice in the literature and drop highly regulated financial firms (SIC 6000-6799) and utilities (SIC 4610-4991). We require no missing observations for all variables of interest, including log(assets), log(employees), capital expenditure, Q, ROA, fixed assets, cash flow volatility, dividend payer, state GDP growth, and political balance. A detailed description of the construction of these variables can be found in the Data Appendix. All variables are winsorized at the 2 percent and 98 percent levels.

We also use data provided by the Bureau of Economic Analysis (BEA) to construct our labor intensity measure. Specifically, we use industry-level data on total employment and capital stock. We aggregate the data at the 3-digit NAICS industry level and then define labor intensity as capital stock scaled by total employment. We also construct a low-labor-intensity indicator that is equal to 1 if the 3-digit NAICS industry's labor intensity is above the sample median, and zero otherwise. We then merge our measures of labor intensity with our overall sample using 3-digit NAICS industry codes.

Next, we use Census and American Consumer Survey (ACS) data from IPUMS (Ruggles et al., 2021) to measure human capital intensity at the industry level. The richness of the data allows us to capture human capital intensity at both the extensive and the intensive margins. We measure industry-level human capital intensity at the extensive margin as the share of workers with a bachelor's degree or more and at the intensive margin as the share of usual weekly hours by workers with a college degree or more. These measures are aggregated at the 3-digit SIC industry level by decade (1980, 1990, 2000, 2010). We construct a high-capital-intensity indicator that is set to 1 if the industry's human capital intensity is greater than the 75th percentile of the sample, and zero otherwise. These data are then merged with our primary sample using 3-digit SIC industry codes and decade indicators.

Because our analysis focuses on the impact associated with IDD adoptions, we end our sample

[11] Compustat North America [Annual Data]. Available: Standard & Poor's/Compustat [access date: 07/22/2022]. Retrieved from Wharton Research Data Service.

five years after the last adoption in 2006. Further, in order to avoid the impact of reversals in the analysis, in our main specification we censor observations from states that reversed their IDD stance in the year before the reversal.[12] Thus, our main sample covers the period 1977 to 2011 and consists of 106,874 firm-year observations.

5 Methodology

5.1 Main Analysis

We adopt a difference-in-differences research design. An important assumption in this approach is that firms in the treated and control states should exhibit no difference in the measured dependent variable of interest under the null hypothesis. For example, under the null, firms in states adopting or not adopting the inevitable disclosure doctrine should display no differences in their capital-labor ratios.

Our main specifications follow a linear regression with two high dimensional fixed effects (see Guimarães and Portugal (2010)). This methodology is well-suited for use with large data sets because we can remove high-dimensional fixed effects from the data in an initial step, and then use the transformed regression variables to consider alternative model specifications. In most of our specifications, we include firm fixed effects and industry×year fixed effects. In particular, our initial specification is given by:

$$Y_{i,t} = \boldsymbol{\beta X}_{i,t} + \varphi_{j(i,t)} + \theta_i + \varepsilon_{i,t} \tag{9}$$

where $Y_{i,t}$ is the dependent variable of interest for firm i in year t, and $X_{i,t}$ is a vector of time-varying controls for firm i, with conformable coefficient vector, $\boldsymbol{\beta}$. Controls include log book assets, market-to-book, operational return on assets, fixed assets, cash flow volatility, a dummy

[12] Within our sample period, reversals of previously adopted IDDs occurred in New York (2009), Florida (2001), Michigan (2002), Texas (2003), Arkansas (2009) and Ohio (2008). We present robustness results in Appendix Section C that include observations post-reversals and results are largely unchanged. Our analysis of IDD reversals follows de Chaisemartin and D'Haultfoeuille (2022a).

to indicate dividend payments, as well as statewide controls, such as state GDP growth and political balance. In addition to statewide control variables, we include our key variable of interest – IDD – a dummy variable equal to 1 if the state currently adopts the IDD. Controls for industry×year fixed effects are denoted by $\varphi_{j(i,t)}$, where $j(i,t)$ maps firm i to its industry j at time t. Similarly, θ_i represents firm i's fixed effect. Finally, standard errors are clustered at the state level.

5.2 Alternative Robust Estimation

Although the two-way fixed effect specification used in our main results is the most common framework used in the literature, recent papers have highlighted potential problems with this methodology.[13] In particular, problems occur when the two-period, two-groups framework is extended in two ways. The first problem arises if treatments occur over time, i.e., the treated group receives treatments at different points in time (staggered treatment). Second, the impact of treatments may be heterogeneous, varying over time, and across groups or adoption cohorts. When these deviations from the standard research design occur, Goodman-Bacon (2021), among others, shows that the two-way fixed-effect specification may imply so-called "forbidden comparisons" in which control group units may have been treated in previous periods. As a result, the effect estimated by the two-way fixed effect model represents a weighted average of the true treatment effect with weights that may be negative due to these "forbidden comparisons." Consequently, the effect estimated by the traditional methodology does not satisfy the no-sign-reversal property. In sum, the estimated effect may be negative even if the treatment effect is positive for all treatment cohorts. Given the pattern of IDDs, our analysis may suffer from some of these recently stressed concerns.

Several new estimators address these research design issues. In our analysis, we present results for the estimator suggested by de Chaisemartin and D'Haultfoeuille (2022a). Although

[13]See Roth et al. (2022) and de Chaisemartin and D'Haultfoeuille (2022b)) for two surveys on the recent literature that highlights the issues with the two-way fixed effect models and possible solutions.

most proposed new estimators that address the issue of "forbidden comparisons" assume that treatment is an absorbing state, de Chaisemartin and D'Haultfoeuille (2022a) allow for treatment reversals (as we have in our case with IDD approvals and reversals). In addition, their estimator admits intuitive placebo tests.

We briefly present the estimator proposed by de Chaisemartin and D'Haultfoeuille (2022a), which is an extension of the event-study approach presented by de Chaisemartin and d'Haultfoeuille (2020) and Sun and Abraham (2021). Consider a partition of observations into G groups and T periods. Similarly, define $N_{g,t} > 0$ as the number of observations for group g in period t. Furthermore, define $D_{g,t} \in \{0, 1\}$ as the treatment status for group g in period t and $\mathbf{d} \in \mathcal{D}^T$ as a possible path for treatments, including the possibility of reversals. Finally, define F_g as the first period in which group g has been treated (for an untreated group u we can consider $F_u = T + 1$) and T_u as the last time when at least one group is untreated. In this environment, the treatment effect for group g, ℓ periods after the first time they received the treatment, compared to the case in which they have never received treatment is given by:

$$\begin{aligned} \delta_{g,\ell} &= E(Y_{g,F_g+\ell}(\mathbf{D}_g) - Y_{g,F_g+\ell}(\mathbf{0})|\mathbf{D}) \\ &= E(Y_{g,F_g+\ell}(\mathbf{0}_{F_{g-1}}, 1, D_{g,F_{g+1}}, ..., D_{g,F_g+\ell}) - Y_{g,F_g+\ell}(\mathbf{0}_{F_g+\ell})|\mathbf{D}) \end{aligned} \tag{10}$$

where $Y_{g,F_g+\ell}(\mathbf{D}_g)$ is the average potential outcome for group g in period $F_g + \ell$ given treatment history $\mathbf{D}_g$. In order to estimate $\delta_{g,\ell}$, de Chaisemartin and D'Haultfoeuille (2022a) suggest the estimator $DID_{g,\ell}$:

$$DID_{g,\ell} = Y_{g,F_g+\ell} - Y_{g,F_g-1} - \sum_{g':D_{g',1}=0, F_{g'}>F_g+\ell} \frac{N_{g',F_g+\ell}}{N^u_{F_g+\ell}} (Y_{g',F_g+\ell} - Y_{g',F_g-1}) \tag{11}$$

i.e., $DID_{g,\ell}$ compares the $F_g - 1$ to $F_g + \ell$ outcome evolution in group g and in groups untreated from period 1 to $F_g + \ell$.

We then consider the average effects of treatment. Define $\delta_{+,\ell}$ as the average effect of having switched treatment for the first time ℓ periods ago, across all initially untreated groups that were treated for the first time at least ℓ periods ago. Furthermore, define δ_+ as the average total effect per unit of treatment. In this case, de Chaisemartin and D'Haultfoeuille (2022a) propose the estimator for $\delta_{+,\ell}$ given by:

$$DID_{+,\ell} = \sum_{g:D_{g,1}=0,F_g\leq T_u-\ell} \frac{\beta^{F_g+\ell}N_{g,F_g+\ell}}{N_\ell^1} DID_{g,\ell} \tag{12}$$

where β is a discount rate (assumed to be 1 unless otherwise defined) and N_ℓ^1 given by

$$N_\ell^1 = \sum_{g:D_{g,1}=0,F_g\leq T_u-\ell} \beta^{F_g+\ell}N_{g,F_g+\ell}$$

is the discounted number of units in groups reaching ℓ periods after their first treatment at or before T_u. Moreover, the proposed estimator for δ_+ is given by:

$$\hat{\delta}_+ = \frac{\sum_{\ell=0}^{L_u} w_{+,\ell} DID_{+,\ell}}{\sum_{\ell=0}^{L_u} w_{+,\ell} w_{+,\ell} \delta_{+,\ell}^D} \tag{13}$$

where $w_{+,\ell} = N_\ell^1 / \sum_{\ell'=0}^{L_u} N_{\ell'}^1$, $L_u = T_u - \min_{g:D_{g,1}=0} F_g$, denoting the difference between the last period when a group has been untreated all along and the first period when a group goes from untreated to treated, and $\delta_{+,\ell}^D$ is the average treatment of groups that were treated for the first time ℓ periods ago, i.e.

$$\delta_{+,\ell}^D = \sum_{g:D_{g,1}=0,F_g\leq T_u-\ell} \frac{\beta^{F_g+\ell N_{g,F_g+\ell}}}{N_\ell^1} D_{g,F_g+\ell}.$$

Finally, de Chaisemartin and D'Haultfoeuille (2022a) propose placebo estimators to test the assumptions of no anticipation and parallel trends for the never-treated outcome. In particular, they propose placebo counterparts for $DID_{g,\ell}$ and $DID_{+,\ell}$. First, for any g such that $D_{g,1} = 0$ and $3 \leq F_g \leq T_u$ and for any $\ell \in \{0, ..., \min(T_u - F_g, F_g - 3)\}$, let:

$$DID_{g,\ell}^{pl} = Y_{g,F_g-\ell-2} - Y_{g,F_g-1} - \sum_{g':D_{g',1}=0,F_{g'}>F_g+\ell} \frac{N_{g',F_g+\ell}}{N_{F_g+\ell}^u}(Y_{g',F_g-\ell-2} - Y_{g',F_g-1}). \tag{14}$$

Notice that $DID^{pl}_{g,\ell}$ compares group g's outcome evolution from periods $F_g - \ell - 2$ to $F_g - 1$, i.e., pre-treatment, to that of groups untreated from period 1 to $F_g + \ell$ during the same time period. In other words, $DID^{pl}_{g,\ell}$ assesses if g and groups not yet treated at $F_g + \ell$ are on parallel trends when untreated. Furthermore, note that while $DID_{g,\ell}$ goes from the past (period $F_g - 1$) to the future (period $F_g + \ell$), $DID^{pl}_{g,\ell}$ goes from the future (period $F_g - 1$) to the past (period $F_g - \ell - 2$), following standard practice in event-study regressions.

Second, the placebo counterpart for $DID_{+,\ell}$ is computed as:

$$DID^{pl}_{+,\ell} = \sum_{g:D_g,1=0,\ell+3\leq F_g\leq T_u-\ell} \frac{\beta^{F_g+\ell} N_{g,F_g+\ell}}{N^{1,pl}_{\ell}} DID^{pl}_{g,\ell} \tag{15}$$

where $N^{1,pl}_{\ell} = \sum_{g:D_g,1=0,\ell+3\leq F_g\leq T_u-\ell} \beta^{F_g+\ell} N_{g,F_g+\ell}$ is the discounted number of observations in groups for which both $DID_{g,\ell}$ and $DID^{pl}_{g,\ell}$ can be computed.

6 Results

6.1 Summary Statistics

We begin the discussion of our results by highlighting the summary statistics for our overall sample. Table 4 presents the mean, median, standard deviation, minimum, and maximum values for our key dependent variables, additional dependent variables, and control variables. Our sample for baseline tests covers the period 1977 to 2011 and consists of 106,874 firm-year observations. We find that the average capital expenditure to lagged assets, and to lagged sales, ratios have means of approximately 7 percent and 13 percent, respectively. In both cases, scaled capital expenditures are highly right-skewed with corresponding medians of 4.5 percent and 4 percent, respectively. Similarly, the total number of employees is highly right-skewed, with a mean of 5,024 and a median of 647. We observe significant dispersion in employees across firms, with a standard deviation of 12,115. Importantly, our data look very similar to those used in the literature related to corporate investment and capital structure.

[Insert Table 4 about here]

6.2 How Does Labor Mobility Affect Capital-Labor Substitution?

As presented in Section 2, the relationship between labor mobility and the firm's choice of labor and capital inputs is endogenous. Because IDD adoption changes the firms' monopsony power, the optimal capital-labor ratio and equilibrium wages change in order to account for the new environment. Therefore, we exploit the exogenous adoption of the IDD by US state courts as an unexpected shock to labor mobility. The adoption of an IDD by a state court enhances the protection of trade secrets by local firms and restricts the labor mobility of employees with access to these secrets.

Based on the results from Section 2.4, we expect an increase in capital demand from I sector firms following IDD adoption. Further, although our model considers a competitive rental market for capital, most capital is owned by firms and capital investment results in adjustment costs that are at least partially convex (Cooper and Haltiwanger, 2006). Convex capital adjustment costs in turn imply that firms should smooth their investments over time. Consequently, once the IDD is adopted, we should observe a persistent increase in capital expenditures over time, until the new equilibrium capital level is achieved.

In Table 5 we present results from a generalized difference-in-differences regression of capital investment on the adoption of the IDD by state courts. We consider the responsiveness in capital expenditures scaled by lagged assets. We control for impacts related to a wide range of controls, including asset size, market-to-book, return on assets, fixed assets, cash flow volatility, dividend payment, state GDP growth, the strength of non-compete clauses, and right to work laws. In all cases, we find a robust and significant increase in capital expenditures after IDD adoption. In particular, based on Table 5's column 3, we see that the adoption of an IDD is associated with a 3.5 percent increase in capital investment on average. Hence, results corroborate our hypothesis that capital investment increases with IDD adoption. Economically, evaluating at the mean of lagged assets, this 3.5 percent increase in capital expenditures represents an average increase of

$198,000 per year.

[Insert Table 5 about here]

We next examine the impact of IDD adoption on the size of a firm's labor force and its corresponding capital expenditure to labor ratio. According to the results from Section 2.4, we expect a small decline in the labor force in I sector firms, jointly with a significant decline in I sector firms' average compensation and wage bill. These long-run results arise with a new equilibrium after the entrance of a new generation of workers (where we calibrate a generation to every 20 years). In the near term, turnover among white collar workers tends to be small even without IDD adoption. Using a sample of 3,612 distinct public firms and 85,334 firm-quarter observations, Li et al. (2022) find an annual turnover rate for white collar workers of around 13 percent. However, the presence of an IDD, prompting some employees to leave the company and switch sectors, may further slow employee turnover. Also, job offers from different industries may be infrequent because they will depend on contacts outside the worker's normal network of connections. Thus, in the short run, I sector firms may have a disproportionately large number of "captive" employees, reducing the need to hire new employees. As a result, the impact on employment levels in the short term may be attenuated.

Our results related to employees and the capital-labor ratio are presented in Table 6. Dependent variables include employees (column 1), capital expenditures to lagged assets (column 2), and capital expenditure to labor ratio (column 3). In column 1, we find that the sign for employment is negative, as expected, and the magnitude is small and not statistically significant. In column 2, we replicate the results from Table 5's column 3, showing that IDD adoption is associated with a 3.5 percent increase in capital investment on average. Finally, in column 3 we show that the capital-labor ratio increases after IDD adoption. In particular, there is an average increase of 5.5 percent on average in the capital-labor ratio after the adoption.

[Insert Table 6 about here]

In Table 7 we examine the importance of labor intensity in understanding how firms increase their capital-labor ratio. We define labor intensity as the ratio of capital stock and total employment. High- and low-labor-intensive industries are the ones above and below the median, respectively. Model (2) shows that when a state adopts the IDD, on average, firms in low-labor-intensive industries increase their capital expenditure by 5 percent, whereas model (1) shows that firms do not alter their labor force. Taken together, we find that firms increase their capital-labor ratio by increasing capital investment. Model (3) confirms this intuition and shows that, on average, the capital-labor ratio increases by 8 percent in low-labor-intensity industries after IDD adoption.

[Insert Table 7 about here]

We also investigate the importance of human capital intensity in understanding how firms substitute labor for capital. We construct two measures of human capital intensity to capture results at both the extensive and the intensive margins. At the extensive margin, we measure human capital intensity as the industry's share of workers with a bachelor's degree or further education. At the intensive margin, we measure human capital intensity as the industry's share of usual weekly hours by workers with a college degree or further education. In Table 8 we find that when a state adopts an IDD and restricts labor mobility, firms in high-human-capital-intensive industries increase their capital expenditure by 5 percent. Because employment changes are not statistically significant, the increase in the capital-labor ratio seen in model (3) – 8 percent on average – is due to increases in capital investments.

[Insert Table 8 about here]

In Table 9, we measure human capital intensity at the intensive margin. We again consider dependent variables that include employees, capital expenditures to lagged assets, and the capital expenditure to labor ratio. We observe that firms in high-human-capital-intensive industries increase their capital expenditure to labor ratio following IDD adoption by investing in new capital. In particular, after the IDD adoption, firms in high-human-capital-intensity industries increase their capital expenditure and capital-labor ratio by 6 percent and 8 percent, respectively.

[Insert Table 9 about here]

6.3 Financing Capital-Labor Substitution

Firms incur significant costs when adjusting their production function. Therefore, we now examine how firms finance the observed increase in capital expenditure to labor following the adoption of the IDD by US state courts. By reducing their reliance on labor, firms may lower their fixed salary payments and also their workforce's aversion to risk (see Agrawal and Matsa (2013) and Braga (2018)), leading to an increase in leverage capacity. As a result, IDD adoptions should be positively related to an increase in leverage. Results in Table 10 columns (1) and (2) corroborate this hypothesis and suggest firms use this additional leverage to finance the capital expenditure to labor substitution. However, as we see in Figure 6, Section 7.1, these leverage-related results are not robust to new methodologies that correct for "forbidden comparisons" made by the traditional methodology.

[Insert Table 10 about here]

7 Alternative Robust Estimation and Robustness Checks

In order to better evaluate the causality of our results, Table 11 presents the changes in labor force, capital expenditures, and capital labor ratios for three years before and after the IDD adoption. Column (1) reveals a consistently negative, albeit insignificant, impact of IDD adoption on employment. Columns (2) and (3) reveal a significantly positive impact on capital expenditure beginning in the IDD adoption year and in the years after adoption. The results also suggest no anticipatory impact of IDD adoption. As discussed earlier, the follow-on impact of increased capital investment is consistent with convex adjustment costs associated with re-alignment of the firm's production technology.

[Insert Table 11 about here]

Next, we discuss potential alternative explanations for our primary results. In particular, if the IDD protects intellectual property, then the IDD should reduce the likelihood of information leakages (see Eeckhout and Jovanovic (2002)). Consequently, by mitigating labor mobility to potential competitors, an IDD should increase the return on investment for R&D and other trade secrets. As a result, we may observe an increase in R&D investment and Tobin's Q after IDD adoption.

Another alternative hypothesis is that the IDD might reduce competition by making it harder for new entrants to join the industry. In this case, incumbents would have more market power, in both the labor and the product markets. As a result, firms are likely to reduce investment in new technologies (R&D). This lack of competition may reduce the incentive to innovate as market power allows management to promote a quieter, less stressful environment (see Bertrand and Mullainathan (2003)). In contrast, as Aghion and Howitt (1992) suggest, innovation may reduce the value of assets in place, harming incumbents. Consequently, an increase in market power should be followed by a reduction in R&D investments. Moreover, the decline in R&D, jointly with a reduction in the threat of being driven out of the market by competition, should boost market-to-book ratios and Q (see Dybvig and Warachka (2015)).

We present empirical evidence for these competing hypotheses in Table 12. We do not find support for the market power hypothesis, as the reported Column (2) coefficient for the IDD is not significantly related to Tobin's Q.[14] Neither the hypothesis of a higher ROI on innovation and trade secrets nor the hypothesis of enhanced market power is corroborated by our empirical results.

[Insert Table 12 about here]

[14]Although we observe a positive impact from IDD adoption on R&D investment in Table 12 – 4 percent on average – Figure 6 in Section 7.1 shows that this result is not robust to controlling for "forbidden comparisons."

7.1 Alternative Robust Estimation Results

We now present our results using the methodology proposed by de Chaisemartin and D'Haultfoeuille (2022a) as described in Section 5.2. In order to compare the results with those in the previous sections, we initially estimate the treatment effect only among IDD adoptions. Later, we present estimates that consider both adoptions and reversals in the sample period. All analyses were performed using Stata's did_multiplegt command provided by de Chaisemartin et al. (2019).

Results are presented graphically based on estimated effects for the difference-in-differences estimators with 95 percent confidence intervals indicated by red whiskers. For intuition, and following common practice, we graphically connect point estimates at yearly intervals for cumulative effects.[15]

Figure 2 provides empirical results for capital investment given the adoption of an IDD. In particular, to the right of the event date 0 on the x-axis, Figure 2 shows $DID_{+,\ell}$, the average effect of having adopted an IDD ℓ years ago on capital investment. We find an immediate time 0 effect ($DID_{+,0} = 0.0069$) that continues to build over the initial two years, reaching $DID_{+,2} = 0.0088$. The IDD effect is statistically significant at the 5 percent level for years 0 to 2 and significant at the 10 percent level for years 3 and 4. Our estimates show that the estimated average effect of IDD adoption on capital investments from year 0 to +4 years after the adoption is 0.0083 (with standard error 0.0032). To analyze the pre-event period (shown on the left side of 0 on the x-axis), we consider the placebo estimates, $DID^{pl}_{+,\ell}$. Reported effects on capital investment are not statistically significant at the 5 percent level. Further, the joint test that all placebos are equal to zero does not reject the null, corroborating our research design.

Figure 3 shows the impact of IDD adoption on capital investment for human-capital-intensive industries, both at the extensive margin (Panel a) and the intensive margin (Panel b). As expected given our previous analysis, the empirical results are highly significant. The impact of IDD adoption on capital investment is positive and statistically significant across all $DID_{+,\ell}$.

[15] We stress, in particular, that the interpolation between relative times -1 and 0 is not indicative of information leakage (as is common in other event-study contexts).

Furthermore, our estimates show that the estimated average effect of IDD adoption on capital investments from years 0 to +4 after the adoption is 0.016 for human capital intensive industries, for both extensive or intensive margin classifications. As with the overall economy-wide result presented in Figure 2, the joint test that all placebos are equal to zero is not rejected, corroborating our research design.

Similar to the results presented in Section 6.2, we observe an increase in capital investment after an IDD adoption, as we see in Figure 4. As a result, estimates show that the estimated average effect of IDD adoption on capital investments from year 0 to +4 years after the adoption is 0.012 for low-labor-intensive industries. Moreover, placebo results corroborate our research design.

Figure 5 shows the impact of IDD adoption on employment levels (Panel a) and capital-labor ratios (Panel b). As we see in Figure 5a, although the effect on employment is negative, it is not statistically significant in the first 4 years after adoption. In contrast, the capital-labor ratio impact is positive and statistically significant at the 10 percent level for $DID_{+,0}, DID_{+,2}, DID_{+,3}$. Thus, the estimated average effect of IDD adoption on capital investments from year 0 to +4 years after the adoption is 0.0014. In both cases, placebo tests corroborate our research design.

Finally, Figure 6a shows results for book leverage as well as for alternative routes through which IDD adoption may affect firm's outcomes (R&D investment, ROA, and Tobin's Q). Results for book leverage are not statistically significant, in contrast with our results presented in Table 10, as well as results from the previous literature (Klasa et al. (2018)). Potentially, recent research design concerns associated with two-way fixed effect models as highlighted by the recent literature may meaningfully impact leverage results. Similarly, results from Figure 6c show no impact of IDD adoption on R&D investment, differently from what we have found in Table 12. In both cases, placebo tests corroborate our research design. Results in Figure 6 Panels b and d show no impact of IDD adoption on ROA and Tobin's Q, consistent with the results in Table 12.

In Appendix Figures A-1 and A-2, we present results that jointly consider adoptions and reversals. Although capital investment results are weakened – in general, statistically significant at the 10 percent level – our overall conclusions remain largely unaffected.

8 Conclusion

We hypothesize that the adoption of IDDs by states has the unintended consequence of triggering capital-labor substitution. Our model shows that the adoption of an IDD increases firm's monopsony power, as well as the cost of labor turnover and the optimal composition of the firm's labor force. As a result, firms increase their capital-labor ratio. Empirically, we show that an IDD adoption increases capital expenditures as well as capital-labor ratios. The impact on a firm's total labor force is initially small and not statistically significant. We find little empirical support for the hypotheses that IDD adoptions mostly affect product market concentration or the return on investment for new technologies.

Data Appendix – Variable Definitions

Key Dependent Variables	Description
$Capital\ Investment_t$	Primarily measured as capital expenditure scaled by the previous year total assets. Compustat:$(capx_t/at_{t-1})$. Alternatively, for robustness, measured as capital expenditure scaled by the previous year total sales. Compustat: $(capx_t/sale_{t-1})$.*
$Log(Employees)_t$	The natural logarithm of the total number of employees. Compustat: $ln(emp_t * 1000)$.*
Capital-Labor Ratio$_t$	Measured as inflation adjusted capital expenditure scaled by total number of employees. Compustat: $(capx_t/deflator)/(emp_t * 1000)$.*
Additional dependent Variables	
$Sales\ Growth_t$	Measured as total sales less previous year's total sales scaled by previous year's total sales. Compustat: $(sale_t - sale_{t-1})/sale_{t-1}$.*
Q_t	Measured as the market value of assets scaled by the book value of assets. Compustat: $(prcc\_f_t * csho_t + at_t - ceq_t)/at_t$.*
R&D$_t$	Measured as R&D expenditure scaled by total assets. Compustat: xrd_t/at_t.*
$Book\ Leverage_t$	Measured as the book value of total debt scaled by the book value of total assets. Compustat: $(dlc_t{+}dltt_t)/at_t$.*
$Net\ Book\ Leverage_t$	Measured as the book value of total debt less cash holdings scaled by the book value of total assets. Compustat: $(dlc_t + dltt_t - che_t)/at_t$.*
$Market\ Leverage_t$	Measured as the book value of total debt scaled by the market value of total assets. Compustat: $(dlc_t + dltt_t)/(prcc\_f_t * csho_t + at_t - ceq_t)$.*
$Net\ Market\ Leverage_t$	Measured as the book value of total debt less cash holdings scaled by the market value of total assets. Compustat: $(dlc_t + dltt_t)/(prcc\_f_t * csho_t + at_t - ceq_t)$.*

Key Independent Variables	
IDD	Equal to 1 if the firm is headquartered in a state that has adopted the IDD, and 0 otherwise.
IDD Rejection	Equal to 1 (beginning from the rejection year) if the firm is headquartered in a state that has rejected a previously recognized IDD, and 0 otherwise.
IDD Adoption (−j)	Equal to 1 if the firm is headquartered in a state that adopts the IDD in j years ($j \in \{0, 1, 2, 3\}$), and 0 otherwise.
IDD Adoption (l)	Equal to 1 if the firm is headquartered in a state that adopted the IDD l years ago ($l \in \{1, 2, 3+\}$), and 0 otherwise.
Other Controls	
$Log(Assets)_{t-1}$	The natural logarithm of total assets adjusted for inflation. Compustat: $ln(at_{t-1}/deflator)$.*
ROA_{t-1}	Measured as operating income before depreciation scaled by total assets. Compustat: $oibdp_{t-1}/at_{t-1}$.*
$Cash\ Holding_{t-1}$	Measured as cash and short-term investments scaled by total assets. Compustat: che_{t-1}/at_{t-1}.*
$Cash\ Flow_{t-1}$	Measured as the sum of income before extraordinary items and depreciation and amortization scaled by total assets. Compustat: $(ib_{t-1} + dp_{t-1})/at_{t-1}$.*
$State\ GDP\ Growth_{t-1}$	Measured as the annual GDP growth rate in the state.
$Political\ Balance_{t-1}$	Measured as the ratio of a state's Congress members belonging to the Democratic party in the US House of Representatives.
$Strength\ of\ CNC_t$	Index ranges from 0 to 12 and is constructed based on Garmaise (2011) and Ertimur et al. (2018). Higher values of the index indicate stronger enforcement of not to compete covenants.
$State\ RTW\ Law_t$	Equal to 1 if the firm is headquartered in a state that has adopted right-to-work laws, and 0 otherwise.

* Final value is winsorized at 2% and 98% levels.

Table 1: Paramater Values for Quantitative Exercise

Note: This table reports parameters values used in the quantitative exercise described in Section 2.4. Model details are presented in Section 2. Details on parameter estimation are presented in Appendix Section B.

Parameter	Value	Source
A	79	Avg. TFP for public firms in 2004 from İmrohoroğlu and Tüzel (2014).
σ	0.5	Estimates of equation (A.3) presented in Appendix Section B.
ρ	0.99	Estimates of equation (A.3) presented in Appendix Section B.
α	0.79	Estimates of equation (A.5) presented in Appendix Section B.
β	0.47	Estimates of equation (A.7) presented in Appendix Section B.
$\underline{s}$	2.30	Estimates of equation (A.9) presented in Appendix Section B.
$\bar{s}$	0.06	Estimates of equation (A.9) presented in Appendix Section B.
$\bar{L}$	22.64	Ratio of the size of the labor force that is not employed in rural areas or government divided by the number of civilian non-rural establishments. Values from the 2004 Census Statistics of US Businesses.
N_I	0.52	Share of establishments in states that have either not adopted or rejected an IDD according to the 2004 County Business Patterns data.
N_N	0.48	Share of establishments in states that have adopted an IDD according to the 2004 County Business Patterns data.
r	10.6	2004's User Cost of Capital from De Loecker et al. (2020).
δ	0.38	Implied annual interest rate of 5% from Shimer (2005).

Table 2: Equilibrium Prices and Quantities: Pre- vs. Post-IDD

Note: This table reports the equilibrium prices and quantities obtained through the quantitative exercise described in Section 2.4. Model details are presented in Section 2, while parameter values are presented in Table 1. Details on parameter estimation are presented in Appendix Section B.

Value	**Pre-IDD**	**Post-IDD**	**% Change**
Capital Demand by Firm in Sector I (k_I)	6.54	6.62	1.22%
Capital Demand by Firm in Sector N (k_N)	6.54	6.45	-1.38%
Wages for Young Workers in Sector I (w_I^Y)	5.46	5.75	5.31%
Wages for Young Workers in Sector N (w_N^Y)	5.46	5.435	-0.46%
Wages for Old Workers in Sector I (w_I^O, $w_I^{O,R}$)	5.46	4.325	-20.79%
Wages for Old Workers in Sector N (w_N^O)	5.46	5.405	-1.01%
Young Worker Demand by Firm in Sector I (l_I^Y)	5.66	7.105	25.53%
Young Worker Demand by Firm in Sector N (l_N^Y)	5.66	4.105	-27.47%
Old Worker Demand by Firm in Sector I (l_I^O)	5.66	3.865	-31.71%
Old Worker Demand by Firm in Sector N (l_N^O)	5.66	7.615	34.54%
Profit for Firm in Sector I (π_I)	238.55	242.35	1.59%
Profit for Firm in Sector N (π_N)	238.55	239.535	0.41%

Table 3: State-Level Recognition of the Inevitable Disclosure Doctrine (1977-2011)

Note: This table reports the statewide precedent-setting IDD adoption and rejection event years in the US. The table lists all IDD-related events in the US, whereas our baseline regressions only use events between 1977 and 2011.

State	IDD Adoption Year	IDD Rejection Year
NY	1919	2009
FL	1960	2001
DE	1964	.
MI	1966	2002
NC	1976	.
PA	1982	.
MN	1986	.
NJ	1987	.
IL	1989	.
TX	1993	2003
MA	1994	.
IN	1995	.
IA	1996	.
CT	1996	.
AR	1997	2009
WA	1997	.
GA	1998	.
UT	1998	.
OH	2000	2008
MO	2000	.
KS	2006	.
VA	.	1999
CA	.	2002
MD	.	2004
WI	.	2009
NH	.	2010

Table 4: Summary Statistics for Full Sample: 1977 - 2011

Note: This table reports summary statistics for the key dependent variables, additional dependent variables, and all control variables for the full sample. Our sample begins 5 years before Pennsylvania's IDD adoption, in 1977, and ends 5 years after Kansas' IDD adoption, in 2011. Detailed variable definitions can be found in the Appendix.

Variable	N	Mean	Median	SD	Min	Max
$\text{Capex}_t/\text{Assets}_{t-1}$	106,874	0.0726	0.0450	0.0829	0.0004	0.4089
$\text{Capex}_t/\text{Sales}_{t-1}$	106,874	0.1267	0.0410	0.2780	0.0005	1.6345
Employees_t	106,874	5,024	647	12,115	5	65,300
$\text{Log(Employees}_t)$	106,874	6.4909	6.4723	2.2168	1.6094	11.0867
Capital-Labor Ratio_t	106,874	0.0238	0.0073	0.0580	0.0001	0.3654
Book Leverage_t	106,740	0.2535	0.2038	0.2500	0.0000	1.1513
Market Leverage_t	105,852	0.1835	0.1321	0.1831	0.0000	0.6749
Net Book Leverage_t	106,737	0.0860	0.1132	0.3733	-0.7568	1.0612
Net Market Leverage_t	105,849	0.0856	0.0686	0.2480	-0.5300	0.6367
Sales Growth_t	106,874	0.1336	0.0482	0.4773	-0.6763	2.3298
$\text{R\&D}_t/\text{Assets}_t$	106,858	0.0537	0.0000	0.1033	0.0000	0.4997
$\text{Log(Assets}_{t-1})$	106,874	4.8612	4.7616	2.1093	0.6337	9.6959
Tobin's Q_{t-1}	106,874	2.1131	1.4132	1.9828	0.6231	11.1917
ROA_{t-1}	106,874	0.0259	0.0707	0.2286	-1.0634	0.3648
Book Leverage_{t-1}	106,874	0.2413	0.1965	0.2315	0.0000	1.0114
Cash Holding_{t-1}	106,874	0.1766	0.0860	0.2095	0.0011	0.8187
Cash Flow_{t-1}	106,874	-0.0170	0.0719	0.2952	-1.4111	0.2643
State GDP Growth_{t-1}	106,874	0.0648	0.0625	0.0348	-0.1379	0.3020
Political Balance_{t-1}	106,874	0.5728	0.5789	0.1812	0.0000	1.0000
Strength of CNC_t	106,874	3.7896	4.0000	2.1693	0.0000	9.0000
State RTW Law_t	106,874	0.2883	0.0000	0.4530	0.0000	1.0000

Table 5: IDD Adoption and Capital Investment

Note: In this table we report results from a generalized difference-in-differences regression of capital investment on the indicator for IDD adoption. Our sample covers the period from 1977 to 2011 and includes all state IDD adoptions between 1982 and 2006. The dependent variable in columns (1), (2), and (3) is $Capital\ Investment_t$, defined as Capex scaled by lagged assets. IDD_t is an indicator variable equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parentheses.

	Capital Investment$_t$		
	(1)	(2)	(3)
IDD$_t$	0.0026*	0.0025**	0.0025**
	(0.0013)	(0.0012)	(0.0012)
Log(Assets)$_{t-1}$	-0.0115***	-0.0115***	-0.0115***
	(0.0009)	(0.0009)	(0.0009)
Tobin's Q$_{t-1}$	0.0088***	0.0088***	0.0088***
	(0.0005)	(0.0005)	(0.0005)
ROA$_{t-1}$	0.0172***	0.0172***	0.0172***
	(0.0022)	(0.0022)	(0.0022)
Book Leverage$_{t-1}$	-0.0368***	-0.0369***	-0.0369***
	(0.0039)	(0.0039)	(0.0039)
Cash Holding$_{t-1}$	0.0065*	0.0064*	0.0064*
	(0.0034)	(0.0034)	(0.0034)
Cash Flow$_{t-1}$	0.0187***	0.0187***	0.0187***
	(0.0032)	(0.0032)	(0.0032)
State GDP Growth$_{t-1}$		0.0548***	0.0548***
		(0.0124)	(0.0124)
Political Balance$_{t-1}$		0.0036	0.0036
		(0.0025)	(0.0025)
Strength of CNC$_t$		-0.0001	-0.0001
		(0.0008)	(0.0008)
State RTW Law$_t$		0.0071*	0.0071*
		(0.0039)	(0.0039)
Observations	106,874	106,874	106,874
R^2	0.6315	0.6317	0.6317
Firm Controls	YES	YES	YES
State Controls	NO	YES	YES
Firm FE	YES	NO	YES
Industry-Year FE	YES	YES	YES
State FE	NO	NO	YES
Clustered by:	State	State	State

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 6: IDD and Capital-Labor Substitution

Note: In this table we report results from a generalized difference-in-differences regression of capital-labor substitution measures on the indicator for IDD adoption. Our sample covers the period from 1977 to 2011. The dependent variables are Log(Employees), Capex/Lag Assets, and the Capital-Labor Ratio. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Log(Employees)$_t$ (1)	Capital Investment$_t$ (2)	Capital-Labor Ratio$_t$ (3)
IDD$_t$	-0.0067	0.0025**	0.0013**
	(0.0152)	(0.0012)	(0.0005)
Observations	106,874	106,874	106,874
R^2	0.9692	0.6317	0.8157
Firm Controls	YES	YES	YES
State Controls	YES	YES	YES
Firm FE	YES	YES	YES
Industry-Year FE	YES	YES	YES
State FE	YES	YES	YES
Clustered by:	State	State	State

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 7: IDD, Labor Intensity, and Capital-Labor Substitution

Note: In this table we report results from a generalized difference-in-differences regression of capital-labor substitution measures on the indicator for IDD adoption and labor intensity. Our sample covers the period from 1977 to 2011. The dependent variables are Log(Employees), Capex/Lag Assets, and the Capital-Labor Ratio. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. We use BEA data at the 3-digit NAICS industry level and measure labor intensity as capital stock scaled by total employment. Low labor intensity is an indicator variable that is equal to 1 if the industry's labor intensity is below the sample median, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Log(Employees)$_t$ (1)	Capital Investment$_t$ (2)	Capital-Labor Ratio$_t$ (3)
IDD$_t$ × High Labor Intensity	0.0005	0.0022	0.0004
	(0.0255)	(0.0022)	(0.0011)
IDD$_t$ × Low Labor Intensity	-0.0008	0.0034*	0.0019**
	(0.0234)	(0.0020)	(0.0008)
Observations	88,766	88,766	88,766
R-squared	0.9689	0.6249	0.8237
Firm Controls	YES	YES	YES
State Controls	YES	YES	YES
Firm FE	YES	YES	YES
Industry-Year FE	YES	YES	YES
State FE	YES	YES	YES
Clustered by:	State	State	State

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 8: IDD, Human Capital Intensity (Extensive Margin) & Capital-Labor Substitution

Note: In this table we report results from a generalized difference-in-differences regression of capital-labor substitution measures on the indicator for IDD adoption and human capital intensity at the extensive margin. Our sample covers the period from 1977 to 2011. The dependent variables are Log(Employees), Capex/Lag Assets, and the Capital-Labor Ratio. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. We use Census and ACS data at the 3-digit SIC industry level and measure human capital intensity at the extensive margin as the share of workers with a BA degree or more. High human capital intensity is an indicator variable that is equal to 1 if the industry's human capital intensity is above the sample 75th percentile, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Log(Employees)$_t$	Capital Investment$_t$	Capital-Labor Ratio$_t$
	(1)	(2)	(3)
IDD$_t$ × High Human Capital Intensity	0.0031	0.0035**	0.0018**
	(0.0197)	(0.0015)	(0.0007)
IDD$_t$ × Low Human Capital Intensity	-0.0253	0.0000	0.0004
	(0.0276)	(0.0024)	(0.0008)
Observations	99,853	99,853	99,853
R^2	0.9701	0.6354	0.8226
Firm Controls	YES	YES	YES
State Controls	YES	YES	YES
Firm FE	YES	YES	YES
Industry-Year FE	YES	YES	YES
State FE	YES	YES	YES
Clustered by:	State	State	State

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 9: IDD, Human Capital Intensity (Intensive Margin) & Capital-Labor Substitution

Note: In this table we report results from a generalized difference-in-differences regression of capital-labor substitution measures on the indicator for IDD adoption and human capital intensity at the intensive margin. Our sample covers the period from 1977 to 2011. The dependent variables are Log(Employees), Capex/Lag Assets, and the Capital-Labor Ratio. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. We use Census and ACS data at the 3-digit SIC industry level and measure human capital intensity at the intensive margin as the share of usual weekly hours by workers with a college degree or more. High human capital intensity is an indicator variable that is equal to 1 if the industry's human capital intensity is above the sample 75th percentile, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Log(Employees)_t (1)	$\text{Capital Investment}_t$ (2)	$\text{Capital-Labor Ratio}_t$ (3)
$\text{IDD}_t \times$ High Human Capital Intensity	-0.0005	0.0043***	0.0020***
	(0.0209)	(0.0016)	(0.0007)
$\text{IDD}_t \times$ Low Human Capital Intensity	-0.0171	-0.0014	-0.0000
	(0.0239)	(0.0020)	(0.0007)
Observations	99,853	99,853	99,853
R-squared	0.9701	0.6355	0.8226
Firm Controls	YES	YES	YES
State Controls	YES	YES	YES
Firm FE	YES	YES	YES
Industry-Year FE	YES	YES	YES
State FE	YES	YES	YES
Clustered by:	State	State	State

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 10: Financing Capital Investment Around IDD Adoption

Note: In this table we report results from a generalized difference-in-differences regression of financing measures on the indicator for IDD adoption. Our sample covers the period from 1977 to 2011. The dependent variables are Book Leverage, Market Leverage, Net Book Leverage, and Net Market Leverage. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. Detailed variable definitions for all dependent and control variables can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Book Leverage$_t$	Market Leverage$_t$	Net Book Leverage$_t$	Net Market Leverage$_t$
	(1)	(2)	(3)	(4)
IDD$_t$	0.0130***	0.0103***	0.0143***	0.0134***
	(0.0044)	(0.0033)	(0.0043)	(0.0041)
Log(Assets)$_{t-1}$	0.0132***	0.0296***	0.0256***	0.0281***
	(0.0049)	(0.0035)	(0.0044)	(0.0046)
Tobin's Q$_{t-1}$	0.0041***	-0.0068***	0.0027**	0.0044***
	(0.0009)	(0.0009)	(0.0011)	(0.0011)
ROA$_{t-1}$	-0.0375***	-0.0347***	-0.0551***	-0.0394***
	(0.0111)	(0.0053)	(0.0131)	(0.0088)
Cash Holding$_{t-1}$	-0.2473***	-0.1526***	-0.6979***	-0.4035***
	(0.0099)	(0.0077)	(0.0131)	(0.0157)
Cash Flow$_{t-1}$	-0.1429***	-0.0534***	-0.1442***	-0.0561***
	(0.0144)	(0.0097)	(0.0152)	(0.0084)
State GDP Growth$_{t-1}$	0.0032	-0.0681**	0.0100	-0.0443
	(0.0364)	(0.0319)	(0.0468)	(0.0347)
Political Balance$_{t-1}$	0.0142	-0.0010	0.0046	-0.0077
	(0.0113)	(0.0075)	(0.0136)	(0.0100)
Strength of CNC$_t$	0.0004	0.0019	0.0004	0.0033
	(0.0035)	(0.0024)	(0.0039)	(0.0030)
State RTW Law$_t$	0.0063	-0.0028	0.0229	0.0121
	(0.0312)	(0.0144)	(0.0364)	(0.0223)
Observations	106,719	105,661	106,716	105,658
R^2	0.6941	0.7514	0.7723	0.7723
Firm Controls	YES	YES	YES	YES
State Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Clustered by:	State	State	State	State

Table 11: Timing of Capital Investment Around IDD Adoption

Note: In this table we report results from a generalized difference-in-differences regression of capital-labor substitution measures on indicators for the timing of IDD adoption or rejection by states. Our sample covers the period from 1977 to 2011. The dependent variables are Log(Employees), Capex/Lag Assets, and the Capital-Labor ratio. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Log(Employees)$_t$	Capital Investment$_t$	Capital-Labor Ratio$_t$
	(1)	(2)	(3)
IDD Adoption (-3)	0.0034	0.0011	0.0004
	(0.0150)	(0.0018)	(0.0009)
IDD Adoption (-2)	0.0102	-0.0003	0.0008
	(0.0199)	(0.0015)	(0.0010)
IDD Adoption (-1)	0.0086	0.0023	0.0006
	(0.0191)	(0.0018)	(0.0010)
IDD Adoption (0)	-0.0058	0.0040**	0.0015*
	(0.0225)	(0.0019)	(0.0008)
IDD Adoption (+1)	-0.0011	0.0019	0.0011
	(0.0217)	(0.0022)	(0.0010)
IDD Adoption (+2)	0.0004	0.0022	0.0017*
	(0.0245)	(0.0018)	(0.0010)
IDD Adoption (3+)	-0.0031	0.0033*	0.0018**
	(0.0233)	(0.0018)	(0.0007)
Observations	106,874	106,874	106,874
R^2	0.9692	0.6317	0.8157
Firm Controls	YES	YES	YES
State Controls	YES	YES	YES
Firm FE	YES	YES	YES
Industry-Year FE	YES	YES	YES
State FE	YES	YES	YES
Clustered by:	State	State	State

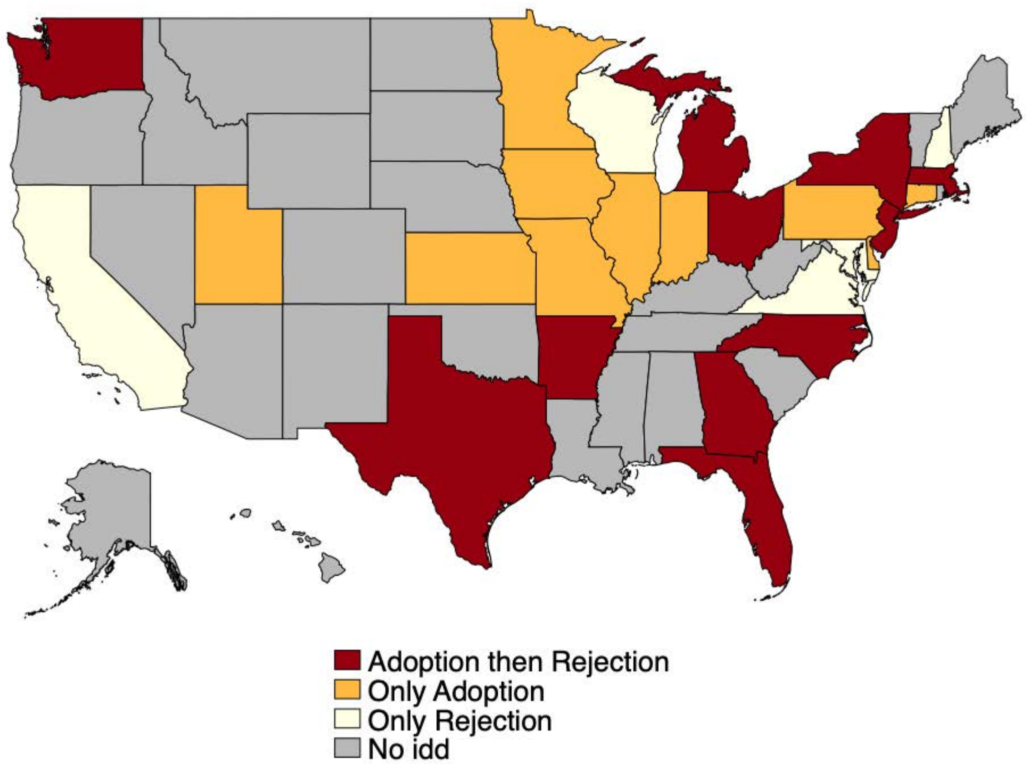
Table 12: IDD, Growth, and Profitability

Note: In this table we report results from a generalized difference-in-differences regression of growth prospects on the indicator for IDD adoption. Our sample covers the period from 1977 to 2011. The dependent variables are Sales Growth, Q, R&D scaled by assets, and ROA. IDD is an indicator variable that is equal to 1 if the headquarters of the firm is located in a state that recognizes the IDD, and 0 otherwise. Detailed variable definitions can be found in the Appendix. We adjust dollar values for inflation and report in 2009 dollars. All continuous variables (except state-level variables) are winsorized at the 2% and 98% levels. We use 3-digit SIC industries to calculate industry fixed effects. Finally, we cluster at the state level and report heteroskedasticity-consistent standard errors in parenthesis.

	Sales Growth_t	Tobin's Q_t	$\text{R\&D}_t$	ROA_t
	(1)	(2)	(3)	(4)
IDD_t	0.0036	0.0228	0.0024*	-0.0021
	(0.0086)	(0.0195)	(0.0013)	(0.0023)
Missing $\text{R\&D}_t$			-0.0385***	
			(0.0052)	
Observations	106,874	104,911	106,852	106,874
R^2	0.3722	0.7335	0.8237	0.7974
Firm Controls	YES	YES	YES	YES
State Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Clustered by:	State	State	State	State

Figure 1: US Statewide Distribution of IDD Events: 1919 - 2019

Note: In this figure we depict the evolution of the inevitable disclosure doctrine policy for each state in the United States. This includes states that have only adopted the IDD, states that have adopted and then rejected the IDD, states that have rejected the IDD without ever adopting it, and states that have never adopted or rejected an IDD. The figure depicts all IDD-related events in the US. Our subsequent baseline regressions only consider IDD events between 1977 and 2011.



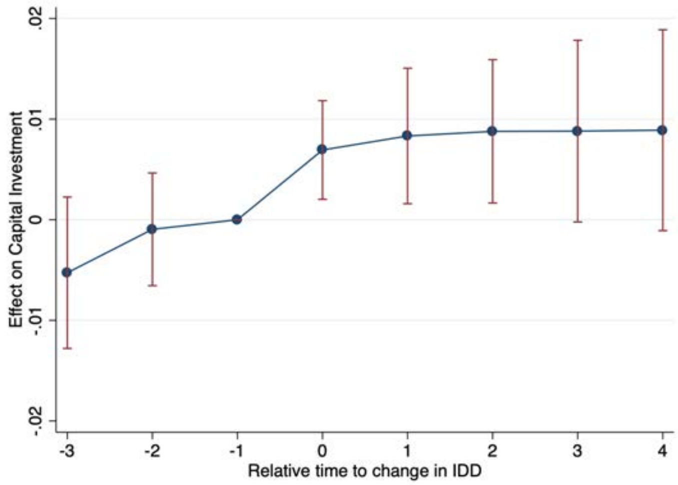
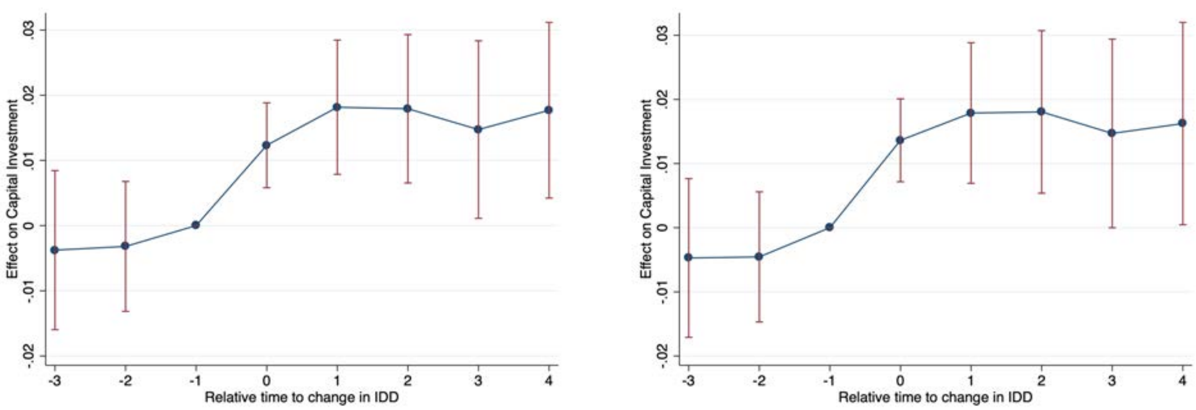


Figure 2: Effect of IDD Adoption over Capital Investment after t years

Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on the capital expenditure scaled by the previous year total assets at the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's number of employees, winsorized at the 2% level in both tails.



(a) Extensive Margin

(b) Intensive Margin

Figure 3: Effect of IDD Adoption on Capital Investment – Human-Capital-Intensive Industries

Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on capital expenditure scaled by the previous year total assets in the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's number of employees, winsorized at the 2% level in both tails.

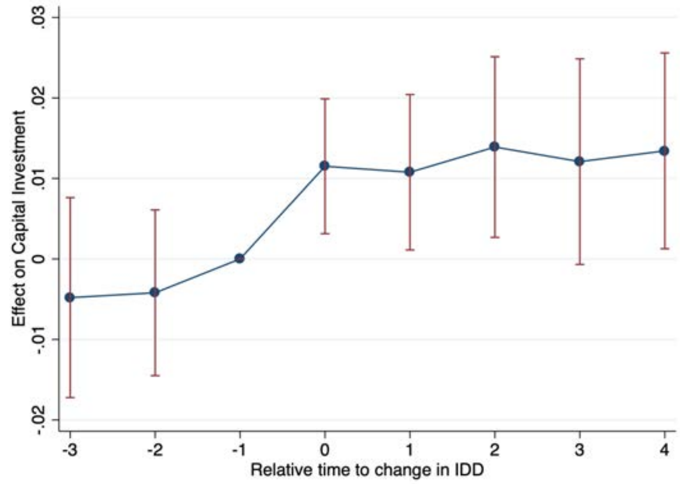
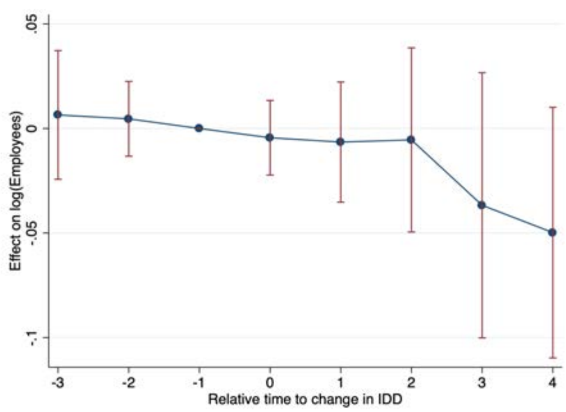
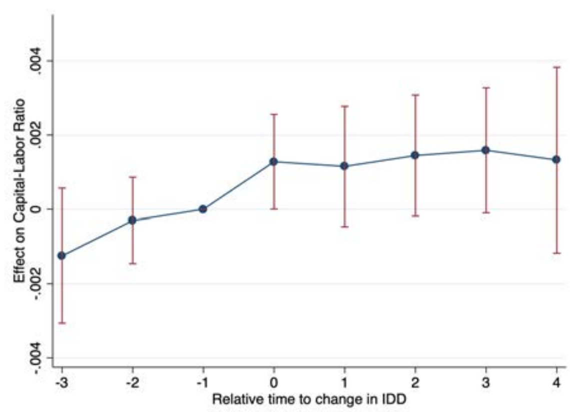


Figure 4: Effect of IDD Adoption on Capital Investment - Low-Labor-Intense Industries

Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on capital expenditure scaled by the previous year total assets in the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's number of employees, winsorized at the 2% level in both tails.



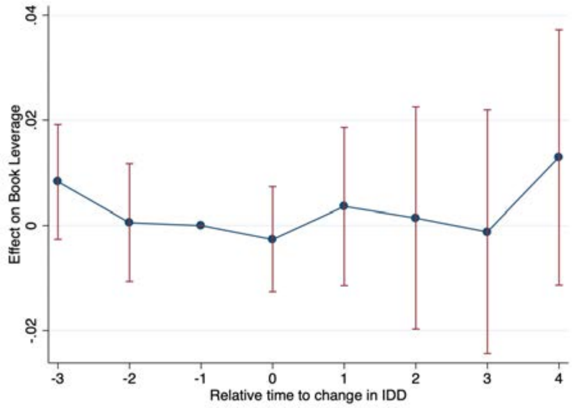
(a) Employment Levels



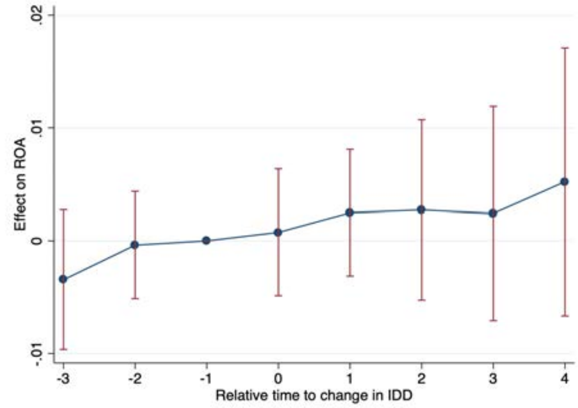
(b) Capital-Labor Ratio

Figure 5: Effect of IDD Adoption on Employment and Capital-Labor Ratio

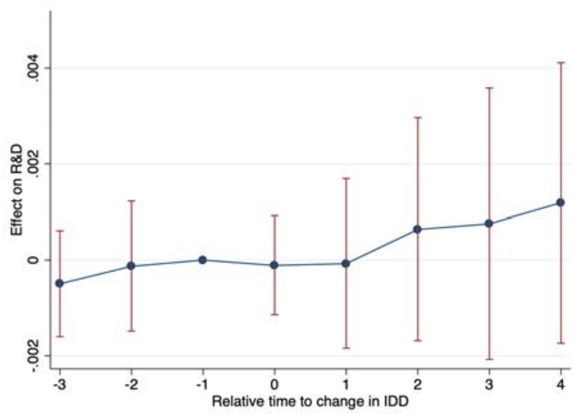
Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on capital expenditure scaled by the previous year total assets in the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's log(total assets) – panel a – and number of employees – panel b – both winsorized at the 2% level in both tails.



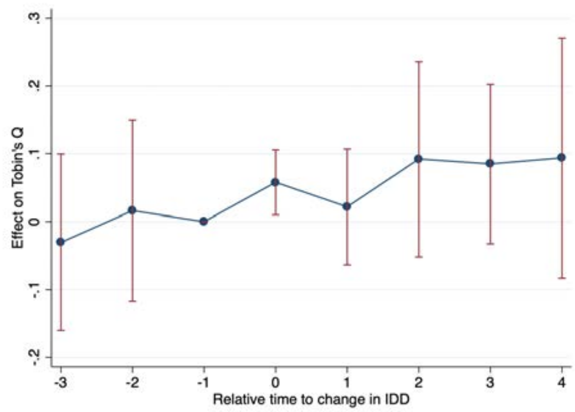
(a) Book Leverage



(b) ROA



(c) R&D



(d) Tobin's Q

Figure 6: Effect of IDD Adoption: Leverage, ROA, R&D, and Tobin's Q

Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on capital expenditure scaled by the previous year total assets in the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's number of employees, winsorized at the 2% level in both tails.

Appendix

A Entry and Exit Decisions

We can endogenize N_I and N_N in a straightforward way. In particular, consider that there is a measure $\overline{N}$ of potential entrants in each sector. Assume that firms are heterogeneous in their cost of entry. We assume that different firms have either different opportunity costs or different degrees of access to financial markets.[16] Entry costs are given by a Uniform distribution with support $[\underline{c}, \bar{c}]$. Then given profit values π_I and π_N, we have that the threshold costs $\bar{c}_I$ and $\bar{c}_N$ are given by:

$$\frac{\pi_j}{1-\delta} - \frac{\bar{c}_j}{1-\delta} = 0 \quad \forall j \in \{I, N\} \tag{A.1}$$

where π_j is the per-period profit in sector j. Consequently, we have that the equilibrium measure of firms in sector $j \in \{I, N\}$ is given by:

$$N_j = \overline{N} \times \frac{\bar{c}_j - \underline{c}}{\bar{c} - \underline{c}}, \quad \forall j \in \{I, N\} \tag{A.2}$$

B Estimation of Parameter Values

B.1 Production Function Parameters

In this section, we briefly describe the estimation of parameter values. For more details on the equations' derivation, please see Online Appendix Section A. We start by determining σ and ρ. From the first-order conditions for the N-sector firm, we obtain the following equation:

$$l^O_{N,t} = \left[\left(\frac{1-\sigma}{\sigma} \right) \frac{w^Y_{N,t}}{w^O_{N,t}} \right]^{\frac{1}{1-\rho}} l^Y_{N,t}$$

Because this equation is valid for every firm due to our focus on homogeneous equilibria, we can replace the labor demands by their aggregate counterparts. Then, taking the natural logarithm of both sides, we have:

$$\ln \left(\frac{L^O_{N,t}}{L^Y_{N,t}} \right) = \frac{1}{1-\rho} \ln \left(\frac{1-\sigma}{\sigma} \right) + \frac{1}{1-\rho} \ln \left(\frac{w^Y_{N,t}}{w^O_{N,t}} \right)$$

Defining:

$$\mathbf{a}_\rho = \frac{1}{1-\rho} \ln \left(\frac{1-\sigma}{\sigma} \right) \text{ and } \mathbf{b}_\rho = \frac{1}{1-\rho}$$

[16] An alternative way would consider that firms are heterogeneous in their total factor productivity A. However, this approach would make the model significantly more difficult without changing the intuition of our main results in a meaningful way.

we have:

$$\ln\left(\frac{L^O_{N,t}}{L^Y_{N,t}}\right) = \mathbf{a}_\rho + \mathbf{b}_\rho \ln\left(\frac{w^Y_{N,t}}{w^O_{N,t}}\right) \tag{A.3}$$

We estimate the parameters from equation (A.3) using data from the 1990 and 2000 Census (5% state sample) and the 2009-2011 American Community Survey (ACS) obtained through IPUMS (see Ruggles et al. (2021)). In particular, we estimate a state-level regression of the ratio of employed workers ages 40-54 (old workers) and workers ages 25-39 (young workers) over the ratio of their respective average residual wages. The average residual wages are obtained by regressing total pre-tax wage and income salary (INCWAGE from IPUMS), deflated by the CPI headline index, against worker characteristics (race, gender, marital status, education, tenure proxied by age and age^2, ethnicity, citizenship status), and industry dummies. To determine the residual average wages by state and age groups, we regress the residuals on a dummy for young workers (25–39 years old) and state dummies for the sample of prime-age workers. Both regressions use the personal weights from IPUMS (PERWT). Our regressions focus on states that have neither adopted nor rejected an IDD over time.

Once we have estimates $\hat{\mathbf{a}}_\rho$ and $\hat{\mathbf{b}}_\rho$, we calculate indirect estimates of ρ and σ as:

$$\hat{\rho} = \frac{\hat{\mathbf{b}}_\rho - 1}{\hat{\mathbf{b}}_\rho} \qquad \text{and} \qquad \hat{\sigma} = \frac{1}{1 + \exp\left(\frac{\hat{\mathbf{a}}_\rho}{\hat{\mathbf{b}}_\rho}\right)} \tag{A.4}$$

Similarly, from the N-sector firm's profit maximization first-order conditions, considering again the aggregated version, we have:

$$K_{N,t} = \left(\frac{w^Y_{N,t}}{r_t \sigma}\right)^{\frac{1}{1-\alpha}} \Phi_{N,t}^{\frac{\rho-\alpha}{\rho(1-\alpha)}} L^Y_{N,t}$$

where $\Phi_{N,t} = \sigma + (1-\sigma)\left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_{N,t}}{w^O_{N,t}}\right]^{\frac{1}{1-\rho}}$. Rearranging and taking the natural logarithm, we have:

$$\ln\left(\frac{K_{N,t}}{L^Y_{N,t}}\right) = \frac{1}{1-\alpha}\ln\left(\frac{\Phi_{N,t}^{\frac{\rho-\alpha}{\rho}}}{\sigma}\right) + \frac{1}{1-\alpha}\ln\left(\frac{w^Y_{N,t}}{r_t}\right)$$

Because $\Phi_{N,t} = \sigma + (1-\sigma)\left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_{N,t}}{w^O_{N,t}}\right]^{\frac{1}{1-\rho}}$ we can construct this variable based on our previous estimates. Then, we can rewrite the above expression as:

$$\ln\left(\frac{K_{N,t}}{L^Y_{N,t}}\right) = -\frac{1}{1-\alpha}\ln\sigma + \frac{\rho-\alpha}{\alpha(1-\alpha)}\ln\hat{\Phi}_{N,t} + \frac{1}{1-\alpha}\ln\left(\frac{w^Y_{N,t}}{r_t}\right)$$

Again, defining:

$$\mathbf{a}_\alpha = -\frac{1}{1-\alpha}\ln\sigma \qquad \text{and} \qquad \mathbf{b}_\alpha = \frac{\rho-\alpha}{\alpha(1-\alpha)} \qquad \text{and} \qquad \mathbf{c}_\alpha = \frac{1}{1-\alpha}$$

as a result, we have:

$$\ln\left(\frac{K_{N,t}}{L^Y_{N,t}}\right) = \mathbf{a}_\alpha + \mathbf{b}_\alpha \ln\hat{\Phi}_{N,t} + \mathbf{c}_\alpha \ln\left(\frac{w^Y_{N,t}}{r_t}\right) \tag{A.5}$$

To estimate equation (A.5), we determine r_t through the user cost of capital as presented by De Loecker and Eeckhout (2017). Further, we proxy $K_{N,t}$ with Compustat's total gross *Property, Plant and Equipment* (PPEGT) deflated by the relative price of investment goods (see DiCecio (2009)) obtained through the Federal Reserve Bank of St. Louis' FRED website.[17] We attribute each firm's PPEGT to the state where the firm's HQ is located and take statewide averages. Finally, residual wages and employment totals are calculated following the same process as previously presented. Similarly, estimated values for σ are obtained from the estimates of equation (A.3) and the calculations presented in equation (A.4). Because we have generated regressors, we bootstrap our estimates 1,000 times.

Given an estimate $\hat{\mathbf{c}}_\alpha$ we can indirectly estimate $\hat{\alpha}$ as:

$$\hat{\alpha} = \frac{\hat{\mathbf{c}}_\alpha - 1}{\hat{\mathbf{c}}_\alpha} \tag{A.6}$$

Finally, to determine β, recall the expression for $l^Y_{N,t}$ (equation (I.A.16) in the Online Appendix Section A), and again assuming a homogeneous equilibrium, we have:

$$L^Y_{N,t} = \left\{\left(\frac{A\beta\sigma}{w^Y_{N,t}}\right)\left[\left(\frac{w^Y_{N,t}}{r_t\sigma}\right)^{\frac{\alpha}{1-\alpha}} \Phi_{N,t}^{\frac{(\rho-\alpha)\alpha}{\rho(1-\alpha)}} + \Phi_{N,t}^{\frac{\alpha}{\rho}}\right]^{\frac{\beta}{\alpha}-1} \Phi_{N,t}^{\frac{\alpha}{\rho}-1}\right\}^{\frac{1}{1-\beta}}$$

Taking the natural logarithm of both sides and rearranging yields:

$$\ln L^Y_{N,t} = \frac{1}{1-\beta}\ln(A\beta\sigma) + \frac{\alpha-\rho}{\rho(1-\beta)}\ln\hat{\Phi}_{N,t} - \frac{1}{1-\beta}\ln w^Y_{N,t} + \frac{\beta-\alpha}{\alpha(1-\beta)}\ln\left[\left(\frac{w^Y_{N,t}}{r_t\hat{\sigma}}\right)^{\frac{\hat{\alpha}}{1-\hat{\alpha}}} \hat{\Phi}_{N,t}^{\frac{(\hat{\rho}-\hat{\alpha})\hat{\alpha}}{\hat{\rho}(1-\hat{\alpha})}} + \hat{\Phi}_{N,t}^{\frac{\hat{\alpha}}{\hat{\rho}}}\right]$$

Again, define:

$$\mathbf{a}_\beta = \frac{1}{1-\beta}\ln(A\beta\sigma) \quad \text{and} \quad \mathbf{b}_\beta = \frac{\alpha-\rho}{\rho(1-\beta)} \quad \text{and} \quad \mathbf{c}_\beta = -\frac{1}{1-\beta} \quad \text{and} \quad \mathbf{d}_\beta = \frac{\beta-\alpha}{\alpha(1-\beta)}$$

Consequently, we have:

$$\ln L^Y_{N,t} = \mathbf{a}_\beta + \mathbf{b}_\beta \ln\hat{\Phi}_{N,t} + \mathbf{c}_\beta \ln w^Y_{N,t} + \mathbf{d}_\beta \ln\left[\left(\frac{w^Y_{N,t}}{r_t\hat{\sigma}}\right)^{\frac{\hat{\alpha}}{1-\hat{\alpha}}} \hat{\Phi}_{N,t}^{\frac{(\hat{\rho}-\hat{\alpha})\hat{\alpha}}{\hat{\rho}(1-\hat{\alpha})}} + \hat{\Phi}_{N,t}^{\frac{\hat{\alpha}}{\hat{\rho}}}\right] \tag{A.7}$$

We analogously construct our regressors in a manner similar to the development in equations (A.3) and (A.5). Further, because we employ generated regressors, we bootstrap our results through 1,000 repetitions. Based on the estimation of equation (A.7), we determine $\hat{\beta}$ as:

[17] `https://fred.stlouisfed.org/series/PIRIC`

$$\hat{\beta} = \frac{1 + \hat{\mathbf{c}}_\beta}{\hat{\mathbf{c}}_\beta} \tag{A.8}$$

B.2 Switching Cost Parameters

We now consider the parameters $\underline{s}$ and $\bar{s}$ from the switching cost distribution. From the aggregate counterpart of the sector I firm's problem, we have:

$$\frac{L^O_{I,t}}{L^Y_{I,t}} = \frac{\bar{s}}{\bar{s} - \underline{s}} - \frac{1}{\bar{s} - \underline{s}} \left(w^O_{N,t} - w^{O,R}_{I,t} \right)$$

where $\left(w^O_{N,t} - w^{O,R}_{I,t} \right)$ matches the wage gap between sector N and I for older workers.

Define:

$$\mathbf{a_s} = \frac{\bar{s}}{\bar{s} - \underline{s}} \qquad \text{and} \qquad \mathbf{b_s} = -\frac{1}{\bar{s} - \underline{s}}$$

As a result:

$$\frac{L^O_{I,t}}{L^Y_{I,t}} = \mathbf{a_s} + \mathbf{b_s} \left(w^O_{N,t} - w^{O,R}_{I,t} \right) \tag{A.9}$$

Analogously to our discussion of equation (A.3), we consider the residual wages averaged by state for the age group 40–59 years old. Because we are unable to see where these workers were employed, we proxy $w^{O,R}_{I,t}$ by the average wage residual in states in which an IDD was adopted. Similarly, we determine $\frac{L^O_{I,t}}{L^Y_{I,t}}$ as the ratio of total young (25-39 years old) and old (40-54 years old) employed workers in states that adopted an IDD. Finally, we include year dummies to control for changes over time.

Once we estimate equation (A.9), we have:

$$\hat{\bar{s}} = -\frac{\hat{\mathbf{a}}_\mathbf{s}}{\hat{\mathbf{b}}_\mathbf{s}} \qquad \text{and} \qquad \hat{\underline{s}} = \frac{1 - \hat{\mathbf{a}}_\mathbf{s}}{\hat{\mathbf{b}}_\mathbf{s}} \tag{A.10}$$

To determine $\hat{\bar{s}}$ and $\hat{\underline{s}}$, we consider the 2010 time dummy coefficient as a component of the intercept to fix the most recent period as our benchmark.

B.3 Free-Entry Parameters

In order to pin down $\underline{c}$ and $\bar{c}$, we first notice that from (A.1), we have that $\pi_{j,t} = \bar{c}_{j,t}$. Then, substituting $\bar{c}_{j,t}$ into equation (A.2), and considering the difference between two periods – before and after a shock that induced entry or exit – we have:

$$N_{j,t+1} - N_{j,t} = \frac{\bar{c}_{j,t+1} - \bar{c}_{j,t}}{\bar{c} - \underline{c}} \tag{A.11}$$

taking the natural logarithm in both sides, we have:

$$\ln \left(N_{j,t+1} - N_{j,t} \right) = -\ln(\bar{c} - \underline{c}) + \ln \left(\pi_{j,t+1} - \pi_{j,t} \right) \tag{A.12}$$

Then, define $\mathbf{a}_\pi = -\ln(\bar{c} - \underline{c})$ and setting $\mathbf{b}_\pi = 1$, we can run a regression of changes in the number of establishments (based on CBP data) against profits, as calculated by Barkai (2020), while fixing the slope to $\mathbf{b}_\pi = 1$.[18] Once we pin down $\hat{\mathbf{a}}_\pi$, we can pin down $\underline{c}$ as:

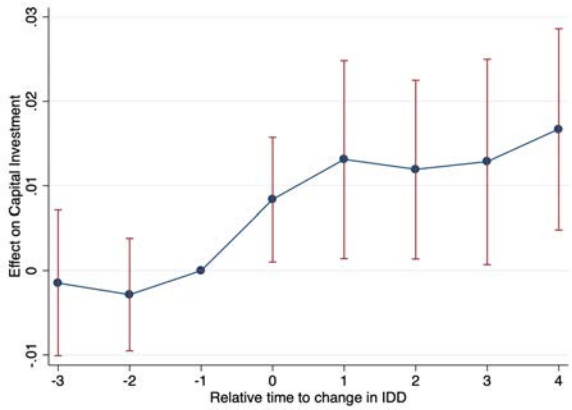
$$\hat{\underline{c}} = \pi_{j,t} - \frac{N_{j,t}}{\exp \hat{\mathbf{a}}_\pi} \tag{A.13}$$

while $\hat{\bar{c}}$ can be pinned down as:

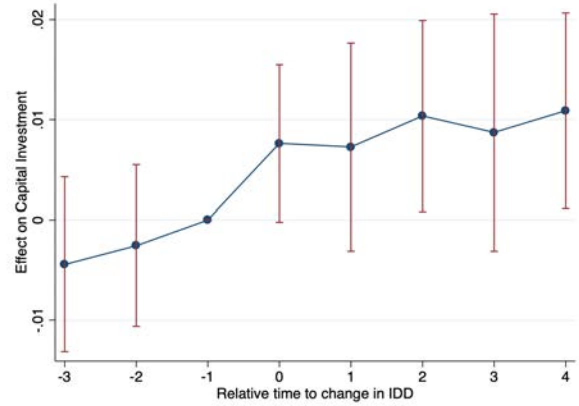
$$\hat{\bar{c}} = \frac{1 + \hat{\underline{c}} \exp \hat{\mathbf{a}}_\pi}{\exp \hat{\mathbf{a}}_\pi} \tag{A.14}$$

[18] While we can pin down $\mathbf{a}_\pi$ through a simple ratio, the benefit of a regression approach is to calculate standard errors.

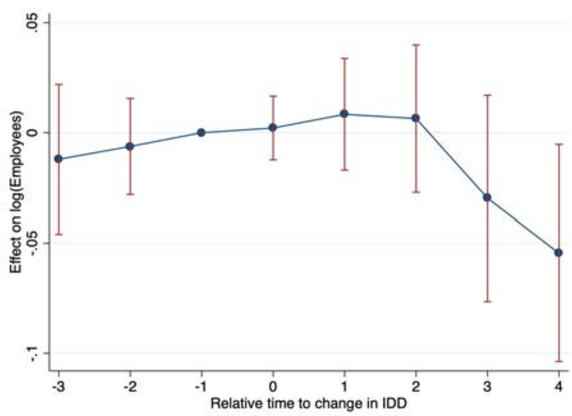
C Additional Results – Adoptions and Reversals Jointly Accounted for



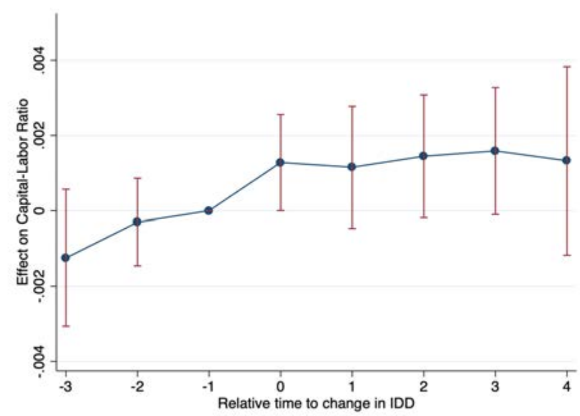
(a) Capital Investment - HC Intensive



(b) Capital Investment - Low Labor Intensive



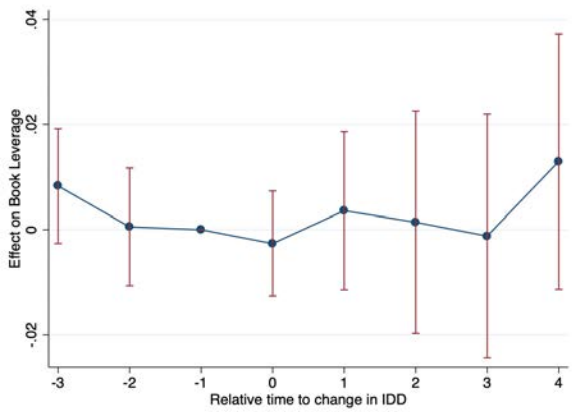
(c) Employment



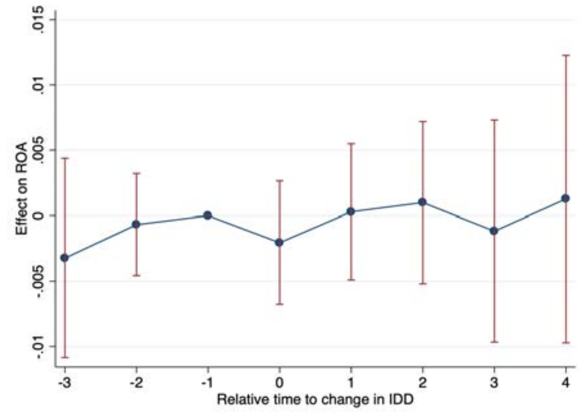
(d) Capital-Labor Ratio

Figure A-1: Effect of IDD adoption: Adoption and Reversals

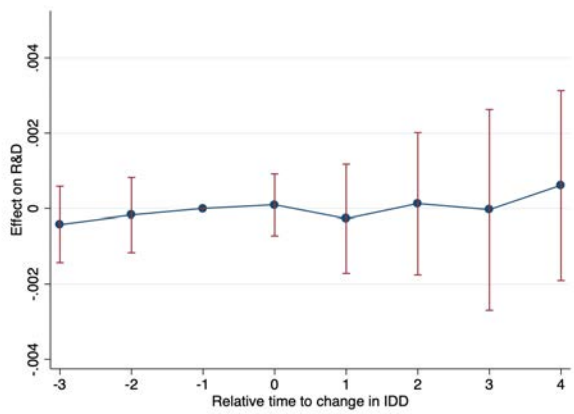
Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on the capital expenditure scaled by the previous year total assets in the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's number of employees, winsorized at the 2% level in both tails.



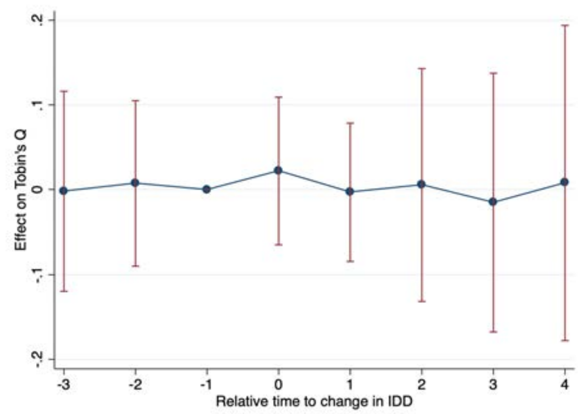
(a) Book Leverage



(b) ROA



(c) R&D



(d) Tobin's Q

Figure A-2: Effect of IDD Adoption: Adoption and Reversals

Note: To the right of zero, the blue line shows the $DID_{+,\ell}$ estimates of the effect of an IDD adoption on capital expenditure scaled by the previous year total assets in the year of the adoption and later years. To the left of zero, the line shows the $DID^{pl}_{+,\ell}$ placebo estimates. Standard errors are estimated using 200 bootstrap replications clustered at the state level. 95% confidence intervals relying on a normal approximation are shown in red. Estimators are weighted by the firm's number of employees, winsorized at the 2% level in both tails.

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Online Appendix to

A Spanner in the Works: Restricting Labor Mobility and the Inevitable Capital-Labor Substitution

A Derivations

A.1 Equilibrium Before an IDD Is Implemented

A.1.1 Worker's Problem

Based on equations (4) and (5), we can show the following results. Proofs are shown in Online Appendix Section B.

Lemma 1. *In an economy in which old workers who spent time in either the I or the N sector when young are perfect substitutes, there is no equilibrium with positive outflows from both sectors.*

Lemma 2. *There is no equilibrium in which both I and N sectors are operating and no old worker is employed in one of the sectors.*

Finally, based on the worker's problem we can restrict the possible equilibria. We summarize our results in the next proposition:

Proposition 4. *Based on the worker's problem, we have 3 possible equilibria:*

1. *A no-outflows equilibrium in which the following equality is satisfied:*

$$w_{I,t}^{Y} - w_{N,t}^{Y} = \delta \left[w_{N,t+1}^{O} - w_{I,t+1}^{O} \right]$$

2. *An equilibrium in which there is an inflow to I in which $w_{I,t}^{Y} < w_{N,t}^{Y}$ and $w_{I,t+1}^{O} > w_{N,t+1}^{O}$*

3. *An equilibrium in which there is an inflow to N in which $w_{I,t}^{Y} > w_{N,t}^{Y}$ and $w_{I,t+1}^{O} < w_{N,t+1}^{O}$*

Consequently, there are only two possible types of equilibria: first, an equilibrium in which workers stay in the same sector all their lives and salaries in both sectors are similar; second, an equilibrium in which one sector is relatively more concentrated on young workers who receive higher wages, while allowing old workers to be poached by the other sector.

A.1.2 Firm's Problem

The first-order conditions are:

$$\begin{cases} A\left\{k_{j,t}^{\alpha} + \left[\sigma(l_{j,t}^{Y})^{\rho} + (1-\sigma)(l_{j,t}^{O})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1} \beta k_{j,t}^{\alpha-1} = r_t & (\mathrm{FOC}_k) \\ A\left\{k_{j,t}^{\alpha} + \left[\sigma(l_{j,t}^{Y})^{\rho} + (1-\sigma)(l_{j,t}^{O})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1} \beta \left[\sigma(l_{j,t}^{Y})^{\rho} + (1-\sigma)(l_{j,t}^{O})^{\rho}\right]^{\frac{\alpha}{\rho}-1} \sigma(l_{j,t}^{Y})^{\rho-1} = w_{j,t}^{Y} & (\mathrm{FOC}_y) \\ A\left\{k_{j,t}^{\alpha} + \left[\sigma(l_{j,t}^{Y})^{\rho} + (1-\sigma)(l_{j,t}^{O})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1} \beta \left[\sigma(l_{j,t}^{Y})^{\rho} + (1-\sigma)(l_{j,t}^{O})^{\rho}\right]^{\frac{\alpha}{\rho}-1} (1-\sigma)(l_{j,t}^{O})^{\rho-1} = w_{j,t}^{O} & (\mathrm{FOC}_o) \end{cases}$$

Then, from (FOC_y) and (FOC_o), we have that:

$$l^O_{j,t} = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_{j,t}}{w^O_{j,t}}\right]^{\frac{1}{1-\rho}} l^Y_{j,t} \tag{I.A.1}$$

and from (FOC_y) and (FOC_k), we have:

$$k_{j,t} = \left\{\frac{w^Y_{j,t}}{r_t\sigma}\left[\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w^Y_{j,t}}{w^O_{j,t}}\right)^{\frac{\rho}{1-\rho}}\right]^{1-\frac{\alpha}{\rho}}\right\}^{\frac{1}{1-\alpha}} l^Y_{j,t} \tag{I.A.2}$$

Finally, from (FOC_y), we have:

$$l^Y_{j,t} = \left\{\begin{array}{c} \frac{A\beta\sigma}{w^Y_{j,t}}\left\{1 + \left(\frac{w^Y_{j,t}}{r_t\sigma}\right)^{\frac{\alpha}{1-\alpha}}\left[\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w^Y_{j,t}}{w^O_{j,t}}\right)^{\frac{\rho}{1-\rho}}\right]^{\frac{\alpha}{\rho}\left(\frac{\rho-1}{1-\alpha}\right)}\right\}^{\frac{\beta}{\alpha}-1} \\ \times\left[\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w^Y_{j,t}}{w^O_{j,t}}\right)^{\frac{\rho}{1-\rho}}\right]^{\frac{\beta}{\rho}-1} \end{array}\right\}^{\frac{1}{1-\beta}} \tag{I.A.3}$$

To simplify notation, we define $\Phi_{j,t}$ as follows:

$$\Phi_{j,t} \equiv \Phi(w^Y_{j,t}, w^O_{j,t}) = \left[\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w^Y_{j,t}}{w^O_{j,t}}\right)^{\frac{\rho}{1-\rho}}\right]$$

Then, we have

$$l^Y_{j,t} = \left\{\frac{A\beta\sigma}{w^Y_{j,t}}\left\{1 + \left(\frac{w^Y_{j,t}}{r_t\sigma}\right)^{\frac{\alpha}{1-\alpha}}\Phi_{j,t}^{\frac{\alpha}{\rho}\left(\frac{\rho-1}{1-\alpha}\right)}\right\}^{\frac{\beta}{\alpha}-1}\Phi_{j,t}^{\frac{\beta}{\rho}-1}\right\}^{\frac{1}{1-\beta}}$$

and after rearranging, we have,

$$l^Y_{j,t} = \left\{\left(\frac{A\beta\sigma}{w^Y_{j,t}}\right)\left[\left(\frac{w^Y_{j,t}}{r_t\sigma}\right)^{\frac{\alpha}{1-\alpha}}\Phi_{j,t}^{\frac{(\rho-\alpha)\alpha}{\rho(1-\alpha)}} + \Phi_{j,t}^{\frac{\alpha}{\rho}}\right]^{\frac{\beta}{\alpha}-1}\Phi_{j,t}^{\frac{\alpha}{\rho}-1}\right\}^{\frac{1}{1-\beta}}$$

and

$$k_{j,t} = \left(\frac{w^Y_{j,t}}{r_t\sigma}\right)^{\frac{1}{1-\alpha}}\Phi_{j,t}^{\frac{\rho-\alpha}{\rho(1-\alpha)}} l^Y_{j,t}$$

From Euler's theorem and the first-order conditions, we can rewrite the profit function as:

$$\sum_{t=0}^{\infty}\delta^t A(1-\beta)\left\{\left(\frac{w^Y_{j,t}}{r_t\sigma}\right)^{\frac{\alpha}{1-\alpha}}\Phi_{j,t}^{\frac{\alpha(\rho-\alpha)}{\rho(1-\alpha)}} + \Phi_{j,t}^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}}\left(l^Y_{j,t}\right)^{\beta} \tag{I.A.4}$$

Finally, substituting $l_{j,t}^{Y}$, we have:

$$\sum_{t=0}^{\infty} \delta^t A(1-\beta) \left(\frac{A\beta\sigma}{w_{j,t}^{Y}} \right)^{\frac{\beta}{1-\beta}} \left\{ \left(\frac{w_{j,t}^{Y}}{r_t \sigma} \right)^{\frac{\alpha}{1-\alpha}} \Phi_{j,t}^{\frac{\alpha(\rho-\alpha)}{\rho(1-\alpha)}} + \Phi_{j,t}^{\frac{\alpha}{\rho}} \right\}^{\frac{\beta(1-\alpha)}{\alpha(1-\beta)}} \Phi_{j,t}^{\frac{\beta(\alpha-\rho)}{\rho(1-\beta)}} \tag{I.A.5}$$

Before proceeding, we consider an auxiliary result that is useful in determining the steady-state equilibrium, in which both prices and quantities do not change over time.

Lemma 3. *In a possible steady-state equilibrium without outflows, quantities and prices are identical in both sectors.*

Consequently, given lemma 3 and proposition 1, the only steady-state equilibrium has prices and quantities that are equal across sectors. In this case, the firm's optimal demand for labor and capital is:

$$l^Y = l^O = \frac{\left(\frac{A\beta\sigma}{w^Y}\right)^{\frac{1}{1-\beta}}}{\left[\left(\frac{w^Y}{r\sigma}\right)^{\frac{\alpha}{1-\alpha}} + 1\right]^{\frac{\alpha-\beta}{\alpha(1-\beta)}}} \quad \text{and} \quad k = \frac{\left(\frac{w^Y}{r\sigma}\right)^{\frac{1}{1-\alpha}} \left(\frac{A\beta\sigma}{w^Y}\right)^{\frac{1}{1-\beta}}}{\left[\left(\frac{w^Y}{r\sigma}\right)^{\frac{\alpha}{1-\alpha}} + 1\right]^{\frac{\alpha-\beta}{\alpha(1-\beta)}}} \tag{I.A.6}$$

and where profits are given by:

$$\pi = \frac{A(1-\beta)}{1-\delta} \left\{ \left(\frac{A\beta}{r}\right)^{\frac{\alpha}{1-\alpha}} + \left(\frac{A\beta\sigma}{w^Y}\right)^{\frac{\alpha}{1-\alpha}} \right\}^{\frac{\beta(1-\alpha)}{\alpha(1-\beta)}} \tag{I.A.7}$$

A.2 Equilibrium Conditions

Given the results from lemmas 2 and 3 and propositions 4 and 1, we have that the equilibrium conditions are simplified to one free-entry condition and one market clearing condition. In particular, considering an entry cost of $c > 0$, the entry condition is given by:

$$\frac{A(1-\beta)}{1-\delta} \left\{ \left(\frac{A\beta}{r}\right)^{\frac{\alpha}{1-\alpha}} + \left(\frac{A\beta\sigma}{w^Y}\right)^{\frac{\alpha}{1-\alpha}} \right\}^{\frac{\beta(1-\alpha)}{\alpha(1-\beta)}} - c = 0 \tag{I.A.8}$$

solving this equation for w_Y, we obtain:

$$w^Y = \frac{A\beta\sigma}{\left\{ \left[\frac{(1-\delta)c}{A(1-\beta)}\right]^{\frac{\alpha(1-\beta)}{\beta(1-\alpha)}} - \left(\frac{A\beta}{r}\right)^{\frac{\alpha}{1-\alpha}} \right\}^{\frac{1-\alpha}{\alpha}}} \tag{I.A.9}$$

The market clearing condition is given by:

$$N_I l^Y + N_N l^Y = \frac{\overline{L}}{2} \Rightarrow (N_I + N_N) l^Y = \frac{\overline{L}}{2} \tag{I.A.10}$$

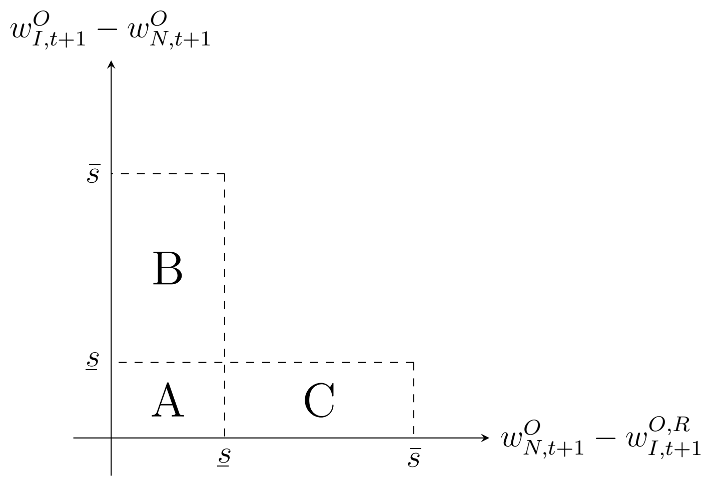

Figure I.A.3: Potential equilibria after IDD

where N_I and N_N are the measure of firms in sectors I and N, respectively. Notice that we can only determine the total number of firms, given that both sectors are identical. Consequently, assume that $N_I = N_2 = \frac{N}{2}$. From the market clearing condition, we then have:

$$N = \frac{\overline{L}}{2} \frac{\left[\frac{(1-\delta)c}{A(1-\beta)}\right]^{\frac{\alpha(1-\beta)}{\beta(1-\alpha)}}}{\left\{\left[\frac{(1-\delta)c}{A(1-\beta)}\right]^{\frac{\alpha-\beta}{\beta(1-\alpha)}} - \left(\frac{A\beta}{r}\right)^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{1}{\alpha}}} \tag{I.A.11}$$

As a result:

$$N_I = N_N = \frac{\frac{\overline{L}}{4}\left[\frac{(1-\delta)c}{A(1-\beta)}\right]^{\frac{\alpha(1-\beta)}{\beta(1-\alpha)}}}{\left\{\left[\frac{(1-\delta)c}{A(1-\beta)}\right]^{\frac{\alpha-\beta}{\beta(1-\alpha)}} - \left(\frac{A\beta}{r}\right)^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{1}{\alpha}}} \tag{I.A.12}$$

A.3 Equilibrium After an IDD Is Implemented

A.3.1 Worker's Problem

Based on proposition 2, we can rule out several combinations of prices as potential equilibria, as we present in the following lemmas.

Lemma 4. *In equilibrium, we cannot have $w^O_{I,t+1} - w^O_{N,t+1} \geq \bar{s}$ or $w^O_{N,t+1} - w^{O,R}_{I,t+1} \geq \bar{s}$.*

Lemma 5. *In an economy in which old workers who spent time in either the I or the N sector when young are perfect substitutes, we will not see an equilibrium with positive outflows from both sectors.*

Consequently, we just need to evaluate three possible cases, in Figure I.A.3. Notice that A is the case without intersector flows, while B and C are the cases with N $\to$ I and I $\to$ N flows.

A.3.2 Firm's Problem

N sector Firm As before, the N sector firm's problem is given by:

$$\max_{k_{N,t}, l^Y_{N,t}, l^O_{N,t}} \sum_{t=0}^{\infty} \delta^t \left\{ A \left\{ k^{\alpha}_{N,t} + \left[\sigma(l^Y_{N,t})^{\rho} + (1-\sigma)(l^O_{N,t})^{\rho}\right]^{\frac{\alpha}{\rho}} \right\}^{\frac{\beta}{\alpha}} - r_t k_{N,t} - w^Y_{N,t} l^Y_{N,t} - w^O_{N,t} l^O_{N,t} \right\} \tag{I.A.13}$$

Again, although the problem is dynamic, due to a lack of commitment and the lack of a state variable, we can solve the problem period-by-period. Consequently, the first-order conditions are:

$$\begin{cases} A\left\{k^{\alpha}_{N,t} + \left[\sigma(l^Y_{N,t})^{\rho} + (1-\sigma)(l^O_{N,t})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1} \beta k^{\alpha-1}_{N,t} = r_t & (\text{FOC}_{k,N}) \\ A\left\{k^{\alpha}_{N,t} + \left[\sigma(l^Y_{N,t})^{\rho} + (1-\sigma)(l^O_{N,t})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1} \beta \left[\sigma(l^Y_{N,t})^{\rho} + (1-\sigma)(l^O_{N,t})^{\rho}\right]^{\frac{\alpha}{\rho}-1} \sigma(l^Y_{N,t})^{\rho-1} = w^Y_{N,t} & (\text{FOC}_{y,N}) \\ A\left\{k^{\alpha}_{N,t} + \left[\sigma(l^Y_{N,t})^{\rho} + (1-\sigma)(l^O_{N,t})^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1} \beta \left[\sigma(l^Y_{N,t})^{\rho} + (1-\sigma)(l^O_{N,t})^{\rho}\right]^{\frac{\alpha}{\rho}-1} (1-\sigma)(l^O_{N,t})^{\rho-1} = w^O_{N,t} & (\text{FOC}_{o,N}) \end{cases}$$

Then, from ($\text{FOC}_{y,N}$) and ($\text{FOC}_{o,N}$), we have that:

$$l^O_{N,t} = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_{N,t}}{w^O_{N,t}}\right]^{\frac{1}{1-\rho}} l^Y_{N,t} \tag{I.A.14}$$

and from ($\text{FOC}_{y,N}$) and ($\text{FOC}_{k,N}$), we have:

$$k_{N,t} = \left\{ \frac{w^Y_{N,t}}{r_t \sigma} \left[\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w^Y_{N,t}}{w^O_{N,t}}\right)^{\frac{\rho}{1-\rho}}\right]^{1-\frac{\alpha}{\rho}} \right\}^{\frac{1}{1-\alpha}} l^Y_{N,t} \tag{I.A.15}$$

Then again defining $\Phi_{N,t} \equiv \left[\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w^Y_{N,t}}{w^O_{N,t}}\right)^{\frac{\rho}{1-\rho}}\right]$, optimal quantities can be rewritten as:

$$l^Y_{N,t} = \left\{ \left(\frac{A\beta\sigma}{w^Y_{N,t}}\right) \left[\left(\frac{w^Y_{N,t}}{r_t\sigma}\right)^{\frac{\alpha}{1-\alpha}} \Phi_{N,t}^{\frac{(\rho-\alpha)\alpha}{\rho(1-\alpha)}} + \Phi_{N,t}^{\frac{\alpha}{\rho}}\right]^{\frac{\beta}{\alpha}-1} \Phi_{N,t}^{\frac{\alpha}{\rho}-1} \right\}^{\frac{1}{1-\beta}} \tag{I.A.16}$$

and

$$k_{N,t} = \left(\frac{w^Y_{N,t}}{r_t\sigma}\right)^{\frac{1}{1-\alpha}} \Phi_{N,t}^{\frac{\rho-\alpha}{\rho(1-\alpha)}} l^Y_{N,t} \tag{I.A.17}$$

I Sector Firm In this case, the I sector firm has some monopoly power over its current workers, being able to set their wages when old. As a result, the firm's problem becomes:

$$\max_{\left\{k_{I,t}, l^Y_{I,t}, w^{O,R}_{I,t}, l^{O,N}_{I,t}\right\}} \sum_{t=0}^{\infty} \delta^t \left\{ \begin{array}{c} A\left\{k^{\alpha}_{I,t} + \left[\sigma\left(l^Y_{I,t}\right)^{\rho} + (1-\sigma)\left(\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}} l^Y_{I,t-1} + l^{O,N}_{I,t}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}} \\ -r_t k_{I,t} - w^Y_{I,t} l^Y_{I,t} - w^{O,R}_{I,t}\left(\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}}\right) l^Y_{I,t-1} - w^O_{I,t} l^{O,N}_{I,t} \end{array} \right\}$$

subject to:

$$\begin{array}{ll} 0 \leq l^Y_{I,t} \leq \frac{\overline{L}}{2} & (C.1) \\ k_{I,t} \geq 0 & (C.2) \\ 0 \leq l^{O,N}_{I,t} \leq L^Y_{N,t-1} & (C.3) \\ \max\{\underline{w}, w^O_{N,t} - \bar{s}\} \leq w^{O,R}_{I,t} \leq w^O_{N,t} - \underline{s} & (C.4) \end{array}$$

where $l^{O,N}_{I,t}$ is the measure of workers who were previously employed in the N sector. Given Inada conditions, restrictions (C.2), $l^Y_{I,t} > 0$, and $w^{O,R}_{I,t} > \max\{\underline{w}, w^O_{N,t} - \bar{s}\}$ are trivially satisfied. We also assume (and later verify) that $l^Y_{I,t} \leq \frac{\overline{L}}{2}$ and $l^{O,N}_{I,t} \leq L^Y_{N,t-1}$ are non-binding. Consequently, the only restrictions that we need to check are $w^{O,R}_{I,t} \leq w^O_{N,t} - \underline{s}$ and $l^{O,N}_{I,t} \geq 0$. As a result, the Lagrangean becomes:

$$\mathcal{L}(k_{I,t}, l^Y_{I,t}, w^{O,R}_{I,t}, \lambda_t) = \sum_{t=0}^{\infty} \delta^t \left\{ \begin{array}{c} A\left\{k^{\alpha}_{I,t} + \left[\sigma\left(l^Y_{I,t}\right)^{\rho} + (1-\sigma)\left(\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}} l^Y_{I,t-1} + l^{O,N}_{I,t}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}} \\ -r_t k_{I,t} - w^Y_{I,t} l^Y_{I,t} - w^{O,R}_{I,t}\left(\frac{\bar{s}-\left(w^O_{N,t}-w^{O,R}_{I,t}\right)}{\bar{s}-\underline{s}}\right) l^Y_{I,t-1} \\ -w^O_{I,t} l^{O,N}_{I,t} - \mu_t(-l^{O,N}_{I,t}) - \lambda_t(w^{O,R}_{I,t} - w^O_{N,t} + \underline{s}) \end{array} \right\}$$

Then, the F.O.C.s are given by:

$$
\left\{
\begin{array}{ll}
A\beta\left\{k_{I,t}^{\alpha}+\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}k_{I,t}^{\alpha-1}=r_t & (FOC_{k,I}) \\
\left[\begin{array}{l}
A\beta\left\{k_{I,t}^{\alpha}+\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times \\
\times\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\times \\
\times\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho-1}(1-\sigma)\frac{l_{I,t-1}^{Y}}{\bar{s}-\underline{s}} \\
-\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}\right)l_{I,t-1}^{Y}-w_{I,t}^{O,R}\frac{l_{I,t-1}^{Y}}{\bar{s}-\underline{s}}-\lambda_t
\end{array}\right]=0 & (FOC_{w,I}) \\
\left[\begin{array}{l}
A\beta\left\{k_{I,t}^{\alpha}+\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times \\
\times\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\sigma\left(l_{I,t}^{Y}\right)^{\rho-1}-w_{I,t}^{Y} \\
+A\beta\delta\left\{k_{I,t+1}^{\alpha}+\left[\sigma\left(l_{I,t+1}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t}^{Y}+l_{I,t+1}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times \\
\times\left[\sigma\left(l_{I,t+1}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t}^{Y}+l_{I,t+1}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\times \\
\times\left(\frac{\bar{s}-\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t}^{Y}+l_{I,t+1}^{O,N}\right)^{\rho-1}(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\right)}{\bar{s}-\underline{s}}\right) \\
-\delta w_{I,t+1}^{O,R}\left(\frac{\bar{s}-\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\right)}{\bar{s}-\underline{s}}\right)
\end{array}\right]=0 & (FOC_{y,I}) \\
\left[\begin{array}{l}
A\beta\left\{k_{I,t}^{\alpha}+\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times \\
\times\left[\sigma\left(l_{I,t}^{Y}\right)^{\rho}+(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\times \\
\times(1-\sigma)\left(\frac{\bar{s}-\left(w_{N,t}^{O}-w_{I,t}^{O,R}\right)}{\bar{s}-\underline{s}}l_{I,t-1}^{Y}+l_{I,t}^{O,N}\right)^{\rho-1}-w_{I,t}^{O}+\mu_t
\end{array}\right]=0 & (FOC_{or,I})
\end{array}
\right.
$$

and the complementary slackness yields:

$$
\begin{gathered}
\lambda_t(w_{I,t}^{O,R}-w_{N,t}^{O}+\underline{s})=0 \quad \text{and} \quad \lambda_t\geq 0 \\
\mu_t l_{I,t}^{O,N}=0 \quad \text{and} \quad \mu_t\geq 0
\end{gathered}
$$

We can now split our problem into 3 possible cases:

Case 1. *No outflows across sectors:*

In this case, both constraints are binding, i.e., $\mu_t>0$ and $\lambda_t>0$. As a result, given the complementary slackness conditions, we must have $l_{I,t}^{O,N}=0$ and $w_{I,t}^{O,R}=w_{N,t}^{O}-\underline{s}$. Moreover, since no worker initially in the N sector switches to the I sector, from the worker's problem we must have $w_{I,t}^{O}-w_{N,t}^{O}\leq\underline{s}$.

As we focus on steady-state equilibria, the problem becomes:

$$\begin{cases} A\beta\left[k_I^{\alpha}+\left(l_I^Y\right)^{\alpha}\right]^{\frac{\beta}{\alpha}-1}k_I^{\alpha-1}=r & (FOC_{k,I}) \\ A\beta\left\{k_I^{\alpha}+\left(l_I^Y\right)^{\alpha}\right\}^{\frac{\beta}{\alpha}-1}(1-\sigma)\frac{\left(l_I^Y\right)^{\alpha}}{\bar{s}-\underline{s}}=\lambda+\left[1+\frac{\left(w_N^O-\underline{s}\right)}{\bar{s}-\underline{s}}\right]l_I^Y & (FOC_{w,I}) \\ A\beta\left\{k_I^{\alpha}+\left(l_I^Y\right)^{\alpha}\right\}^{\frac{\beta}{\alpha}-1}\left[\sigma+\delta(1-\sigma)\right]\left(l_I^Y\right)^{\alpha-1}=w_I^Y+\delta\left(w_N^O-\underline{s}\right) & (FOC_{y,I}) \\ A\beta\left\{k_I^{\alpha}+\left(l_I^Y\right)^{\alpha}\right\}^{\frac{\beta}{\alpha}-1}(1-\sigma)\left(l_I^Y\right)^{\alpha-1}=w_I^O-\mu & (FOC_{or,I}) \end{cases}$$

From $(FOC_{k,I})$ and $(FOC_{y,I})$, we have:

$$k_I=\left[\frac{w_I^Y+\delta\left(w_N^O-\underline{s}\right)}{r\left[\sigma+\delta(1-\sigma)\right]}\right]^{\frac{1}{1-\alpha}}l_I^Y \tag{I.A.18}$$

From equation (I.A.18) and the first-order conditions, we have:

$$k_I=\frac{\left(\frac{A\beta}{r}\right)^{\frac{1}{1-\beta}}}{\left\{1+\left[\frac{r[\sigma+\delta(1-\sigma)]}{w_I^Y+\delta\left(w_N^O-\underline{s}\right)}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{\alpha-\beta}{\alpha(1-\beta)}}}\quad\text{and}\quad l_I^Y=\frac{\left(\frac{A\beta}{r}\right)^{\frac{1}{1-\beta}}\left\{\frac{r[\sigma+\delta(1-\sigma)]}{w_I^Y+\delta\left(w_N^O-\underline{s}\right)}\right\}^{\frac{1}{1-\alpha}}}{\left\{1+\left[\frac{r[\sigma+\delta(1-\sigma)]}{w_I^Y+\delta\left(w_N^O-\underline{s}\right)}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{\alpha-\beta}{\alpha(1-\beta)}}}$$

and from the N sector firm's problem, we have $w_N^Y=\frac{\sigma}{1-\sigma}w_N^O$. As a result,

$$w_I^Y=\frac{\sigma}{1-\sigma}w_N^O+\delta\underline{s} \tag{I.A.19}$$

Consequently, we have $w_I^Y+\delta(w_N^O-\underline{s})=\frac{w_N^O}{1-\sigma}\left[\sigma+\delta(1-\sigma)\right]$. As a result, the optimal quantities of capital and labor are:

$$l_I^Y=\frac{\left(\frac{A\beta}{r}\right)^{\frac{1}{1-\beta}}\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{1}{1-\alpha}}}{\left\{1+\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{\alpha-\beta}{\alpha(1-\beta)}}}\quad\text{and}\quad k_I=\frac{\left(\frac{A\beta}{r}\right)^{\frac{1}{1-\beta}}}{\left\{1+\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{\alpha-\beta}{\alpha(1-\beta)}}}$$

Finally, the profit for a sector I firm is:

$$\pi_I = \left\{ \begin{array}{c} A(1-\beta)\left\{1+\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{\beta(1-\alpha)}{\alpha(1-\beta)}}\left(\frac{A\beta}{r}\right)^{\frac{\beta}{1-\beta}} \\ +(1-\delta)\underline{s}\frac{\left(\frac{A\beta}{r}\right)^{\frac{1}{1-\beta}}\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{1}{1-\alpha}}}{\left\{1+\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{\alpha}{1-\alpha}}\right\}^{\frac{\alpha-\beta}{\alpha(1-\beta)}}} \end{array} \right\} \tag{I.A.20}$$

We can now show some auxiliary results:

Lemma 6. *In possible steady-state equilibria without labor outflows across sectors, we must have* $\frac{k_I}{k_N} = \frac{l_I^Y}{l_N^Y}$.

Lemma 7. *There is no equilibrium without outflows from a sector.*

In summary, an equilibrium without outflows is only possible if the range of switching costs is narrow. Moreover, in such an equilibrium, the capital-labor share is constant across sectors—there is no capital-labor substitution across sectors.

Finally, before we discuss the equilibrium, consider the optimal N sector quantities in this case. From the N sector firm's problem and the conditions for no-outflows, we have:

$$l_N^Y = \frac{\left(\frac{A\beta}{r}\right)^{\frac{1}{1-\beta}}\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{1}{1-\beta}}}{\left[1+\left(\frac{w_N^O}{r(1-\sigma)}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{\alpha-\beta}{\alpha(1-\beta)}}} \quad \text{and} \quad k_N = \left(\frac{w_N^O}{r(1-\sigma)}\right)^{\frac{1}{1-\alpha}} l_N^Y$$

and

$$\pi_N = (1-\beta)A\left[1+\left(\frac{w_N^O}{r(1-\sigma)}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{\beta(1-\alpha)}{\alpha(1-\beta)}}\left(\frac{A\beta}{r}\right)^{\frac{\beta}{1-\beta}}\left[\frac{r(1-\sigma)}{w_N^O}\right]^{\frac{\beta}{1-\beta}}$$

Case 2. *Net outflows from sector N*

In this case, $\mu = 0$ and $\lambda > 0$. In this case, $w_{N,t}^O - w_{I,t}^{O,R} = \underline{s}$. Then, considering a steady-state equilibrium, the F.O.C.s are:

$$
\begin{cases}
A\beta\left\{k_I^{\alpha}+\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}k_I^{\alpha-1}=r & (FOC_{k,I})\\
\left[\begin{array}{c}A\beta\left\{k_I^{\alpha}+\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times\\ \times\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\times\\ \times(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho-1}\frac{l_I^Y}{\bar{s}-\underline{s}}\end{array}\right]=l_I^Y+w_I^{O,R}\frac{l_I^Y}{\bar{s}-\underline{s}}+\lambda & (FOC_{w,I})\\
\left[\begin{array}{c}A\beta\left\{k_I^{\alpha}+\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times\\ \times\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\times\\ \left[\sigma\left(l_I^Y\right)^{\rho-1}+\delta(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho-1}\right]\end{array}\right]=w_I^Y+\delta w_I^{O,R} & (FOC_{y,I})\\
\left[\begin{array}{c}A\beta\left\{k_I^{\alpha}+\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times\\ \times\left[\sigma\left(l_I^Y\right)^{\rho}+(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\times\\ \times(1-\sigma)\left(l_I^Y+l_I^{O,N}\right)^{\rho-1}\end{array}\right]=w_I^O & (FOC_{or,I})
\end{cases}
$$

Proposition 5. *There is no equilibrium with a positive outflow from sector N*

Case 3. *Net outflows from sector I*

In this case, $\mu > 0$ and $\lambda = 0$. In this case, $w_{N,t}^O - w_{I,t}^{O,R} > \underline{s}$. Then, considering a steady-state equilibrium, the F.O.C.s are:

$$
\begin{cases}
A\beta\left\{k_I^{\alpha}+\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\left(l_I^Y\right)^{\alpha}\right\}^{\frac{\beta}{\alpha}-1}k_I^{\alpha-1}=r_t & (FOC_{k,I})\\
\left[\begin{array}{l}
A\beta\left\{k_I^{\alpha}+\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\left(l_I^Y\right)^{\alpha}\right\}^{\frac{\beta}{\alpha}-1}\times\\
\times\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\left(l_I^Y\right)^{\alpha-1}\times\\
\times(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho-1}
\end{array}\right]=\bar{s}-w_N^O+2w_I^{O,R} & (FOC_{w,I})\\
\left[\begin{array}{l}
A\beta\left\{k_I^{\alpha}+\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}}\left(l_I^Y\right)^{\alpha}\right\}^{\frac{\beta}{\alpha}-1}\times\\
\times\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\left(l_I^Y\right)^{\alpha-1}\times\\
\times\left[\sigma+\delta(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]
\end{array}\right]=w_I^Y+\delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right) & (FOC_{y,I})\\
\left[\begin{array}{l}
A\beta\left\{k_I^{\alpha}+\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\left(l_I^Y\right)^{\alpha}\right]^{\frac{\alpha}{\rho}}\right\}^{\frac{\beta}{\alpha}-1}\times\\
\times\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}-1}\left(l_I^Y\right)^{\alpha-1}\times\\
\times(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho-1}
\end{array}\right]=w_I^O-\mu & (FOC_{or,I})
\end{cases}
$$

Dividing $(FOC_{w,I})$ by $(FOC_{y,I})$, we have:

$$
\frac{(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho-1}}{\sigma+\delta(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}}=\frac{\bar{s}-w_N^O+2w_I^{O,R}}{w_I^Y+\delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)}
$$

Rearranging we have:

$$
\frac{1-\sigma}{\sigma\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{1-\rho}+\delta(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)}=\frac{\bar{s}-w_N^O+2w_I^{O,R}}{w_I^Y+\delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O-w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)} \qquad \text{(I.A.21)}
$$

equation (I.A.21) determines $w_I^{O,R}$ as a function of equilibrium prices and parameters. Moreover, notice that the RHS of (I.A.21) is strictly decreasing in $w_I^{O,R}$, while the LHS is strictly increasing and concave as long $w_I^Y < \frac{\delta w_I^{O,R}}{\bar{s}-\underline{s}}$.

Then, from $(FOC_{k,I})$ and $(FOC_{y,I})$, we have:

$$k_I = \left\{ \frac{w_I^Y + \delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)}{r} \frac{\left[\sigma + (1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{1-\frac{\alpha}{\rho}}}{\left[\sigma + \delta(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]} \right\}^{\frac{1}{1-\alpha}} l_I^Y \tag{I.A.22}$$

Comparing to firms in the N sector, we have:

$$\frac{k_I}{k_N} = \left\{ \frac{w_I^Y + \delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)}{w_N^Y + \delta \frac{(1-\sigma)}{\sigma} w_N^Y \left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}} \left[\frac{\sigma + (1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}}{\sigma + (1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w_N^Y}{w_N^O}\right)^{\frac{\rho}{1-\rho}}}\right]^{1-\frac{\alpha}{\rho}} \right\}^{\frac{1}{1-\alpha}} \frac{l_I^Y}{l_N^Y} \tag{I.A.23}$$

Then, replacing equation (I.A.22) into $(FOC_{y,I})$ and manipulating, we have:

$$\left(l_I^Y\right)^{1-\beta} = \frac{A\beta \left\{ \begin{array}{c} \left\{ \frac{w_I^Y + \delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)}{r\left[\sigma+\delta(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]} \right\}^{\frac{\alpha}{1-\alpha}} \left[\sigma + (1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{(\rho-\alpha)\alpha}{\rho(1-\alpha)}} \\ + \left[\sigma + (1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{\frac{\alpha}{\rho}} \end{array} \right\}^{\frac{\beta}{\alpha}-1}}{\left\{ \left[w_I^Y + \delta w_I^{O,R}\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)\right] \frac{\left[\sigma+(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]^{1-\frac{\alpha}{\rho}}}{\left[\sigma+\delta(1-\sigma)\left(\frac{\bar{s}-\left(w_N^O - w_I^{O,R}\right)}{\bar{s}-\underline{s}}\right)^{\rho}\right]} \right\}}$$

$$\left(l_N^Y\right)^{1-\beta} = \frac{A\beta\left[\left(\frac{w_N^Y}{r\sigma}\right)^{\frac{\alpha}{1-\alpha}}\left[\sigma+(1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w_N^Y}{w_N^O}\right)^{\frac{\rho}{1-\rho}}\right]^{\frac{(\rho-\alpha)\alpha}{\rho(1-\alpha)}} + \left[\sigma+(1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w_N^Y}{w_N^O}\right)^{\frac{\rho}{1-\rho}}\right]^{\frac{\alpha}{\rho}}\right]^{\frac{\beta}{\alpha}-1}}{\frac{w_N^Y}{\sigma}\left[\sigma+(1-\sigma)\left(\frac{1-\sigma}{\sigma}\frac{w_N^Y}{w_N^O}\right)^{\frac{\rho}{1-\rho}}\right]^{1-\frac{\alpha}{\rho}}}$$

B Proofs

Proof of Lemma 1

Proof. Notice that we can rewrite equations (4) and (5) as:

$$\begin{cases} w^Y_{I,t} + \delta w^O_{I,t+1} & \text{if} \quad w^O_{N,t+1} \leq \underline{s} + w^O_{I,t+1} \\ w^Y_{I,t} + \delta \left\{ w^O_{I,t+1} + \frac{\left(w^O_{N,t+1} - w^O_{I,t+1} - \underline{s}\right)^2}{2(\bar{s} - \underline{s})} \right\} & \text{if} \quad w^O_{N,t+1} > \underline{s} + w^O_{I,t+1} \quad \text{and} \quad w^O_{N,t+1} < \underline{s} + w^O_{I,t+1} \\ w^Y_{I,t} + \delta \left[w^O_{N,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right] & \text{if} \quad w^O_{N,t+1} \geq \bar{s} + w^O_{I,t+1} \end{cases} \tag{I.A.24}$$

and

$$\begin{cases} w^Y_{N,t} + \delta\, w^O_{N,t+1} & \text{if} \quad w^O_{N,t+1} \geq w^O_{I,t+1} - \underline{s} \\ w^Y_{N,t} + \delta \left\{ w^O_{N,t+1} + \frac{\left(w^O_{I,t+1} - w^{O,}_{N,t+1} - \underline{s}\right)^2}{2(\bar{s} - \underline{s})} \right\} & \text{if} \quad w^O_{N,t+1} > w^O_{I,t+1} - \bar{s} \quad \text{and} \quad w^O_{N,t+1} < w^O_{I,t+1} - \underline{s} \\ w^Y_{N,t} + \delta \left[w^O_{I,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right] & \text{if} \quad w^O_{N,t+1} \leq w^O_{I,t+1} - \bar{s} \end{cases} \tag{I.A.25}$$

Figure I.A.4 plots the boundaries presented in equation (I.A.24) (in blue) and equation (I.A.25) (in red). Areas A and B represent the combinations of $w^O_{I,t+1}$ and $w^O_{N,t+1}$ that would induce an outflow from sector I, while areas C and D represent the combinations of $w^O_{I,t+1}$ and $w^O_{N,t+1}$ that would induce an outflow from sector N. As is clear, these areas do not overlap.

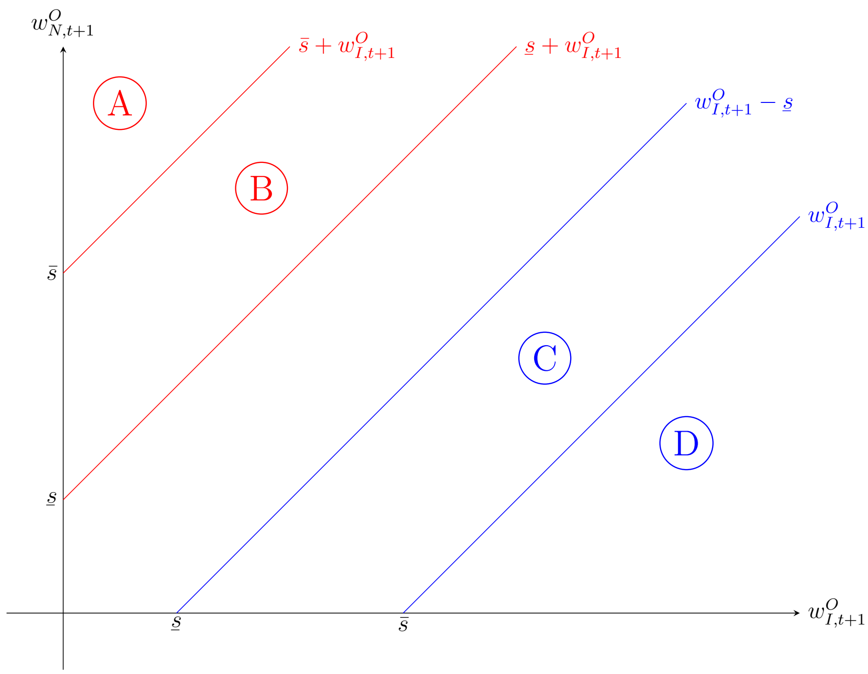

Figure I.A.4: Areas of Outflow from Sectors I and N

□

Proof of Proposition 4

Proof. From lemmas 1 and 2, we have that the possible equilibria are represented in areas B, E, and C in Figure I.A.5.

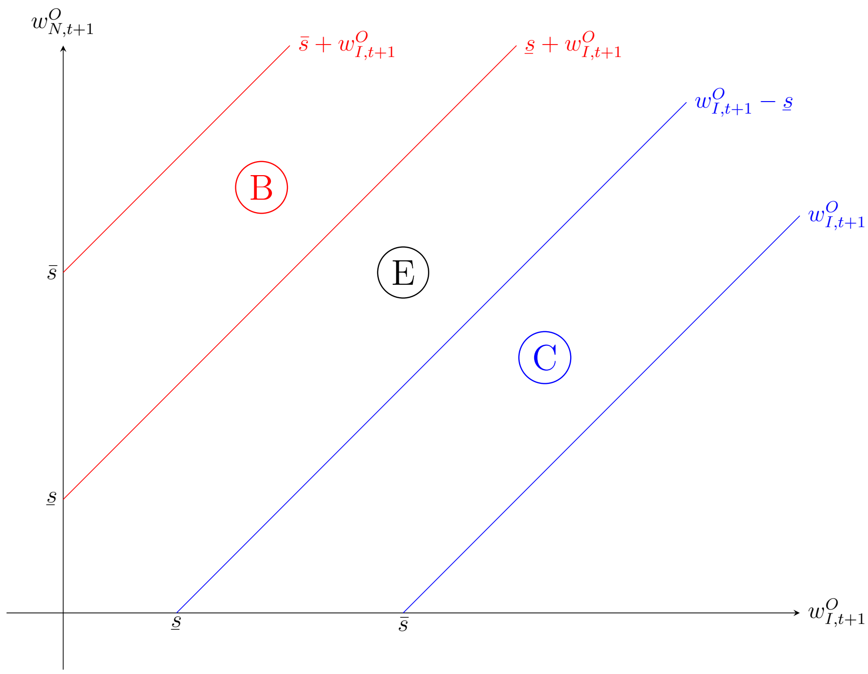

Figure I.A.5: Possible Equilibria

In area E, we have from equations (I.A.24) and (I.A.25) that no old worker will switch sectors. Moreover, young workers will join both sectors if:

$$w^Y_{I,t} - w^Y_{N,t} = \delta \left[w^O_{N,t+1} - w^O_{I,t+1} \right]$$

concluding the proof of item 1.

In area C, we have from equations (I.A.24) and (I.A.25) that some workers from sector N will switch to sector I. Furthermore, because C is below the 45-degree line, we have that $w^O_{N,t+1} < w^O_{I,t+1}$. Finally, in order for young workers to join both sectors, we must have:

$$w^Y_{I,t} - w^Y_{N,t} = \delta \left\{ w^O_{N,t+1} - w^O_{I,t+1} + \frac{\left(w^O_{I,t+1} - w^O_{N,t+1} - \underline{s} \right)^2}{2\left(\bar{s} - \underline{s} \right)} \right\} \tag{I.A.26}$$

Simplification of the RHS of equation (I.A.26), yields:

$$\frac{\left(w^O_{I,t+1} - w^O_{N,t+1} \right)^2 - 2\bar{s}\left(w^O_{I,t+1} - w^O_{N,t+1} \right) + \underline{s}^2}{2\left(\bar{s} - \underline{s} \right)} \tag{I.A.27}$$

The derivative of the expression in (I.A.27) with respect to $w^O_{I,t+1} - w^O_{N,t+1}$ is strictly negative for all $w^O_{I,t+1} - w^O_{N,t+1} \in (\underline{s}, \bar{s})$. Furthermore, the expression is negative for $w^O_{I,t+1} - w^O_{N,t+1} = \underline{s}$. Consequently, in any equilibrium in C, we must have $w^Y_{I,t} < w^Y_{N,t}$, concluding the proof for item 2.

Finally, consider possible equilibria in B. In this case, we have a positive inflow to sector N. Moreover, because the area B is above the 45-degree line, we have that $w^O_{N,t+1} > w^O_{I,t+1}$. Finally, in order for young workers to join both sectors, we must have:

$$w^Y_{N,t} - w^Y_{I,t} = \delta\left\{w^O_{I,t+1} - w^O_{N,t+1} + \frac{\left(w^O_{N,t+1} - w^O_{I,t+1} - \underline{s}\right)^2}{2\left(\bar{s} - \underline{s}\right)}\right\} \tag{I.A.28}$$

Again, we simplify the RHS of equation (I.A.28) to produce:

$$\frac{\left(w^O_{N,t+1} - w^O_{I,t+1}\right)^2 - 2\bar{s}\left(w^O_{N,t+1} - w^O_{I,t+1}\right) + \underline{s}^2}{2\left(\bar{s} - \underline{s}\right)} \tag{I.A.29}$$

Analogously to our development for area C, we can show this term is negative for all $w^O_{N,t+1} - w^O_{I,t+1} \in (\underline{s}, \bar{s})$. Consequently, in any equilibrium in B, we must have $w^Y_{I,t} > w^Y_{N,t}$, concluding the proof for item 3. □

Proof of Lemma 3

Proof. From equation (I.A.1) and steady-state conditions, we have:

$$l^O_j = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_j}{w^O_j}\right]^{\frac{1}{1-\rho}} l^Y_j$$

Given that we are in a no-outflows case and due to the strict concavity of the firm's problem, we have that $l^O_j = l^Y_j$. Consequently, we must have:

$$\left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_j}{w^O_j}\right]^{\frac{1}{1-\rho}} = 1 \Rightarrow w^Y_j = \frac{\sigma}{1-\sigma} w^O_j \quad \forall j \in \{I, N\} \tag{I.A.30}$$

Then, from equation (I.A.30) for both sectors I and N, we have:

$$w^Y_I - w^Y_N = \left(\frac{\sigma}{1-\sigma}\right)\left[w^O_I - w^O_N\right] \tag{I.A.31}$$

However, in order to satisfy equation (I.A.31) and the restriction in proposition 4, given that $\sigma, \delta \in (0,1)$ we must have $w^Y_I = w^Y_N$ and $w^O_I = w^O_N$. Consequently, given the results from the firm's problem, all quantities must be the same. □

Proof of Proposition 1

Proof. Without loss of generality, assume an equilibrium in which there is a positive outflow from sector N to I. From lemma 2 and the fact that we are focusing on a steady-state equilibrium, we have that $l^O_I = l^Y_I + t_I$, with $t_I > 0$. Consequently, $l^O_I > l^Y_I$. By the same rationale, $l^O_N < l^Y_N$. From proposition 4, we have that $w^Y_I < w^Y_N$ and $w^O_I > w^O_N$. Then, from equation (I.A.1) and the steady-state condition, we have:

$$l^O_I = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w^Y_I}{w^O_I}\right]^{\frac{1}{1-\rho}} l^Y_I$$

Because $l_I^O > l_I^Y$ and $\rho < 1$, we must have:

$$\left(\frac{1-\sigma}{\sigma}\right)\frac{w_I^Y}{w_I^O} > 1 \Rightarrow \frac{w_I^Y}{w_I^O} > \frac{\sigma}{1-\sigma} \tag{I.A.32}$$

Because equation (I.A.1) must also hold for sector N, we have that:

$$l_N^O = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_N^Y}{w_N^O}\right]^{\frac{1}{1-\rho}} l_N^Y$$

Because $l_N^O > l_N^Y$ and $\rho < 1$, we must have:

$$\left(\frac{1-\sigma}{\sigma}\right)\frac{w_N^Y}{w_N^O} < 1 \Rightarrow \frac{w_N^Y}{w_N^O} < \frac{\sigma}{1-\sigma} \tag{I.A.33}$$

However, proposition 4 also requires $w_I^Y < w_N^Y$ and $w_I^O > w_N^O$, thus, we must also have $\frac{w_I^Y}{w_I^O} < \frac{w_N^Y}{w_N^O}$. Consequently, no values can jointly satisfy equations (I.A.32) and (I.A.33) and we have a contradiction. □

Proof of Proposition 2

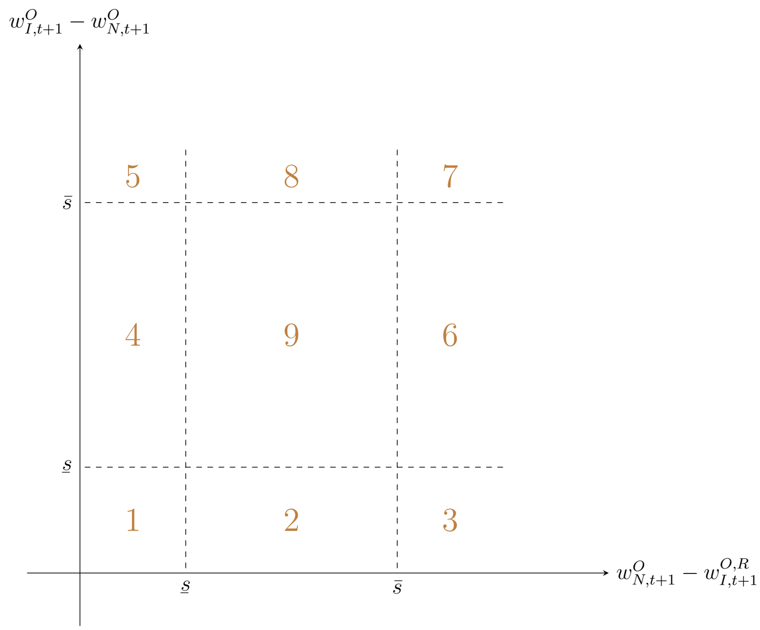

Figure I.A.6: Possible Combinations of Sector Wage Differentials in Period 2

Proof. We need to go through the cases presented in Figure I.A.6. We begin with case (1):

(1) In this case, the restrictions give us $w^O_{N,t+1} - w^{O,R}_{I,t+1} \leq \underline{s}$ and $w^O_{I,t+1} - w^O_{N,t+1} \leq s$. In order for young workers to join both sectors, we must have:

$$w^Y_{I,t} + \delta\, w^{O,R}_{I,t+1} = w^Y_{N,t} + \delta\, w^O_{N,t+1} \implies w^Y_{I,t} - w^Y_{N,t} = \delta \left(w^O_{N,t+1} - w^{O,R}_{I,t+1} \right)$$

We know that $w^O_{N,t+1} - w^{O,R}_{I,t+1} \leq \underline{s}$, where $\underline{s}$ is positive. Toward a contradiction, assume that $w^{O,R}_{N,t+1} > w^O_{N,t+1}$, while both wages remain greater than the participation constraint $\underline{w}$. In this case, given a lack of commitment, it would be optimal for the sector I firm to deviate and reduce $w^{O,R}_{I,t+1}$, because it would not change old workers' labor supply and it would decrease wages. Consequently, we must have $w^O_{N,t+1} \geq w^{O,R}_{I,t+1}$, but then we must also have $w^Y_{I,t} \geq w^Y_{N,t}$.

(2) In this case, the restrictions give us $\underline{s} < w^O_{N,t+1} - w^{O,R}_{I,t+1} < \underline{s}$ and $w^O_{I,t+1} - w^O_{N,t+1} \leq \underline{s}$. Assuming a uniform distribution for switching costs, we have :

$$w^Y_{I,t} + \delta \left\{ w^{O,R}_{I,t+1} + \frac{\left(w^O_{N,t+1} - w^{O,R}_{I,t+1} - \underline{s} \right)^2}{2\,(\bar{s} - \underline{s})} \right\} = w^Y_{N,t} + \delta\, w^O_{N,t+1}$$

Rearranging yields:

$$w_{I,t}^{Y} - w_{N,t}^{Y} = \delta \left\{ w_{N,t+1}^{O} - w_{I,t+1}^{O,R} - \frac{\left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R} - \underline{s} \right)^2}{2\left(\bar{s} - \underline{s}\right)} \right\} \tag{I.A.34}$$

But then we notice that:

$$\frac{\partial RHS(\text{I.A.34})}{\partial \left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \right)} = \frac{\bar{s} - \left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \right)}{\bar{s} - \underline{s}} > 0, \forall w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \in (\underline{s}, \bar{s})$$

As a result, we just need to show that RHS(I.A.34) > 0 for $w_{N,t+1}^{O} - w_{I,t+1}^{O,R} = \underline{s}$. But in this case, RHS(I.A.34) $= \delta \underline{s} > 0$, concluding the proof.

(3) In this case, the restrictions give us $w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \geq \bar{s}$ and $w_{I,t+1}^{O} - w_{N,t+1}^{O} \leq \underline{s}$. Then, we have:

$$w_{I,t}^{Y} + \delta \left\{ w_{N,t+1}^{O} - \frac{(\bar{s} + s)}{2} \right\} = w_{N,t}^{Y} + \delta\, w_{N,t+1}^{O} \implies w_{I,t}^{Y} - w_{N,t}^{Y} = \delta \left[\frac{\bar{s} + \underline{s}}{2} \right] > 0$$

(4) In this case, the restrictions give us $w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \leq \underline{s}$ and $\underline{s} < w_{I,t+1}^{O} - w_{N,t+1}^{O} < \bar{s}$. Then we have:

$$w_{I,t}^{Y} + \delta\, w_{I,t+1}^{O,R} = w_{N,t}^{Y} + \delta \left\{ w_{N,t+1}^{O} + \frac{\left(w_{I,t+1}^{O} - w_{N,t+1}^{O} - \underline{s} \right)^2}{2\left(\bar{s} - \underline{s}\right)} \right\}$$

Rearranging, we have:

$$w_{I,t}^{Y} - wN,t^{Y} = \delta \left\{ \left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \right) + \frac{\left(w_{I,t+1}^{O} - w_{N,t+1}^{O} - \underline{s} \right)^2}{2\left(\bar{s} - \underline{s}\right)} \right\}$$

From (1), we have shown that $w_{N,t+1}^{O} \geq W_{I,t+1}^{O,R}$. Then, because $\underline{s} < w_{I,t+1}^{O} - w_{N,t+1} < \bar{s}$, we must have $w_{I,t}^{Y} > w_{N,t}^{Y}$.

(5) In this case, the restrictions give us $w_{N,t+1}^{O} - w_{I,t+1}^{O,R} \leq \bar{s}$ and $w_{I,t+1}^{O} - w_{N,t+1}^{O} \geq \underline{s}$. Then:

$$w_{I,t}^{Y} + \delta w_{I,t+1}^{O,R} = w_{N,t}^{Y} + \delta \left\{ w_{I,t+1}^{O} - \frac{(\bar{s} + \underline{s})}{2} \right\} \implies w_{I,t}^{Y} - w_{N,t}^{Y} = \delta \left\{ w_{I,t+1}^{O} - w_{I,t+1}^{O,R} - \frac{(\bar{s} + \underline{s})}{2} \right\} \tag{I.A.35}$$

Using an analogous argument from case (1), we have $w_{N,t+1}^{O} \geq w_{I,t+1}^{O,R}$. Then, taking into account that $w_{I,t+1}^{O} - w_{N,t+1}^{O} \geq \bar{s}$, we have

$$\delta \left\{ w_{I,t+1}^{O} - w_{I,t+1}^{O,R} - \frac{(\bar{s} + \underline{s})}{2} \right\} \geq \delta \underbrace{\left\{ \bar{s} - \frac{(\bar{s} + \underline{s})}{2} \right\}}_{\frac{\bar{s} - \underline{s}}{2}} > 0$$

Consequently, $w^Y_{I,t} > w^Y_{N,t}$.

(6) In this case, the restrictions give us $w^O_{N,t+1} - w^{O,R}_{I,t+1} \geq \bar{s}$ and $\underline{s} < w^O_{I,t+1} - w^O_{N,t+1} < \bar{s}$. Then:

$$w^Y_{I,t} + \delta \left\{ w_{N,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right\} = w^Y_{I,t} - w^Y_{N,t} = \delta \left\{ \frac{(\bar{s} + \underline{s})}{2} + \frac{\left(w^O_{I,t+1} - w^O_{N,t+1} - \underline{s}\right)^2}{2\,(\bar{s} - \underline{s})} \right\} \quad \text{(I.A.36)}$$

Consequently $w^Y_{I,t} > w^Y_{N,t}$.

(7) In this case, the restrictions give us $w^O_{N,t+1} - w^{O,R}_{I,t+1} \geq \bar{s}$ and $w^O_{I,t+1} - w^O_{N,t+1} \geq \bar{s}$. Then, we have:

$$w^Y_{I,t} + \delta \left\{ w^O_{N,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right\} = w^Y_{N,t} + \delta \left\{ w^O_{I,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right\} \implies w^Y_{I,t} - w^Y_{N,t} = \delta \left\{ w^O_{I,t+1} - w^O_{N,t+1} \right\} > 0 \quad \text{(I.A.37)}$$

Consequently $w^Y_{I,t} > w^Y_{N,t}$.

(8) In this case, the restrictions give us $\underline{s} < w^O_{N,t+1} - w^{O,R}_{I,t+1} < \bar{s}$ and $w^O_{I,t+1} - w^O_{N,t+1} \geq \bar{s}$. Then:

$$w^Y_{I,t} + \delta \left\{ w^{O,R}_{I,t+1} + \frac{\left(w^O_{N,t+1} - w^{O,R}_{I,t+1} - \underline{s}\right)^2}{2\,(\bar{s} - \underline{s})} \right\} = w^Y_{N,t} + \delta \left\{ w^O_{I,t+1} - \frac{(\bar{s} + \underline{s})}{2} \right\} \quad \text{(I.A.38)}$$

Rearranging, yields:

$$w^Y_{I,t} - w^Y_{N,t} = \delta \left\{ \left(w^O_{I,t+1} - w^{O,R}_{I,t+1}\right) - \frac{(\bar{s} + \underline{s})}{2} - \frac{\left(w^O_{N,t+1} - w^{O,R}_{I,t+1} - \underline{s}\right)^2}{2\,(\bar{s} - \underline{s})} \right\}$$

Notice

$$\left(w^o_{I,t+1} - w^{O,R}_{I,t+1}\right) = \left(w^O_{I,t+1} - w^O_{N,t+1}\right) + \left(w^O_{N,t+1} - w^{O,R}_{I,t+1}\right)$$

and because $w^O_{I,t+1} - w^O_{N,t+1} \geq \bar{s}$ and $\underline{s} < w^O_{N,t+1} - w^{O,R}_{I,t+1} < \bar{s}$, $\left(w^O_{N,t+1} - w^{O,R}_{I,t+1} - \underline{s}\right)^2$ is increasing for $w^O_{N,t+1} - w^{O,R}_{I,t+1} \in (\underline{s}, \bar{s})$, we have:

$$\delta \left\{ \left(w^O_{I,t+1} - w^{O,R}_{I,t+1}\right) - \frac{(\bar{s} + \underline{s})}{2} - \frac{\left(w^O_{N,t+1} - w^{O,R}_{I,t+1} - \underline{s}\right)^2}{2\,(\bar{s} - \underline{s})} \right\} \geq \delta \left(w^O_{N,t+1} - w^{O,R}_{I,t+1}\right) > 0$$

Consequently, $w^Y_{I,t} > w^Y_{N,t}$.

(9) In this case, the restrictions give us $\underline{s} < w^O_{N,t+1} - w^{O,R}_{I,t+1} < \bar{s}$ and $\underline{s} < w^O_{I,t+1} - w^O_{N,t+1} < \bar{s}$. In

this case, we have:

$$w_{I,t}^{Y}+\delta\left\{w_{I,t+1}^{O,R}+\frac{\left(w_{N,t+1}^{O,R}-w_{I,t+1}^{O,R}-\underline{s}\right)^{2}}{2\left(\bar{s}-\underline{s}\right)}\right\}=w_{N,t}^{Y}+\delta\left\{w_{N,t+1}^{O}+\frac{\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}-\underline{s}\right)^{2}}{2\left(\bar{s}-\underline{s}\right)}\right\}$$

Rearranging, we have:

$$w_{I,t}^{Y}-w_{N,t}^{Y}=\delta\left\{\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\right)-\frac{\left(w_{N,t+1}^{O}-w_{I,t+1}^{O,R}-\underline{s}\right)^{2}}{2\left(\bar{s}-\underline{s}\right)+\frac{\left(w_{I,t+1}^{O}-w_{N,t+1}^{O}-\underline{s}\right)^{2}}{2\left(\bar{s}-\underline{s}\right)}}\right\}$$

But notice that this is the same as the expression (I.A.34) in (2), with the addition of a positive term. □

Proof of Lemma 4

Proof. We again focus on the areas presented in Figure I.A.6. In particular, we focus on areas (3), (5), (6), (7), and (8).

First, consider areas (3) and (5). In these areas, we have either $l_{I,t+1}^{O}=0$ (in area 3) or $l_{N,t+1}^{O}=0$ (in area 5). In both areas, marginal labor productivity tends to infinity due to the Inada condition. As a result, we can rule out these areas as potential equilibria.

Consider area (6), i.e. $w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\geq\bar{s}$ and $\underline{s}<w_{I,t+1}^{O}-w_{N,t+1}^{O}<\bar{s}$. In this area, given the concavity of the firm's problem and the fact that firms are homogeneous within-sector, we have that:

$$\begin{aligned}
l_{N,t+1}^{O}&=\left[1-S\left(w_{I,t+1}^{O}-w_{N,t+1}^{O}\right)\right]l_{N,t}^{Y}+l_{I,t}^{Y}\\
l_{I,t+1}^{O}&=S\left(w_{I,t+1}^{O}-w_{N,t+1}^{O}\right)l_{N,t}^{Y}
\end{aligned}$$

However, this is suboptimal for sector I firms, because they may increase their profits by raising $w_{I,t+1}^{O,R}$ and retain some $l_{I,t}^{Y}$ workers, instead of allowing them to switch to sector N, while concomitantly poaching workers from the N sector, at a higher cost.

Considering (7), i.e. $w_{N,t+1}^{O}-w_{I,t+1}^{O,R}\geq\bar{s}$ and $w_{I,t+1}^{O}-w_{N,t+1}^{O}\geq\bar{s}$. In this case, at the aggregate level, we have:

$$L_{N,t+1}^{O}=L_{I,t}^{Y}\quad\text{and}\quad L_{I,t+1}^{O}=L_{N,t}^{Y}$$

Again, as in area (6), this is suboptimal for sector I firms. Intuitively, it would be optimal for I firms to raise $w_{I,t+1}^{O,R}$ and retaining some $l_{I,t}^{Y}$ workers, instead of allowing them to switch to sector N, while concomitantly poaching workers from the N sector, at a higher cost.

Finally, considering (8), $\underline{s}<w_{N,t+1}^{O}-w_{I,t+1}^{O,R}<\bar{s}$ and $w_{I,t+1}^{O}-w_{N,t+1}^{O}\geq\bar{s}$. In this area, given the concavity of the firm's problem and the fact that firms are homogeneous within-sector, we have that:

$$l_{N,t+1} = S\left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R}\right) l_{I,t}^{Y}$$
$$l_{I,t+1}^{O} = l_{N,t}^{Y} + \left[1 - S\left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R}\right)\right] l_{I,t}^{Y}$$

Again, sector I firms would have a profitable deviation by increasing $w_{I,t+1}^{O,R}$ and reducing $l_{I,t+1}^{O,N}$. $\square$

Proof of Lemma 5

Proof. Again, we consider Figure I.A.6. Lemma 4 ruled out areas (3), (5), (6), (7), and (8) as possible equilibria. Therefore, in order to prove the statement in lemma 5, we must show that wages within area (9) cannot be an equilibrium. In (9), we have $\underline{s} < w_{N,t+1}^{O} - w_{I,t+1}^{O,R} < \bar{s}$ and $\underline{s} < w_{I,t+1}^{O} - w_{N,t+1}^{O} < \bar{s}$. Given the concavity of the firm's problem and the fact that firms are homogeneous within-sector, we have that:

$$l_{N,t+1}^{O} = \left[1 - S\left(w_{I,t+1}^{O} - w_{N,t+1}^{O}\right)\right] l_{N,t}^{Y} + S\left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R}\right) l_{I,t}^{Y}$$
$$l_{I,t+1}^{O} = \left[1 - S\left(w_{N,t+1}^{O} - w_{I,t+1}^{O,R}\right)\right] l_{I,t}^{Y} + S\left(w_{I,t+1}^{O} - w_{N,t+1}^{O}\right) l_{N,t}$$

But again, this is suboptimal for sector I firms, since it would be more cost-effective to increase $w_{I,t+1}^{O,R}$ and reduce $l_{I,t+1}^{O,N}$. $\square$

Proof of Lemma 6

Proof. In order for workers to join both sectors when young, we must have:

$$w_I^Y + \delta w_I^{O,R} = w_N^Y + \delta w_N^O$$

because in this case we have $w_I^{O,R} = w_N^O - \underline{s}$ in an equilibrium without outflow from sector I, we have:

$$w_I^Y + \delta\left(w_N^O - \underline{s}\right) = w_N^Y + \delta w_N^O \Rightarrow w_I^Y = w_N^Y + \delta \underline{s}$$

Consequently, from equation (I.A.18), we have:

$$k_I = \left[\frac{w_N^O}{r(1-\sigma)}\right]^{\frac{1}{1-\alpha}} l_I^Y \tag{I.A.39}$$

Similarly, from equation (I.A.15), taking into account that in an equilibrium without outflows from sector N we must have $w_N^Y = \frac{\sigma}{1-\sigma} w_N^O$, we have:

$$k_N = \left[\frac{w_N^O}{r(1-\sigma)}\right]^{\frac{1}{1-\alpha}} l_N^Y \tag{I.A.40}$$

As a result, from equations (I.A.39) and (I.A.40), we have:

$$\frac{k_I}{k_N} = \frac{l_I^Y}{l_N^Y}$$

concluding our proof. $\square$

Proof of Lemma 7

Proof. First, from $(FOC_{y,I})$ and equation (I.A.19), we have that:

$$A\beta\left\{k_I^\alpha + \left(l_I^Y\right)^\alpha\right\}^{\frac{\beta}{\alpha}-1}(1-\sigma)\left(l_I^Y\right)^{\alpha-1} = w_N^O \tag{I.A.41}$$

But then, from $(FOC_{w,I})$, we have:

$$\frac{w_N^O}{\bar{s}-\underline{s}}l_I^Y = \lambda + \left[1 + \frac{\left(w_N^O - \underline{s}\right)}{\bar{s}-\underline{s}}\right]l_I^Y$$

simplifying, we have:

$$\lambda + \frac{\bar{s}-2\underline{s}}{\bar{s}-\underline{s}}l_I^Y = 0$$

Because in a no-outflow equilibrium we must have $\lambda > 0$, we must have $\bar{s} - 2\underline{s} < 0$ in order for the above equality to be satisfied, concluding our proof.

$\square$

Proof of Proposition 5

Proof. Toward a contradiction, assume that such as equilibrium exists. From equations $(FOC_{y,I})$ and $(FOC_{or,I})$ we have:

$$\frac{\sigma\left(l_I^Y\right)^{\rho-1} + \delta(1-\sigma)\left(l_I^Y + l_I^{O,N}\right)^{\rho-1}}{(1-\sigma)\left(l_I^Y + l_I^{O,N}\right)^{\rho-1}} = \frac{w_I^Y + \delta w_I^{O,R}}{w_I^O}$$

Multiplying both sides by $\frac{1}{\delta}$ and rearranging, we have:

$$l_I^O \equiv l_I^Y + l_I^{O,N} = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_I^Y - \delta\left(w_I^O - w_I^{O,R}\right)}{w_I^O}\right]^{\frac{1}{1-\rho}} l_I^Y \tag{I.A.42}$$

Then, multiplying both sides by the measure of firms in the sector I equilibrium (N_I), we obtain the aggregate counterpart:

$$L_I^O = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_I^Y - \delta\left(w_I^O - w_I^{O,R}\right)}{w_I^O}\right]^{\frac{1}{1-\rho}} L_I^Y \tag{I.A.43}$$

Similarly, from (I.A.15) from the sector N firm's problem, after multiplying both sides by N_N, we have:

$$L_N^O = \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_N^Y}{w_N^O}\right]^{\frac{1}{1-\rho}} L_N^Y \tag{I.A.44}$$

Moreover, given that there is a positive outflow from sector N and no outflow from sector I, we must have that:

$$\left(\frac{1-\sigma}{\sigma}\right)\frac{w_I^Y-\delta\left(w_I^O-w_I^{O,R}\right)}{w_I^O} > 1 \quad \text{and} \quad \left(\frac{1-\sigma}{\sigma}\right)\frac{w_N^Y}{w_N^O} < 1 \tag{I.A.45}$$

Then, from the market clearing condition for both markets ($L_N^O + L_I^O = \frac{\bar{L}}{2}$ and $L_N^Y + L_I^Y = \frac{\bar{L}}{2}$) we have:

$$L_I^Y = \frac{\left\{1-\left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_N^Y}{w_N^O}\right]^{\frac{1}{1-\rho}}\right\}\frac{\bar{L}}{2}}{\left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_I^Y-\delta\left(w_I^O-w_I^{O,R}\right)}{w_I^O}\right]^{\frac{1}{1-\rho}} - \left[\left(\frac{1-\sigma}{\sigma}\right)\frac{w_N^Y}{w_N^O}\right]^{\frac{1}{1-\rho}}} \tag{I.A.46}$$

Therefore, for this equilibrium to exist, we must check that the inequalities in (I.A.45) are satisfied. From the young worker's problem, we have:

$$w_I^Y + \delta w_I^{O,R} = w_N^Y + \delta\left[w_N^O + \frac{\left(w_I^O - w_N^O - \underline{s}\right)^2}{2\left(\bar{s}-\underline{s}\right)}\right]$$

Subtracting δw_I^O from both sides and rearranging, we have:

$$w_I^Y - \delta\left(w_I^O - w_I^{O,R}\right) = w_N^Y + \delta\left[\frac{\left(w_I^O - w_N^O - \underline{s}\right)^2}{2\left(\bar{s}-\underline{s}\right)} - \left(w_I^O - w_N^O\right)\right] \tag{I.A.47}$$

But then, notice that:

$$\frac{\partial\left[\frac{\left(w_I^O - w_N^O - \underline{s}\right)^2}{2\left(\bar{s}-\underline{s}\right)} - \left(w_I^O - w_N^O\right)\right]}{\partial\left(w_I^O - w_N^O\right)} = -\left(\frac{\bar{s}-\left(w_I^O - w_N^O\right)}{\left(\bar{s}-\underline{s}\right)}\right)$$

Because in an equilibrium with a positive outflow from sector N we must have $\underline{s} < w_I^O - w_N^O < \bar{s}$, we have that $\frac{\partial\left[\frac{\left(w_I^O - w_N^O - \underline{s}\right)^2}{2\left(\bar{s}-\underline{s}\right)} - \left(w_I^O - w_N^O\right)\right]}{\partial\left(w_I^O - w_N^O\right)} < 0$. Consequently, we must have:

$$w_I^Y - \delta\left(w_I^O - w_I^{O,R}\right) < w_N^Y - \delta\underline{s}$$

Moreover, since $\underline{s} < w_I^O - w_N^O < \bar{s}$ and $\underline{s} > 0$, we have that $w_I^O >_N^O$. As a result, $\frac{w_I^Y-\delta\left(w_I^O-w_I^{O,R}\right)}{w_I^O} < \frac{w_N^Y}{w_N^O}$ and (I.A.45) cannot be satisfied, concluding the proof. □

Proof of Proposition 3

Proof. Combine proofs of Lemma 7 and Proposition 5. □