Relational Contracts, Unemployment Insurance, and Trade

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Abstract

Labor-market institutions determine how workers match with employers. In this paper, I argue that generous unemployment insurance protects workers against liquidity shocks and so induces superior matching with firms. Better matching has limited returns if firms can offer effective formal bonus contracts to their workers. In contrast, better matching leads to large returns if firms cannot use formal contracts and so must motivate their workers using long-term relational contracts. As a consequence, a country may implement generous unemployment insurance policies in order to cultivate firms that rely on relational contracts. If contracting technologies vary across industries, then ex ante homogeneous countries may optimally choose different levels of unemployment insurance to acquire absolute and comparative advantage in different sectors of the economy.

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1 Introduction

Firms in different countries must contend with very different labor-market institutions. Some nations have relatively fluid labor markets and provide little social insurance, while others are characterized by a substantial safety net and relatively rigid labor markets. Some of this institutional heterogeneity has disappeared in the wake of growing international trade, but countries continue to engender a wide variety of labor market regulations. Why do such disparate institutions persist?

One possibility is that nations adopt labor market policies to cultivate firms that motivate their workers in complementary ways. Nations seek (comparative and absolute) advantage through their choice of institutions, so that multiple "styles" of labor markets can coexist in a world with free trade. In this paper, I consider the interaction between unemployment insurance and the types of contracts that can be written within an industry. I argue that unemployment insurance protects workers from liquidity shocks, which allows them to spend more time searching for better employment opportunities. The social value of this additional search depends on the types of firms in the market. Firms that have access to effective formal contracts experience only moderate returns from better employee-employer matching. In contrast, firms that cannot write formal contracts and so must rely on long-term relational contracts experience substantial returns if they are matched to productive workers. As a result, a nation that hosts many firms that rely on relational contracts is more willing to "invest" in good employer-employee matching by implementing generous unemployment insurance.

Consider a firm that uses relational incentive contracts to motivate its workers. Any bonuses promised by the firm must be made credible within the context of the ongoing relationship. A firm can credibly promise large bonuses to a worker only if it earns substantial rent from its relationship with that worker. Very productive workers generate a lot of rent for their employers, which means that more productive agents can be promised stronger relational incentives. So the marginal return of a highly-skilled worker is larger in a relational relative to a formal contract.

Now, suppose that there are two sectors in the economy. In one sector, output is contractible and agents can be motivated using short-term formal bonus schemes. Firm in the other sector produce non-contractible output and so must rely on long-term relational contracts to motivate their workers. By the logic outlined above, generous unemployment insurance is more valuable for firms that rely on relational contracts. If firms sell their products on a global market, then nations have an incentive to "specialize" in a single sector by implementing labor-market institutions that are complementary to that sector. A nation that focuses on relational contracts implements more geneous social insurance than one that specializes in formal contracts. As a consequence, different social safety nets persist in a global economy.

Different industries and different firms within the same industry rely on formal contracts to radically different extents. Some companies reward their workers using elaborate formal piece rates and bonus schemes. Other organizations require extensive human capital investments or work on complex goods, both of which are difficult to motivate using formal contracts. Even within the relatively narrow industry of automobile manufacturing, Ford has historically relied on market competition to lower input costs, while Toyota has developed close-knit, long-term relationships with its suppliers. Similarly, Lincoln Electric's success is typically ascribed to the motivational powers of its long-term employment policies and large discretionary bonuses, relational incentives that are not as prevalent in other manufacturing firms.

The argument in this paper is closely related to the substantial literature in comparative political economy on the so-called "Varieties of Capitalism." The pioneering work by Hall and Soskice (2001) argues that developed capitalist economies can be roughly split into two distinct "styles." Liberal Market Economies (LMEs), including the United Kingdom and the United States, have sharply limited collective bargaining, fluid labor markets, and weak social safety nets. In contrast, Coordinated Market Economies (CMEs), including

Germany and Italy, have widespread collective bargaining, rigid labor markets, and strong social safety nets. This conceptual framework has spurred a rich literature in political science; for example, Thelen (2014) offers a recent analysis.

One purpose of this paper is to link work on the Varieties of Capitalism to the growing economics literature on relational contracts. I suggest that the contracting requirements of different industries, particularly whether an industry uses relational or formal contracts, may plausibly drive some of the differences between CMEs and LMEs. CMEs tend to have extensive unionization, onerous regulations that limit labor-market mobility, and close relationships between management and labor, all institutions that are broadly supportive of relational contracts. I argue that unemployment insurance complements these institutions by facilitating better labor-market matching, which further strengthens long-term relationships. My argument contrasts with Acemoglu, Robinson, and Verdier (2012), who argue that some countries may adopt generous social programs that dilute incentives because they benefit from technical innovations made in other countries.

This paper also draws on the contract theory and search literatures. I adapt tools from the seminal relational-contracting papers of Bull (1987), Baker, Gibbons, and Murphy (1994), and Levin (2003). Malcomson (2013) gives an overview of the relational contracting literature. Several papers have integrated relational contracts into labor and output markets, including McAdams (2011) and Powell (2014). Board and Meyer-ter-Vehn (2014) study the interaction betweeen incomplete contracts and search frictions. I similarly consider relational contracts in a labor market with frictions. However, I focus on how unemployment insurance interacts with relational contracts, and how the resulting complementarity drives nations to adopt different labor-market institutions. My analysis is related to the literature on search frictions, including classic contributions by Mortensen (1977) and many others. In particular, Diamond (1981), Acemoglu and Shimer (2000), and Marimon and Zilibotti (1999) provide various channels through which unemployment insurance can lead to better match quality between employers and workers and higher welfare. Centeno (2004) documents that more generous unemployment insurance leads to longer job tenure and interprets this as a sign of better match quality. I similarly provide a simple argument for why unemployment insurance improves match quality. However, I focus on how the contractibility of a task determines the returns from a better matching technology.

Finally, a growing literature discusses the role of heterogeneous institutions in international trade. Acemoglu, Antras, and Helpman (2007), Costinot (2009), Nunn (2007), and others have considered how national institutions generate comparative advantage if contracts are incomplete. A particularly related contribution is Tang (2012), who studies how labor institutions affect workers' willingness to invest in firm-specific and general skills. My paper differs from this literature in two ways. First, most of these papers assume that contracts are incomplete only because institutions are imperfect. In contrast, I suppose that contractibility is a feature of the *production process:* output is contractible in some sectors, while other sectors produce fundamentally non-contractible outputs. I also focus on the interaction between relational contracts and search frictions as a driver of institutional heterogeneity. Finally, in line with the Varieties of Capitalism literature, I argue that institutions can complement certain industries and confer not just comparative but also absolute advantage.

In the next section, I present a stylized model of a labor market. Firms are characterized by whether they rely on formal or relational contracts. Workers with varying ability match to firms. Some of these workers suffer a liquidity shock that forces them to inefficiently drop out of the marketplace unless the social safety net is sufficiently generous. Section 3 characterizes firm entry and profits in each contracting environment and shows that relational-contracting firms benefit more from generous unemployment insurance than formal-contracting firms. In Section 4, I extend the model to argue that nations might adopt different levels of unemployment insurance in a world with free trade. Section 5 concludes.

2 Model

Consider a game with three sets of players: a continuum of **good workers** indexed by the interval $[0, G]$ for $G \leq 1$, a continuum of **bad workers** indexed by $[0, 1]$, and a continuum of **principals** indexed by $[0, 1]$. At the beginning of the game, each principal can choose to either become **self-employed** or pay a one-time cost to become a **firm**. A fraction $H \leq 1$ of good workers suffer a liquidity shock that requires them to pay some amount $l \geq 0$. Each worker chooses to exit the market and earn l, or remain in the market and earn unemployment benefits $b \geq 0$. Hence, a worker can only cover this liquidity shock if $b \geq l$.

Following the liquidity shock, each firm matches to a single worker. I assume that firms are first matched uniformly at random to good agents. If any firms remain unmatched at the end of this process, they are matched to bad agents. Each firm makes a take-it-or-leave-it **contract offer** to its matched worker that specifies promised compensation in each period of their relationship. If the worker rejects this offer, then she receives her outside option and the firm is immediately rematched to one of the remaining unmatched workers. Otherwise, the firm and worker engage in repeated production: the worker exerts costly effort to produce output, and the firm pays wages and bonuses to the worker.

The **formal contracting strength** of a firm is given by a number $\bar{\tau} > 0$ equal to the **maximum output-contingent formal bonus** that can be offered by that firm. I consider two different contracting regimes. If $\bar{\tau} = \infty$, then the firm can use formal contracts to motivate the worker to choose any level of effort. If $\bar{\tau} = 0$, then formal contracts are ineffective and the firm must use relational contracts to motivate the agent. In Section 4, I expand the model to consider an environment with two different industries - one that has access to formal contracts ($\bar{\tau} = \infty$), and one that must rely on relational contracts ($\bar{\tau} = 0$). A principal in one country chooses whether or not to start a firm, and if so which industry to enter. Each country has a set of (immobile) workers and can choose the level of unemployment benefits faced by those workers.

Formally, the model consists of two stages: a one-time **matching** stage followed by a repeated **production** game.

Matching Stage:

1. Each principal can start a firm at cost $K > 0$. The set of firms is $\mathcal{F}$ with measure μ_F.

2. Worker receives benefits $b \geq 0$. With probability $H \in (0, 1]$, a good worker suffers a liquidity shock and must exit the market unless $b \geq l > 0$. Let μ_G be the measure of good workers remaining.

3. Measure $\min\{\mu_F, \mu_G\}$ of firms are chosen uniformly at random and matched to a single good worker. Remaining firms are matched to a single bad worker.

4. The firm makes a take-it-or-leave-it contract offer C to its worker. C is a strategy in the Production Game. If the agent rejects, then the pair remains unmatched.

Production Game: This game is played repeatedly with common discount $\delta \in (0, 1)$.

1. Each matched firm $f \in \mathcal{F}$ decides whether or not to continue with its worker. If it chooses not to continue, then the pair become unmatched.

2. Unmatched firms and workers are matched uniformly at random. Each firm makes a take-it-or-leave-it contract offer C to its worker. If the worker rejects, the pair remains unmatched.

3. Each matched $f \in \mathcal{F}$ makes a take-it-or-leave-it offer $(w_f, \tilde{b}_f(\cdot))$ to its worker, with $w_f \in \mathbb{R}_+$, $\tilde{\tau}_f : \mathbb{R}_+ \to [0, \bar{\tau}]$. If the worker rejects, the pair become unmatched.

4. A worker matched to f chooses output $y_f \in \mathbb{R}_+$ at cost $k_f y_f$. $k_f = k_G$ if the worker is good and $k_f = k_B > k_G$ if the worker is bad.

5. Matched firm f pays a bonus $\tau_f \geq \tilde{\tau}_f(y_f) \geq 0$ to its worker.

Principals, unmatched workers, and unmatched firms earn $(1-\delta)\bar{u}(b)$ in each period. Define $Y = \int_{\mathcal{F}} y_f df$ as aggregate production. In each period, a matched firm earns $(1-\delta)(\pi(y_f|Y) - w_f - \tau_f)$ and its worker earns $(1-\delta)(w_f + \tau_f - k_f y_f)$. A firm's profit can depend on both its own production and the aggregate production in the market. A principal that chooses to start a firm pays K. I assume that $\bar{u}(b)$ is strictly increasing in b, with $\bar{u}(0) \geq l$.

This model is highly stylized, but is designed to capture the following intuition. An unemployed worker faces a liquidity shock that may result in him dropping out of the labor market. Intuitively, this worker might have an opportunity to accept a job that is not very socially valuable but allows him to survive the liquidity shock. If unemployment insurance is sufficiently generous ($b \geq l$), then the unemployed worker can weather the liquidity shock without leaving the market.

I consider two industries that differ in terms of the formal bonus contracts available to firms in that industry. In a **contractible industry**, $\bar{\tau} = \infty$ so that the firm can freely reward its worker for producing high output. In contrast, $\bar{\tau} = 0$ so that formal bonuses are totally unavailable in the **relational industry**. While a firm can still offer informal bonuses ($\tau_f > \tilde{\tau}_f(y_f)$), these payments must be made credible by the promise of future rents created by its relationship with that worker.

I look for a subgame-perfect equilibrium of this game that satisfies two properties. First, firms make **credible** contract offers: if a firm offers a contract C that is a subgame-perfect equilibrium of the repeated game and the worker accepts, then the two parties play according to C. Second, contract offers are **anonymous:** the firm's offer C and the worker's decision to accept or reject cannot depend on the history of either player. These assumptions imply that the market cannot collectively punish a firm that does not fulfill its promises to agents. A firm can credibly offer any equilibrium as a contract C, and in particular can offer the equilibrium that maximizes its continuation surplus. Unlike McAdams (2011), the equilibrium can only consist of contract offers that maximize the firm's continuation surplus.

Assumption 1 *Profit $\pi(y|Y)$ is smooth, with $\frac{\partial \pi}{\partial y} > 0$, $\frac{\partial^2 \pi}{\partial y^2} < 0$, and $\frac{\partial \pi}{\partial Y} < 0$. π satisfies* *strictly decreasing differences in* (y, Y)*:* $\frac{\partial^2 \pi}{\partial Y \partial y} < 0$*.* $\lim_{Y \to 0} \pi(y|Y) = \infty$ *and* $\lim_{Y \to \infty} \pi(y|Y) = 0$ *for any* $y > 0$*.*

The profit function $\pi(y|Y)$ captures the effects of competition on profits. A single firm's profit depends on both its production and the aggregate production in the market. The higher the aggregate production, the sharper the competition and hence the lower a firm's profit. The profit-maximizing output quantity is strictly decreasing in aggregate output Y because $\pi(y|Y)$ satisfies strictly decreasing differences. Note that an individual firm's output has no effect on Y, which is determined by a continuum of firms. Assumption 1 is assumed to hold for the rest of the paper.

3 Unemployment Insurance Leads to Better Matching

This section studies the relational and contractible industries separately. I consider how unemployment insurance determines profitability, entry, and aggregate production.

3.1 The Contractible Sector

Consider the "contractible sector:" $\bar{\tau} = \infty$, so firms can commit to an output-contingent bonus scheme. Then firm f can offer the contract $\tilde{\tau}_f(y_f) = k_f y_f$ and induce its worker to choose first-best output.

Define

$$y_x^{FB}(Y) = \arg\max_{y \geq 0} \pi(y|Y) - k_x y$$

as the first-best output for a firm matched to a worker of type $x \in \{G, B\}$. Since $\pi(y|Y)$ satisfies strictly decreasing differences, $y_x^{FB}(Y)$ is strictly decreasing in Y. Firm f can set w_f to make its worker indifferent between accepting and rejecting the contract because the worker's outside option is at least $b \geq 0$. So a firm matched to an agent of type x produces output $y_x^{FB}(Y)$.

First, I prove that the level of aggregate output Y is uniquely determined by the measure of firms that enter the market.

Lemma 1 *There exists a unique non-negative solution $Y^C(\mu_F, \mu_G)$ to the equation*

$$Y = \min\{\mu_F, \mu_G\}(y_G^{FB}(Y) - y_B^{FB}(Y)) + \min\{1, \mu_F\}y_B^{FB}(Y), \tag{1}$$

with $Y^C(\mu_F, \mu_G)$ increasing in both arguments.

Proof: See Appendix A.

The left-hand side of (1) is clearly strictly increasing in Y, and it is straightforward to show that the right-hand side is decreasing in Y. The result then follows from the Intermediate Value Theorem.

A firm can write a formal contract that maximizes profit for any level of aggregate output. A single firm has no effect on Y and so chooses output to maximize $\pi(y|Y) - k_f y$. Aggregate output depends only on the measure of firms by Lemma 1, so profit can likewise be written as a function of entry of the number of firms and good workers in the market (μ_F, μ_G). Proposition 1 describes contracts and entry in an industry with formal contracts.

Proposition 1 *Suppose $\bar{\tau} = \infty$. Define $\mu \equiv (\mu_F, \mu_G)$ and let $\Pi_x^C(\mu) = \pi\left(y_x^{FB}(Y^C(\mu))|Y^C(\mu)\right) - k_x y_x^{FB}(Y^C(\mu))$ for $x \in \{G, B\}$. Assume $\bar{\tau} = \infty$ and $\Pi_G^C(G, G) - 2\bar{u}(b) > K$. Then:*

1. *A worker earns $\bar{u}(b)$ in every period of the repeated game. A firm that is matched to a worker of quality $x \in \{G, B\}$ earns $\Pi_x^C(\mu) - \bar{u}(b)$ continuation surplus. A firm matched to a good worker never separates. A firm matched to a bad worker is indifferent between continuing or separating.*

2. *Given μ_G, the measure of firms $\mu_F^C(\mu_G)$ is uniquely determined by*

$$\frac{\mu_G}{\mu_F^C}\left(\Pi_G^C(\mu_F^C, \mu_G) - \Pi_B^C(\mu_F^C, \mu_G)\right) + \Pi_B^C(\mu_F^C, \mu_G) \leq K + 2\bar{u}(b). \tag{2}$$

with equality if $\mu_F^C(\mu_G) < 1$.

Proof: See Appendix A.

A firm can use formal bonus contracts to hold a worker at her outside option while simultaneously motivating her to produce first-best effort. Firms have an incentive to undercut the prevailing wage because workers suffer at least one period of unemployment after rejecting a firm's offer. As a result, workers earn $\bar{u}(b)$ regardless of their type or whether they are matched or not. The firm earns profits equal to $\Pi_x^{FB} - \bar{u}(b)$. Given this surplus, a principal has an incentive to start a firm so long as the expected profits from entering exceeds the combined entry cost K and foregone cost of remaining a principal $\bar{u}(b)$. So firm entry is pinned down by (2).

Fixing the number of good workers μ_G in the market, more generous unemployment insurance diminishes a principal's incentive to start a firm. However, the level of unemployment insurance also affects the number of good workers who remain in the market. If $b < l$, then a fraction H of good workers leave the market and $\mu_G = GH$. Workers who have more generous unemployment insurance do not need to drop out of the market as a result of liquidity shocks, so $\mu_G = G$ if $b \geq l$. The gain from an additional good worker in the market is $\Pi_G^{FB} - \Pi_B^{FB}$. The optimal level of unemployment insurance balances the costs of potentially lower entry against the benefits of better matching. Note that if $k_G - k_B$ is small, then the benefits of better matching are negligible. We analyze this trade-off further in Section 4.

3.2 The Relational Sector

In the "relational sector," $\bar{\tau} = 0$ so that formal bonus contracts are completely unavailable: $\tilde{\tau}_f(y_f) \equiv 0$ for any y_f. In this section, I describe profit and firm entry in this environment. Entry is lower and the returns to improved matching are higher relative to a market with perfect formal contracts.

In a relational contract, the principal motivates the worker to produce output by promising him a bonus $\tau > \tilde{\tau}(y) \equiv 0$ that strictly exceeds the bonus specified in the formal contract. This promise is credible only if the worker can punish the firm following non-payment. The worst possible punishment available to the worker is to leave the firm, since the firm can always opt to end a relationship. So a firm's relational contract - and hence its productivity - depends on both the expected profitability of the current relationship and its outside option.

For the moment, assume that a firm matched to a good worker produces the profit-maximizing output and a firm matched to a bad worker produces no output. Then total production is limited by the number of good workers in the market.

Lemma 2 *There exists a unique non-negative solution $Y^R(\mu_F, \mu_G)$ to the equation*

$$Y = \min\{\mu_F, \mu_G\} y_G^{FB}(Y), \tag{3}$$

with $Y^R(\mu_F, \mu_G)$ increasing in both arguments.

Proof: This argument is nearly identical to Lemma 1. ■

Lemma 2 mirrors Lemma 1 for the relational sector. A key difference between these two results comes from the assertion that a bad worker produces no output in a relational contract. In the contractible sector, a firm matched to a bad worker nevertheless produces output. Indeed, as $k_B \to k_G$ the output of a firm matched to a bad worker approximates that of a firm matched to a good worker. I show in Proposition 2 that a bad worker indeed produces no output if $\bar{\tau} = 0$. Consequently, aggregate output in the non-contractible sector is limited by the number of good workers μ_G rather than the number of firms.

Why does a firm matched to a bad worker produce no output? Unmatched bad workers are always available on the labor market, so the firm can always refuse to pay a promised bonus and costlessly replace a betrayed bad worker. In contrast, a firm matched to a good worker has an incentive to follow through on promised bonuses because good workers are scarce. A firm can credibly motivate a good worker if players are not too impatient. In fact, for sufficiently high discount factors δ, good workers can be induced to produce first-best output. In that case, aggregate output is given by $Y^R(\mu_F, \mu_G)$.

The next result formalizes this intuition to characterize entry and output if players are patient.

Proposition 2 *Suppose $\bar{\tau} = 0$. Define $\mu = (\mu_F, \mu_G)$ and $\Pi_x^R(\mu) = \pi\left(y_x^{FB}(Y^R(\mu))|Y^R(\mu)\right) - k_x y_x^{FB}(Y^R(\mu))$ for $x \in \{G, B\}$. Assume $\bar{\tau} = \infty$ and $\Pi_G^R(G,G) - 2\bar{u}(b) > K$. Then:*

1. *each worker and each firm matched to a bad worker earns $\bar{u}(b)$ in every period of the repeated game. There exists $\bar{\delta} < 1$ such that if $\delta \geq \bar{\delta}$, there exists an equilibrium in which a firm matched to a good worker earns $\Pi_G^R(\mu) - \bar{u}(b)$ continuation surplus.*

2. *Suppose $\delta > \bar{\delta}$, and consider an equilibrium in which firms matched to good workers earn $\Pi_G^R(\mu) - \bar{u}(b)$. The measure of firms $\mu_F^R(\mu_G)$ is uniquely determined by*

$$\frac{\mu_G}{\mu_F^R}\left(\Pi_G^R(\mu_F^R, \mu_G) - 2b\right) \leq K. \tag{4}$$

with equality if $\mu_F^R(\mu_G) < 1$.

Proof See Appendix A.

Proposition 2 starkly illustrates how relational contracts magnify the returns from high-skilled employees. In a sector that lacks access to effective formal contracts, a firm can only motivate a worker by promising that worker a discretionary bonus $\tau > \tilde{\tau}(y_f) \equiv 0$. The firm must prefer to pay $\tau > 0$ rather than renege in order for this bonus to be credible. A firm matched to a bad worker never has an incentive to pay the bonus, since that firm can simply fire that worker and immediately replace him with an alternative who is at least as productive. Therefore, a bad worker can never be motivated to produce any positive output. In contrast, a firm matched to a good worker strictly prefers to continue its relationship with that worker because high-productivity workers are scarce. A patient firm can credibly motivate a good worker to produce first-best output. Intuitively, the *continuation rents* produced by a worker are increasing in that worker's type. As a result, more productive workers can be credibly promised larger rewards and hence can be motivated to produce more output.

So long as $\delta > \bar{\delta}$, a firm that is matched to a good worker generates first-best surplus regardless of whether that firm relies on formal or relational contracts. However, a firm that is matched to a bad worker produces positive surplus if formal contracts are available but *no* surplus in a relational contract. Note that this result holds regardless of the *magnitude* of the difference between good and bad workers (so long as $k_B > k_G$). The key is that there are always more bad workers than firms, so a firm can immediately replace a bad worker rather than paying him a bonus. Recognizing that it is impossible to credibly motivate a bad worker, the firm remains unmatched rather than beginning a relationship with a bad worker. So the firm's outside option in its relationship with a good worker is $\bar{u}(b)$ so long as $k_B > k_G$.

The surplus created in each relationship depends on which workers are unemployed, so there are potentially multiple equilibria corresponding to different labor-market conditions. If a single firm enters the market, then that firm has a high probability of re-matched to another good worker if its current relationships dissolves, which raises the firm's outside option and makes it harder to sustain a strong relational contract. For $\delta > \bar{\delta}$, there is always an equilibrium such that (i) the number of firms exceeds the number of good workers, and (ii) a firm matched to a good worker produces first-best surplus. This equilibrium induces maximal entry, so I restrict attention to it for the remainder of the paper.

4 Unemployment Insurance Leads to Absolute and Comparative Advantage

Thus far, I have shown that firms that rely on relational contracts have high returns from better matching. Generous unemployment insurance is a costly investment in the matching technology: it discourages firms from entering, but also induces good workers to remain in the market. In this section, I consider a world with two countries that freely trade with one another. If different sectors of the economy have differing access to formal contracts, what level of unemployment insurance should each country choose?

To answer this question, I augment the game from Section 2 in two ways. First, I introduce nations as players who choose unemployment benefits b at the start of the game. Second, I consider two different **sectors** $s \in \{R, C\}$ that differ in terms of whether formal incentive contracts can be written. More precisely, suppose there are **two nations** $n \in \{A, B\}$. Nations are *ex ante* homogeneous: each has measures G and 1 of **immobile** good and bad workers, respectively. Each nation also has a set of **immobile** principals with measure 1, who can choose to start a firm in that nation. At the beginning of the game, nations simultaneously choose **unemployment insurance levels** $b_A, b_B \in \{0, l, \bar{b}\}$, with $\bar{b} > l$**.** Then, principals in each nation choose (i) whether to pay K to enter a market, and if so (ii) which sector s to enter. Let $\mathcal{F}_n^s$ (measure $\mu_{F,n}^s$) denote the firms that enter sector s in nation n, with $\mathcal{F}^s = \mathcal{F}_A^s \cup \mathcal{F}_B^s$ (measure μ_F^s) the set of all firms in sector s and $\mathcal{F}_n = \mathcal{F}_n^C \cup \mathcal{F}_n^R$ (measure $\mu_{F,n}$) the firms in nation n. The rest of the game proceeds as in Section 2. Workers and firms in nation n are matched to one another and face outside option $\bar{u}(b_n)$.

The technology available to firms in different sector differs only in terms of which contracts are feasible. Any firm in the **contractible sector** $s = C$ faces a bonus cap of $\bar{\tau} = \infty$ and so can write perfect formal contracts. In contrast, a firm in the **relational sector** $s = R$ is unable to write formal contracts, $\bar{\tau} = 0$, and so can only use relational contracts to motivate its worker.

A firm in sector s earns profit $\pi(y|Y^s)$, where Y^s is **global sectoral output** $Y^s = \int_{f\in\mathcal{F}^s} y_f df$. Intuitively, goods may be freely traded between countries so that firms face global competition. However, firms in different sectors do not compete with one another. The assumption that goods are traded globally is crucial for the argument, since absent international trade countries would have no incentive to specialize in different sectors. It is also important that the two sectors produce differentiated goods. All firms would enter the formal contracting sector if output was homogeneous. However, the assumption that profits in the two sectors are totally independent of one another is stronger than necessary and made for convenience.

A nation chooses unemployment insurance b_n to maximize **aggregate output net of unemployment insurance costs.** Then nation n chooses b_n to maximize $W(Y^C, Y^R) - \lambda b_n$ for $\lambda > 0$. This formulation reinforces the two assumptions made about firm profits. First, the nation cares about **global output**. If goods may be freely traded between nations, then consumers in each nation have access to the full range of products produced in the world. Each nation n also cares about its own cost of providing generous unemployment insurance, λb_n. Second, the two sectors produce heterogeneous products which enter social surplus separately.

Assumption 2 *Assume:*

1. $\Pi^s_G(1, G) - 2\bar{u}(0) < K$ *and* $\Pi^s_G(G, G) - 2\bar{u}(\bar{b}) > K$ *for any* $s \in \{C, R\}$.

2. $W(Y^C, Y^R)$ *is differentiable and strictly increasing in both arguments.* $\bar{u}(b)$ *is differentiable.* $\frac{\partial W}{\partial Y^s}, \frac{\partial \bar{u}}{\partial b} > \chi$ *for some* $\chi > 0$.

3. *For* $b = \bar{b}$*, define* $\bar{\bar{\delta}} < 1$ *as in Proposition 2. Then* $\delta > \bar{\bar{\delta}}$.

The first part of Assumption 2 has two main implications. First, not every principal finds it profitable to start a firm, regardless of the level of unemployment insurance. Second, if $b = l$ and there are fewer firms than good workers in sector s, then a principal finds it profitable to start a firm in sector s. These conditions ensure that equations analogous to (2) and (4) hold with equality in the formal and relational contracting sectors, respectively. The second part of Assumption 2 implies that nations prefer higher aggregate output. While this assumption is relatively mild, note that I have already assumed that the two sectors do not compete with one another. That is, my argument requires firms in the two sectors to produce goods that are not perfect substitutes. The final part of Assumption 2 ensures that a non-contractible firm matched to a good worker can induce that worker to produce first-best output, *even* if unemployment insurance is generous enough to cover the initial liquidity shock.

Under Assumption 2 and if neither λ nor $k_G - k_B$ is large, then one of the two nations chooses relatively generous unemployment insurance and attracts *only* firms in the relational sector. Under a slightly stronger assumption, each nation exclusively specializes in one sector, with the relational contracting nation choosing strictly more generous unemployment insurance.

Proposition 3 *Suppose Assumption 2 holds. Define* $\max\{\lambda, k_G - k_B\} = \xi > 0$ *and suppose* $H > \frac{1-G}{2-G}$. *Then:*

1. *There exists* $\bar{\xi} > 0$ *such that if* $\xi < \bar{\xi}$, *then* $\exists n$ *with* $b_n \geq l$. *If* $b_n = b_{n'}$, *then the equilibrium is payoff-equivalent to an equilibrium with* $\mathcal{F}_n \subseteq \mathcal{F}^R$ *for some* n.

2. *Define* $\bar{\mu}(b)$ *as the unique solution to* $\Pi_G^C(\bar{\mu}(b), G) - 2\bar{u}(b) = K$. *Assume* $\frac{G}{\bar{\mu}(b)}\left(\Pi_G^C(G,G) - 2\bar{u}(b)\right) < K$ *for* $b \in \{l, \bar{b}\}$ *and* $\frac{(1-H)G}{\bar{\mu}(0)}\left(\Pi_G^C(G,G) - 2\bar{u}(0)\right) < K$. *Then there exists* $\bar{\xi} > 0$ *such that if* $\xi < \bar{\xi}$, $\mathcal{F}_n = \mathcal{F}^R$ *and* $\mathcal{F}_{n'} = \mathcal{F}^C$ *in any equilibrium, with* $b_n \geq l$ *and* $b_{n'} = 0$.

Proof: See Appendix A.

In the equilibrium described in Proposition 3, at least one of the two nations chooses relatively generous unemployment insurance and specializes in the relational contracting sector. Moreover, if a condition holds that guarantees the total number of firms in the contractible sector exceed the total number in the relational sector, then nations specialize in different sectors. One nation chooses poor unemployment insurance and attracts firms in the contractible sector, while the other chooses generous unemployment insurance and attracts firms that produce non-contractible output.

In the contractible sector, the returns to matching depend on $k_G - k_B$. Unemployment insurance has a direct cost because $\lambda > 0$. It also deters entry by increasing the wage and opportunity costs for entering firms. Therefore, a nation that specializes in the formal contracting sector chooses low unemployment insurance unless $k_G - k_B$ is large.

A nation that specializes in the relational sector chooses $b_n \geq l$ for three reasons. As noted before, generous unemployment insurance increases the number of good workers who remain in the market. Proposition 2 shows that good workers are particularly valuable in the relational sector. Second, while increasing b_n deters entry in the relational contracting sector, the resulting impact on *output* is limited. Intuitively, unemployment insurance has both a direct cost $\lambda > 0$ and deters entry. However, output is limited by the *number of good workers available* μ_G in the non-contractible sector. An excess number of firms $\mu_F^R > \mu_G$ have an incentive to enter in the hopes matching to a good worker. These excess firms produce no output in equilibrium. Therefore, while a nation that specializes in the non-contractible sector must bear the direct cost λ of more generous unemployment insurance, it does not suffer from the corresponding lower entry. This intuition is in stark contrast to the formal contracting sector, where even firms that are matched to a bad worker produce output. Finally, the nation may increase b_n in order to *deter poaching by the formal contracting sector*. If $b_n \geq l$ is too small, then a principal in nation n may be tempted to enter the formal contracting sector in order to take advantage of the large number of good workers. Increasing b_n deters entry in the formal contracting sector, which ensures that good workers are matched to firms that rely on relational contracts.

5 Conclusion

Labor market institutions determine a nation's economic strengths and weaknesses. In this paper, I have argued that generous unemployment insurance encourages workers to remain in the market longer to search for a good match. The value of a good match depends on whether output is contractible or not. A firm that relies on relational contracts earns large returns from a good match. Therefore, a nation that specializes in relational contracts has an incentive to implement a generous safety net.

Several features of the model are essential for this intuition. First, the number of firms is strictly larger than the number of good workers for any level of unemployment insurance. If this condition did not hold, then increasing unemployment insurance might lead to a flood of good workers. In that case, a firm could easily betray a good worker and then replace him, which would undermine the relational contract. Second, workers who drop out of the market due to the liquidity shock lead to a loss in efficiency. For simplicity, I have assumed that these workers contribute nothing, but this assumption is stronger than required. Finally, workers cannot move between nations. This assumption implies that a worker cannot relocate to take advantage of a more generous social safety net. Considering worker mobility would be an interesting direction for future research, particularly given the broad changes in European markets spurred by the rise of the European Union.

As noted in the introduction, this argument is closely related to work in political science on the Varieties of Capitalism. The overarching thesis of that framework is that different institutions are complementary to one another and together determine a nation's comparative advantages. A host of other institutions could complement unemployment insurance policies to support relational contracts. Unions and collective bargaining agreements facilitate communication among agents and help them coordinate punishments of a deviating firm. Firing costs lower a firm's temptation to renege on its promises by increasing the cost of replacing a worker. Financial institutions that focus on long-term profitability encourage firms to ignore short-term gains and cultivate long-term relationships. Future research could further explore these complementarities, linking the theoretical literature on relational contracts to the empirical and descriptive literature on institutional complementarities.

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A Omitted Proofs

A.1 Proof of Lemma 1

Fix $\mathcal{G}$ and $\mathcal{F}$ and consider equation (1). The left-hand side of this equation is strictly increasing and continuous in Y. Since π is twice differentiable and satisfies strictly decreasing differences, $y_G^{FB}(Y)$ and $y_B^{FB}(Y)$ are both continuous and strictly decreasing in Y by Topkis' Theorem. At $Y = 0$, $\infty > y_x^{FB}(0) > 0$. Therefore, there exists a unique Y that satisfies the desired equality by the Intermediate Value Theorem.

Let $\mu_F^{'} > \mu_F$ and $\mu_G^{'} > \mu_G$. and suppose towards contradiction that $Y^C(\mu_F^{'}, \mu_G^{'}) \leq Y^C(\mu_F, \mu_G)$. Then $y_G^{FB}(Y^C(\mu_F^{'}, \mu_G^{'})) \geq y_G^{FB}(Y^C(\mu_F, \mu_G))$. The right-hand side of (1) is strictly increasing in μ_F and μ_G and hence is strictly larger under $(\mu_F^{'}, \mu_G^{'})$ relative to (μ_F, μ_G). But then $Y^C(\mu_F^{'}, \mu_G^{'}) > Y^C(\mu_F, \mu_G)$ for (1) to hold; contradiction. ■

A.2 Proof of Proposition 1

(1): Suppose that a worker matched to firm f earns $\bar{u}$ continuation surplus if she rejects production in this period. Every worker earns at least b continuation surplus in any equilibrium, so $\bar{u} \geq b \geq 0$. The following formal contract attains first-best and maximizes principal profit: $\tilde{\tau}_f(y) = k_f y$ and $w_f = \bar{u}$. The worker chooses $y_x^{FB}(Y)$ under this contract. If μ_F firms enter the market, the corresponding profits are $\Pi_x^C(\mu_F, \mu_G)$.

Suppose $\bar{u} > b$. Then there exists some firm f that gives the worker a continuation payoff that strictly exceeds b. Define u_{max} as the largest continuation payoff offered by a firm in equilibrium, and let f be a firm that offers this continuation payoff. If the worker rejects the firm's offer, she earns no more than $(1-\delta)\bar{u}(b)+\delta u_{max}=\bar{u}$. By the argument above, the firm holds the worker at her outside option, so $(1-\delta)\bar{u}(b)+\delta u_{max}=u_{max}$. But then $u_{max}=\bar{u}(b)$ and every worker earns $\bar{u}(b)$ in each period of the game.

Because agents earn b in every period of the repeated game, a firm matched to a worker of quality x earns $\Pi_x^C(\mathcal{F})-\bar{u}(b)$. Consider a firm matched to a good worker. The worker will accept the optimal contract in each period by construction. The firm is earning its maximum feasible surplus. If it chooses not to continue the relationship, then it earns strictly smaller surplus because it is matched to a bad worker with positive probability. So the firm will always choose to continue the relationship. $\mu_F \geq \mu_G$ in any equilibrium because $\Pi_G^C(G,G)-2b>K$. Therefore, only bad workers will be available on the market. Hence, a firm matched to a bad worker earns $\Pi_B^C(\mu)-\bar{u}(b)$ continuation surplus and (without loss) chooses to continue the relationship.

(2): Principals have an incentive to start firms so long as expected profits exceed the cost of starting a firm plus the foregone value of remaining a principal. So entry occurs so long as

$$\frac{\mu_G}{\mu_F}(\Pi_G^C(\mu_F,\mu_G)-\bar{u}(b))+\frac{\mu_F-\mu_G}{\mu_F}(\Pi_B(\mu_F,\mu_G)-\bar{u}(b))>K+\bar{u}(b).$$

$\Pi_x^C(\mu)$ is decreasing in μ_F because $Y^C(\mu)$ is strictly increasing in μ_F. So either this inequality holds for all $\mu_F \leq 1$ or there exists a unique μ_F^C such that this inequality holds for all $\mu_F < \mu_F^C$. Rearranging yields (2) as desired. ■

A.3 Proof of Proposition 2

(1):

Suppose that a worker earns strictly more than b in a given period. Then this worker must be matched to a firm. By an argument similar to Proposition 1, some firm can profitably deviate by undercutting its wage offer. So workers earn b in each period.

Define $\bar{\pi}$ as the outside option of the firm at the start of the next period. Let Π be equal on-path total continuation surplus. By a straightforward adaptation of Levin (2003), the pair can produce any y_f in this period that satisfies

$$k_f y_f \leq \frac{\delta}{1-\delta}(\Pi - \bar{u}(b) - \bar{\pi}) \tag{5}$$

Suppose that a firm matches to a bad worker. The firm can always choose not to continue the relationship and immediately rematch with another worker because $\mu_F \leq 1 < G + 1$. A firm matched to a bad worker can make a contract offer C that exactly replicates continuation play with the current worker. A firm matched to a good worker can do strictly better by offering a contract with higher production that also satisfies (5). So $\bar{\pi} \geq \Pi$. But then $y_f = 0$ in any firm matched to a bad worker. Because $\bar{u}(b) > 0$, a firm matched to a bad worker earns no more than $\bar{u}(b)$ in that period.

Firms matched to bad workers produce no output. Therefore, aggregate output in each period cannot exceed $Y^R(\mathcal{G})$. Define $\bar{\delta} < 1$ as the solution to

$$k_G y_G^{FB}(Y^R(G,G)) = \frac{\bar{\delta}}{1-\bar{\delta}} K.$$

Let $\delta \geq \bar{\delta}$. Suppose that a firm matched to a good worker always continues the relationship, and makes a contract offer C that induces $y_x^{FB}(Y^R(G,G))$. A firm matched to a good worker earns $\Pi_G^R(G,G) - b$ in this equilibrium, so $\mu_F \geq \mu_G$ because $\Pi_G^R(G,G) - 2b > K$. Hence, only bad workers are unmatched in any period on the equilibrium path. Therefore, every firm matched to a good worker faces an outside option $\bar{\pi} = b$. For $\delta \geq \bar{\delta}$, (5) holds because $\Pi_G^R(G,G) - 2b > K$. So there exists a relational contract that satisfies (5) and induces first-best output from a good worker in each period. The resulting strategies form a relational contract, as desired.

(2): In this equilibrium, entry continues so long as

$$\frac{\mu_G}{\mu_F}(\Pi_G^R(\mu_F, \mu_G) - b) + \left(1 - \frac{\mu_G}{\mu_F}\right) \bar{u}(b) \geq K + \bar{u}(b).$$

As in Proposition 1, there exists a unique μ_F^R such that this inequality is satisfied if and only if $\mu_F \leq \mu_F^R$. Rearranging yields (4) as desired. ■

A.4 Proof of Proposition 3

Consider an equilibrium of this game. For the moment, assume $\mu_F^s < 1$ for $s \in \{C, R\}$. With abuse of notation, let

$$\tilde{\Pi}_x(Y) = \pi(y_x^{FB}(Y)|Y) - k_x y_x^{FB}(Y)$$

for $x \in \{G, B\}$. Then free entry in nation n, sector C is determined by

$$\frac{\mu_{G,n}}{\mu_{F,n}} \left(\tilde{\Pi}_G(Y^C) - \tilde{\Pi}_B(Y^C)\right) + \tilde{\Pi}_B(Y^C) - 2\bar{u}(b_n) \leq K \tag{6}$$

with equality if $\mu_{F,n}^C > 0$. Similarly, free entry in sector R is determined by

$$\frac{\mu_{G,n}}{\mu_{F,n}} \left(\tilde{\Pi}_G(Y^R) - 2\bar{u}(b_n)\right) \leq K \tag{7}$$

with equality if $\mu_{F,n}^R > 0$.

Aggregage production in $s = C$ is given by the fixed point to

$$Y = y_B^{FB}(Y) + \left(\frac{\mu_{G,A}}{\mu_{F,A}}\mu_{F,A}^C + \frac{\mu_{G,B}}{\mu_{F,B}}\mu_{F,B}^C\right)(y_G^{FB}(Y) - y_B^{FB}(Y)) \tag{8}$$

Aggregate production in $s = R$ is given by the fixed point to

$$Y = \left(\frac{\mu_{G,A}}{\mu_{F,A}}\mu_{F,A}^R + \frac{\mu_{G,B}}{\mu_{F,B}}\mu_{F,B}^R\right) y_G^{FB}(Y). \tag{9}$$

By assumption, $\mu_F^R, \mu_F^C > 0$ in any equilibrium.

(1): Towards contradiction, suppose $b_A = b_B = 0$. Fix $k_G > 0$. Then $\tilde{\Pi}_G(Y^C) - \tilde{\Pi}_B(Y^C)$ is continuous in k_B for $k_B > k_G$, and approaches 0 as $k_B \downarrow k_G$. Entry and aggregate output μ_F^C and Y^C are likewise continuous in k_B. So (6) and (7) imply that no principal in A chooses to start a contractible firm if $b_A = \bar{b}$, $b_B = 0$, and $k_B - k_G < \bar{\xi}$ for some $\bar{\xi} > 0$. These same conditions imply that $\mu_{F,A} = \mu_{F,B}$ in any equilibrium.

Since $\mu_{F,A} = \mu_{F,B}$, I claim there exists a payoff-equivalent equilibrium in which $\mathcal{F}_n \subseteq \mathcal{F}^s$ for some nation n and sector s. Suppose not; then consider holding the total number of firms in each sector and nation fixed, but rearranging them so that $\mathcal{F}_n \subseteq \mathcal{F}^s$ for some n and s. This rearrangement changes neither entry nor aggregate production in either sector. Thus, this alternative is also an equilibrium.

Let $k_B - k_G < \bar{\xi}$ and suppose $\mathcal{F}_A \subseteq \mathcal{F}^C$. Consider a deviation by nation B to $b_B = \bar{b}$. Following this deviation, $\mathcal{F}_B \subseteq \mathcal{F}^R$ and $\mu_{G,B} = G$. Part 1 of Assumption 2 implies that $\mu_{F,B}^R \geq G$, so aggregate production Y^R satisfies $Y^R = G y_G^{FB}(Y^R)$, and in particular is strictly larger than if $b_B = 0$. Production in the contractible sector Y^C strictly decreases, but the size of this decrease approaches 0 as $k_B \uparrow k_G$. Therefore, there exists a $\bar{\xi}$ such that if $k_B - k_G < \bar{\xi}$ and $\lambda < \bar{\xi}$, then $W(Y^R, Y^C) - \lambda b_B$ is strictly larger following this deviation.

Let $k_B - k_G < \bar{\xi}$ and suppose $\mathcal{F}_A \subseteq \mathcal{F}^R$. Consider a deviation by nation A to $b_A = \bar{b}$. I claim that Y^R strictly increases following this deviation. If $b_A = 0$, then aggregate output from the two nations' relational contract sectors equal

$$\begin{array}{c} Y_A^R = (1-H)G \\ Y_B^R = \frac{\mu_{F,B}^R}{\mu_{F,B}}(1-H)G \end{array},$$

respectively. Part 1 of Assumption 2 implies that $\mu_{F,B}^C > G$ for $k_B - k_G$ sufficiently small, since $\Pi_B^C \to \Pi_G^C$ as $k_B \downarrow k_G$. Since $H > \frac{1-G}{2-G}$, I conclude that $Y^R < G$ for $k_B - k_G$ sufficiently small. In contrast, $Y^R \geq G$ if $b_A = \bar{b}$, since otherwise part 1 of Assumption 2 implies that a principal would have an incentive to start a relational firm in A. So Y^R strictly increases. As a result, $\mu^R_{F,B}$ strictly decreases and so $\mu^C_{F,B}$ strictly increases. So Y^C strictly increases as well. Thus, nation A has a profitable deviation so long as $\chi(\Delta Y^R + \Delta Y^C) > \lambda \bar{b}$, which is true if λ is sufficiently small.

Thus far, I have shown that there exists a $\bar{\xi} > 0$ such that $b_A = b_B = 0$ is never an equilibrium if $\max\{\lambda, k_B - k_G\} < \bar{\xi}$. It remains to show that if $b_A = b_B$, then the equilibrium is payoff-equivalent to an equilibrium with $\mathcal{F}_n \subseteq \mathcal{F}^R$ for some nation n. By an argument essentially identical to the case $b_A = b_B = 0$, the equilibrium is payoff-equivalent to an equilibrium with $\mathcal{F}_n \subseteq \mathcal{F}^s$ for some nation n and sector s. Suppose (without loss) $\mathcal{F}_A \subseteq \mathcal{F}^C$ and $\mathcal{F}_B \cap \mathcal{F}^C \neq \emptyset$. Since $b_A = b_B$, $\mu_{F,A} = \mu_{F,B}$ in this equilibrium and so $\mu^R_F < \mu^C_F$. If $b_A = b_B \geq l$, consider a deviation by nation A to $b_A = 0$. For $k_B - k_G$ sufficiently close to 0, this deviation leads to $\mathcal{F}_B \subseteq \mathcal{F}^R$. As a result, Y^R strictly from $\frac{\mu^R_{F,B}}{\mu_{F,B}} G$ at least G, while Y^C strictly increases by (6) in nation A. So this is a profitable deviation for $k_B - k_G$ sufficiently close to 0.

So if $k_B - k_G$ is sufficiently close to 0, then any equilibrium with $b_A = b_B$ must be payoff-equivalent to an equilibrium with $\mathcal{F}_n \subseteq \mathcal{F}^R$ for some nation n.

(2): I first claim that $b_A \neq b_B$ in equilibrium. I have already shown that $b_A = b_B = 0$ is never an equilibrium. Suppose towards contradiction that $b_A = b_B \geq l$. By the argument from Part 1, this equilibrium must be payoff-equivalent to an equilibrium in which $\mathcal{F}_n \subseteq \mathcal{F}^R$ for some nation n. From (1) and (3), $\Pi^R_G(\mu_F, G) = \Pi^R_G(G, G) = \Pi^C_G(G, G)$. Moreover, $Y^R \geq G$ in any equilibrium with $\mathcal{F}_n \subseteq \mathcal{F}^R$ and $b_n \geq l$ by part 1 of Assumption 2.

If $Y^R \geq G$, then $\mu^R_{F,n} < \bar{\mu}(b_n)$ for the free entry condition (7) to hold in nation n. But for fixed k_G, as $k_B \downarrow k_G$ $\mu^C_F \to \bar{\mu}(b_n)$. In particular, $\mu^R_{F,n} < \mu^F_C$ for $k_B - k_G$ sufficiently close to 0. But then $\mu_{F,A} \neq \mu_{F,B}$, which contradicts a requirement for equilibrium. So $b_A \neq b_B$ in equilibrium.

Suppose $b_A > b_B$. For $k_B - k_G$ sufficiently small, all contractible firms locate in nation

B: $\mathcal{F}^C \subseteq \mathcal{F}_B$. By Assumption 2, aggregate relational output satisfies $Y^R \geq G$. Since $\frac{\mu_G}{\bar{\mu}(b_B)}\left(\Pi_G^R(G,G) - 2\bar{u}(b_B)\right) < K$, (7) implies that no relational firm finds it optimal to enter nation B. So $\mathcal{F}^C = \mathcal{F}_B$ and hence $\mathcal{F}^R = \mathcal{F}_A$. But then aggregate contractible output Y^C is largest if $b_B = 0$, so nation B can profitably deviate to $b_B = 0$. Therefore, in any equilibrium $b_n \geq l$, $b_{n'} = 0$, $\mathcal{F}_n = \mathcal{F}^R$, and $\mathcal{F}_n = \mathcal{F}^C$, as desired. ■