Capitalists in Revolution[1]

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Abstract

Political risk of regime change reduces foreign investment and raises capital flight. Conversely, such investment decisions in anticipation of political risk harm the economy, amplifying political instability. This paper develops a theoretical framework that integrates a general equilibrium model of economy into a model of collective action to study the interactions between globalization, capital mobility, capital control, state repression, and regime change. Our model consists of two global games (one between the capitalists and one between the workers) linked through domestic markets that determine wages and capital returns. Small changes in foreign capital returns and capital mobility can cause sudden and significant social and economic changes—they have a threshold effect on the likelihood of regime change. These results suggest that in conflict-prone societies, globalization and economic development can amplify the likelihood of regime change. Moreover, capitalists face a coordination problem. As a result, when capital mobility is high and foreign returns are low, they support a state with strong coercive power to impose capital control. We investigate when economic coercion (capital control) and political coercion (repression) are complements (e.g., Nazi Germany) or substitutes (e.g., Latin American military regimes).

Keywords: Political Risk, Regime Change, Capital Control, Globalization, Capital Mobility, Repression, General Equilibrium, Global Games.

JEL Classification: D74, D8.

1 Introduction

A leading empirical explanation for why capital doesn't flow from rich to poor countries (Lucas Paradox) is the quality of institutions, including government stability and internal conflict (Alfaro et al. 2008; Papaioannou 2009). The flip side of this observation is also true: "political instability is the most important factor associated with capital flight" (Le and Zak 2006, 308; Collier et al. 2001; Lesnik et al. 2000).[1] Conversely, it is well-known that bad economy causes political instability (Besley and Persson 2011; Blattman and Miguel 2010). The picture that emerges from these empirical observations shows layers of feedback between the economy and politics stemming from the expectations of what is to come: the risk of expropriation that accompanies regime change reduces investments and encourages capital flight, thereby harming the economy. The bad economy, in turn, heightens the risk of political instability and further hurt the economy, and so on. However, the literature typically either takes political risk as given and studies its effect on the economy, or takes the economy as given and investigates political stability. This paper develops a theoretical framework that integrates a simple general equilibrium model of economy into a model of collective action to study the interactions between globalization, capital mobility, capital control, state repression, and regime change.

The key logic of this paper is that decisions of a multitude of small economic players to withhold investment in a country in anticipation of political instability work through the levers of the economy to reduce economic opportunities (e.g., reduce wages). In turn, this endogenous reduction in opportunity costs of political activities raises the incentives of potential activists to switch their efforts from economic to political activities, increasing the likelihood of regime change. A key substantive lesson of the analysis is that economic development and

[1] Indeed, capital flew out of the Philippines in response to heightened protests against Marcos (Boyce 1993), and in the months preceding the Iranian Revolution, "$50 million was leaving the country every day" (Parsa 2000, p. 201). The countries of the Arab Spring also conform to this pattern. Empirical estimates suggest an increase in capital flight in both Egypt and Tunisia in 2010 just before the Arab Spring (Ndikumana and Boyce 2012). Using quarterly panel data on greenfield FDI, Burger et al. (2016) show that FDI dropped dramatically in countries that experienced the Arab Spring. Further, according to World Bank data, between 2010 and 2011, FDI dropped from about 6386 (millions of U.S. dollars) to -483 in Egypt, from 189 to -518 in Yemen, and from 1334 to 433 in Tinisia. In Libya, FDI dropped from 1784 in 2010 to mere 50 in 2014. According to IMF data, "official reserve assets and other foreign currency assets" dropped from 43,500 (millions of U.S. dollars) in 2010 to 18,500 in 2011 in Egypt, and from 9,500 to 7,500 in Tunisia.

globalization generate forces that can reduce political stability and strengthen demand by elites for a strong, coercive state. Moreover, the model sheds light on the nature of right-wing governments by investigating when economic and political coercion (e.g., capital control and repression) are complements (e.g., Nazi Germany) or substitutes (e.g., Latin American military regimes). We first give an overview of the main results, followed by a description of the model and key strategic forces. Then, we discuss the results and intuitions in more detail.

The feedback channels between the economy and politics as well as the expectations of players of each others' behavior mentioned above, tend to create a self-fulfilling strategic environment with multiple equilibria. Our first result is that, by taking a global games approach, we obtain a unique equilibrium with a simple closed-form solution that identifies when regime change happens. Moreover, the equilibrium likelihood of regime change can rise sharply with foreign capital returns and with capital mobility—and hence with globalization and economic development, which facilitate capital movements and its transaction costs. Second, we show that when capital mobility is high and foreign returns on capital are low, the rich (capital owners) support a state with strong coercive power to impose capital control to reduce the likelihood of regime change. Extending this result, we show how the rich support a combination of economic coercion (capital control) on themselves together with political coercion (repression) against workers. In particular, we investigate when economic and political coercion are complements (e.g., Nazi Germany) or substitutes (e.g., Latin American military regimes). These results reveal the unintended consequences of processes of economic development and globalization: These processes invoke strategic responses that tend to strengthen the alliance between the rich and the state, and raise support for centralization of a state authority with strong coercive power.

In our model, there is a continuum of citizens distinguished by whether they own capital (*capitalists*) or labor (*workers*). Capitalists decide how to allocate their (mobile) capital into domestic or foreign markets. Workers decide whether to allocate their labor into economic production or into revolutionary activities aimed at regime change. Revolution succeeds if the mass of workers who revolt exceeds a threshold of regime strength (*regime change*). This threshold is uncertain and capitalists and workers have noisy private signals about it (*global game*). A subset of workers would like to revolt, but when they divert efforts from economic production to revolt, they lose their wages—thus, they revolt only if they are sufficiently optimistic about success. Capitalists do not like revolution because if it succeeds, their domestic capital is confiscated. In anticipation of this political risk, they can move their capital to foreign markets. Investments in foreign markets yield a safe expected return. However, absent a revolution, foreign returns are lower than (endogenously determined) domestic returns. These capital allocations influence the workers' wages through market mechanisms. In particular, wages and domestic capital returns are determined endogenously in a *competitive market* with a Cobb-Douglas production technology. The complementarities between capital and labor imply that when capital flies, marginal productivity of labor and hence wages fall. Conversely, the workers' decisions to allocate their efforts into economic or political activities also influence domestic capital returns both through the political risk channel and through the complementarities between capital and labor. Thus, the model consists of two global games, one between the capitalists and one between the workers, linked through domestic markets that determine wages and capital returns.

Capitalists face a coordination problem. The *strategic uncertainty* arising from their private information of regime strength impairs their ability to coordinate on their investments. For example, when the regime is strong enough that revolution can be avoided if all capitalists invested domestically, strategic uncertainty about others' behavior causes some capitalists to move their capital abroad. This reduction in domestic capital reduces economic opportunities (wages), raising the workers' incentives to switch from economic to political activities that tips the balance toward regime change. Thus, when other capitalists are more likely to move their capital abroad, political risks of domestic investment increase, raising a capitalist's incentives to do the same. This underlies the *political source of strategic complementarities* among the capitalists. Market mechanisms generate their own strategic forces. One reinforces the above political strategic force: When more capitalists move their capital abroad, and consequently more workers withdraw their labor, capital returns in domestic markets fall due to complementarities between capital and labor in production technology. This raises a capitalist's incentive to move his capital abroad, and underlies the *economic source of strategic complementarities* among the capitalists. The second market-induced strategic force goes to the opposite direction. When more capitalists move their capital abroad so that the domestic supply of capital falls, capital returns increase. This raises a capitalist's incentive to keep his capital in domestic markets, and underlies the (economic) *strategic substitutes* force in capitalists' interactions.

The mirror image of these strategic considerations arises in the workers' decisions: strategic complementarities arise because enough workers must revolt for the revolution to succeed; strategic substitutes arise due to reduction in labor supply (congestion externalities). These conflicting forces arise from the couplings between the coordination problems of the capitalists and workers through the market. Despite these interlinked strategic considerations, we show that (under mild conditions and) when the noise in private signals is vanishingly small, there is a unique equilibrium in cutoff strategies. In equilibrium, the regime collapses when its strength is below a threshold (*equilibrium regime change threshold*).

If the wages and capital returns were exogenous, there would be little interactions between capitalists and workers, and no possibility of feedback channels between the economy and politics.[2] In such a model, the equilibrium regime change threshold would be proportional to the exogenous wage: reducing wages would raise the likelihood of regime change. We show that in our model where wages and capital returns are endogenous, the equilibrium regime change threshold takes the same form, but with an *effective wage*. This effective wage (and hence the ex-ante likelihood of regime change) is decreasing in foreign returns and in capital mobility: Higher foreign returns increases the capitalists' incentives to move their capital abroad; Higher degrees of capital mobility means that the capitalists can move a larger fraction of their capital abroad. The threshold nature of equilibrium implies that small changes in foreign returns or capital mobility can cause sudden and dramatic changes in the country's social and economic structures (regime change). These results have direct consequences for processes of economic development and globalization. Economic development often involves reallocation of capital from relatively immobile to more mobile sectors—e.g., from the agricultural sector to services and finance. Similarly, globalization and market integration facilitate international capital movements. Thus, although these processes can create significant value by improving efficiency and raising productivity, they also generate opposing forces that work to undermine their continuation.

[2]Then, the workers' problem would become a standard global game of regime change, and each capitalist would have to estimate the likelihood of regime change with no concern about the behavior of other capitalists.

Anticipating the dangerous consequences of their collective action problem, the capitalists seek a remedy. They recognize that when each of them decides to move his capital abroad, he does not internalize the adverse effect of his decision on other capitalists: reductions in domestic capital reduce wages and increase the likelihood of revolution, thereby hurting the capitalists who invest domestically. To curb these negative externalities, the capitalists can support a central authority with sufficient coercive power to impose capital control.[3] Capital control features a tradeoff for capitalists: it reduces the ex-ante likelihood of revolution, but it also prevents the capitalists with pessimistic (ex-post) beliefs about stability from moving their capital abroad and escaping confiscation. We show that capitalists want to impose capital control if and only if expected foreign capital returns are sufficiently low *and* capital mobility (the magnitude of mobile capital) is sufficiently high.

Capital control is one form of coercive instrument of the state that the capitalists support to reduce the likelihood of regime change. Repression of revolutionary workers is another coercive instrument that raises the costs of revolt and help maintaining the status quo. Capital control is a form of economic coercion and repression is a form of political coercion. Thus, to maintain the status quo, the capitalists can employ a combination of these two key coercive instruments of state: economic coercion on themselves and political coercion against the workers. State policies of low capital control and high repression in some Latin American countries between 1960s and 1980s suggest that capital control and state repression of labor are substitute instruments to contain the threat of revolution.

However, the capitalists' tradeoffs between economic and political coercion are more subtle. With capital control, if the revolution occurs, it has higher costs for capitalists who could not save their capital by moving it abroad in anticipation of the revolution. This increases the capitalists' incentive to use repression when there is capital control. We call this the *Boix Effect*, capturing the idea that capital mobility would reduce the elite's resistance to regime change by alleviating confiscatory consequences for the elite (Boix 2003). Thus, the Boix effect makes capital control and labor repression complements. But capital control also reduces the likelihood of revolution. When this lower likelihood translates into lower *marginal* change in the likelihood from raising repression, it creates more incentives to repress when

[3]This logic also implies the presence of a force for concentration of capital into conglomerates that internalize the externalities that its constituents would have imposed on each other.

capital moves freely (absent capital control). We call this the *Marx Effect*, reflecting the idea that freer global movement of capital can result in labor repression. Thus, the Marx effect makes capital control and labor repression substitutes. We show that when there is little prior knowledge about the regime's strength, the Boix effect dominates, making economic coercion and political coercion complements.[4] These complementarities resonate with the Nazi regime's policies in the 1930s that combined state control of capital movements and harsh repression of labor (Overy 1996, 2002).[5] In contrast, when the Marx effect dominates, capital control and labor repression become substitutes, resonating with the policies of Latin American right-wing regimes between 1960s and 1980s.[6]

We next review the literature and the contribution of the paper. Section 2 presents the main model. Section 3 discusses two benchmarks. The workers' problem is analyzed in section 4. Section 5 analyzes the capitalists' problem and characterizes the equilibrium. We discuss capital control (economic coercion) in section 6, and its relationship with state repression (political coercion) in section 7. Section 8 concludes. Proofs are in the Appendix.

1.1 Literature

This paper contributes to a number of literatures. First, a large literature examines various aspects of revolutions, focusing on the coordination problem among the citizens who aim to topple the regime, and on the state's decisions to prevent regime change by using coercion and information manipulation.[7] This paper contributes to this literature in three ways. (1)

[4]The reason is that when capitalists (ex ante) believe that the regime's strength is almost uniformly distributed, marginal changes in the likelihood of revolution (from raising repression) are almost independent of the overall likelihood of revolution (from capital control decisions). As a result, the force that underlies the Marx effect becomes negligible.

[5]Nazi's harsh treatment of labor unions and the left is well-known. So is the capitalists' support of the Nazis, at least for the most part of the 1930s and partly to contain the revolutionary threat of the left (Shirer 1960). Perhaps less well-known is the pre-war economic policy of the Nazis. As Overy (1996) argues, as early as 1934 when the regime was not still fully secured, as part of the economic recovery and social stabilization plans, "comprehensive control over foreign transactions were established in the so-called 'New Plan' drawn up by Hjalmar Schacht, President of the Reichbank [1923-30 and 1933-39] and Minister of Economics." In particular, "capital could not be moved freely abroad" (Overy 1996, p. 26).

[6]Alesina and Tabellini (1989) document the high degree of capital control by right-wing governments in Latin America from 1967 to 1986. The repression of labor in these governments is well-known. The "dependent development" literature (following Evans (1979)) show the alliance between the state and capital (foreign and domestic) in Latin America (among other places), and the state's facilitation of capital movements.

[7]Topics studied in this literature include: coordination and information aggregation (Bueno de Mesquita 2010; Shadmehr and Bernhardt 2011; Chen et al. 2014; Tyson and Smith 2017), revolutionary leaders and

It studies the complex interactions between the economy and regime change: the anticipation of regime change influences the economic decisions that, in turn, in a general equilibrium framework, affect citizens' decision to revolt. (2) It reveals the coordination problem among pro-regime players (capitalists) that would like to maintain the status quo.[8] (3) It studies the consequences of this coordination problem for the state's policies of political coercion (repression) and economic coercion (capital control). In sum, the paper provides a more complete picture of the subtle interactions between economics and politics in authoritarian regimes.

Second, a large political economy literature studies the interactions between the economy and regime change. However, in this literature either the critical aspects of the economy (e.g., wages and capital returns) are exogenous, or coordination and information frictions among relevant players are absent, or both. Acemoglu and Robinson (2001, 2006a) and the literature that followed develop dynamic models of regime change that study the interactions between economic inequality, social mobility, and political regimes. In these models, high levels of inequality increase the incentives of the non-elite (representative agent) to revolt and confiscate the elite's assets. To prevent such a revolution, (the representative agent of) the elite can use costly repression, redistribution, or democratization, which involves commitment to future redistributions. Because revolutionary potential happens only on (exogenous and random) occasions, current redistribution may not suffice to quell revolution as the representative non-elite citizen knows that the elite will renege on redistribution.

In Persson and Tabellini (2009), citizens are either young or old. The young obtain exogenous wages and decide how much to save, and the old decide whether to revolt, where the likelihood of regime change is the fraction of revolters. The benefits of regime change are contingent on success, and consist of an exogenous "democratic capital" and an exogenous return on capital that takes two different known values under democracy and dictatorship. The

their tactics (Shadmehr and Bernhardt 2012; Bueno de Mesquita 2013; Loeper et al. 2014; Wantchékon and García-Ponce 2014; Morris and Shadmehr 2017), the role of media (Egorov et al. 2009; Edmond 2013; Shadmehr and Bernhardt 2015, 2017; Guriev and Treisman 2015; Barbera and Jackson 2016; Quigley and Toscani 2016), the effect of elections (Egorov and Sonin 2017), contagion (Chen and Suen 2016), determinants of extremism (Shadmehr 2015), and middle class activism (Chen and Suen 2017).

[8] Tyson and Smith (2017) study a setting in which a group of regime opponents must decide whether to revolt and a group of regime adherent must decide whether to support the regime. Between-group interactions stem from the technology of regime change: The regime collapses when the measure of revolters minus that of regime supporters exceeds an uncertain threshold, about which players receive noisy private signals.

"costs" of revolt are uncertain, distributed on the real line, and players receive noisy private signals about these costs. Thus, the old engage in a standard global game. The economy and politics are linked: when the (exogenously given) returns to capital are higher under democracy, the young have more incentives to invest under dictatorship, because they expect the old to have more incentives to revolt, raising the likelihood of democracy in the next period when the young will receive returns to their investments. Relatedly, the modernization hypothesis that economic development leads to democratization (Lipset 1959; Rueschemeyer et al. 1992; Barro 1999; Acemoglu et al. 2009) links economic development to political change through a variety of channels. Conversely, the effect of political structure on the economy such as political barriers to economic development has been a topic of significant interest (Grossman and Helpman 1994; Barro 1998; Przeworski et al. 2000; Acemoglu and Robinson 2006b). This paper develops a theoretical framework that allows researchers to investigate the interactions between the economy and politics without abstracting from either endogenizing key economic parameters or coordination and information frictions that are inherent in conflict settings.

Third, this paper contributes to the political economy literature on capital flight and capital control. In addition to the differences described above, in this paper the capitalists themselves want to impose capital control to limit their collective action problem, whereas in this literature, capital control is favored by those who own less capital (Schulze 2000, Ch. 3; Eichengreen 2003, p. 54-8). In Alesina and Tabellini (1989), capital flight occurs due to exogenous uncertainty about whether the future government will expropriate capital, and capital control is imposed to limit this capital flight. In particular, a government that represents capitalists never imposes capital control, while one that represents workers always does. Chang (2010) endogenizes the likelihood of pro-business victory based on a probabilistic voting model: This likelihood is increasing in marginal gains of entrepreneurs from the pro-business government (relative to the pro-labor government), and decreasing in workers' corresponding marginal gains. Multiple equilibria can arise because when the likelihood of a pro-business victory is expected to be low, the interest rate is higher, cutting into the profits of the entrepreneurs who have to borrow money. This reduces their incentives to vote for pro-business government (e.g., causing low turnout), fulfilling the expectations—see also Tornell and Velasco (1992), Bartolini and Drazen (1997), and Broner and Ventural (2016).

Fourth, this paper contributes to the emerging literature on determinants of state repression. Egorov and Sonin (2017) show that in authoritarian regimes, free and fair elections and repression can be complements. Shadmehr and Boleslavsky (2015) show that exogenous restrictions on repression (international pressure) or endogenous restrictions (partially independent judiciaries) can raise the likelihood of repression. Besley and Persson (2011) show that higher (exogenous) wages, public spending, and checks and balances and lower natural resources all reduce the likelihood that repression or civil war is observed. In Acemoglu and Robinson (2001, 2006), higher inequality raises the likelihood of repression—see Earl (2011) for a review. Critically, in Boix (2003), higher capital mobility reduces the costs of democracy to the (representative) elite, and hence reduces their incentives to use repression. We show that repression and capital control (which reduces capital mobility) can either be complements (Boix Effect) or substitutes (Marx Effect) instruments to maintain the status quo. We then identify conditions under which capital control (economic coercion) and repression (political coercion) are positively or negatively correlated—i.e., complements or substitutes.

From a methodological perspective, we integrate a global game model of regime change (Morris and Shin 1998, 2003) with a general equilibrium model of the economy where wages and capital returns are determined endogenously in a competitive market with production. The model departs from standard global games in several key ways. Two groups of players interact, each group has coordination incentives and strategic uncertainty within the group, and the actions of the groups are linked through the economy: when capitalists are more likely to invest domestically, due to the complementarities between capital and labor in the production technology, wages increase, reducing the likelihood of revolution. Conversely, when workers are less likely to revolt, capitalists' incentives to invest domestically rise because their capital is safer, and because of the complementarities between capital and labor in the production technology. Due to congestion externalities in production technology (e.g., more supply of labor reducing wages) within-group strategic interactions do not feature global strategic complementarities and the game is not a super-modular game. We show that under mild conditions monotone equilibria exist, and there is a unique equilibrium in monotone strategies when the noise in private signals is vanishingly small.[9]

[9]The existence and uniqueness of equilibrium in monotone strategies are related to "Action Single Crossing" property in Morris and Shin (2003, p. 69) and to Athey (2001).

2 Model

Players and Actions. There is a continuum 1 of workers, indexed by $i \in [0,1]$, and a continuum 1 of capitalists, indexed by $j \in [0,1]$. Each worker is endowed with 1 unit of labor. Each capitalist j is endowed with $\overline{K}$ units of capital, $\underline{K} \in (0, \overline{K})$ units of which are immobile and must be invested in domestic market, while the remaining $\overline{K} - \underline{K}$ units can be invested in domestic or foreign markets. The game proceeds in two stages. In stage one, each capitalist decides how to divide his mobile capital between domestic and foreign investments. Let $k_j \in [0, \overline{K} - \underline{K}]$ be capitalist j's domestic investment of his mobile capital, and $K = \int k_j dj \in [0, \overline{K} - \underline{K}]$ be the aggregate domestic mobile capital. In stage two, each worker observes the total capital investment, and decides whether to work or to revolt. The labor is inelastic, so that if a worker decides to work, he contributes $l_i = 1$ unit of labor.

Payoffs. Payoffs are realized after the success or failure of the revolution. All players are risk-neutral, and maximize their expected payoffs. If the revolution fails, the capitalists receive their returns from domestic and foreign capital; the workers who worked, receive their wages, and those who revolted get 0. If the revolution succeeds, domestic capital is confiscated from the capitalists, and is distributed evenly among all workers, and the workers who worked, receive their wages. Moreover, a fraction $1 - \underline{L} \in (0,1)$ of workers are willing participants in the revolution, and derive warm-glow payoffs $s > 0$ from participating in a successful revolution.[10] Let $L = \int l_i di \in [0, 1 - \underline{L}]$ be the aggregate labor input of these potential revolutionary workers. The remaining workers do not gain from participating in a successful revolution, and hence always work in equilibrium.[11]

Markets and Production Technology. Domestic markets are competitive, so that the wage and the return to capital are their marginal revenue products. The production tech-

[10] As Morris and Shadmehr (2017) discuss in detail, this "warm glow" benefit is identical to the notion of "pleasure in agency" in revolutions and civil wars formulated by Wood (2003) based on extensive qualitative works and the sociological and historical literature on conflict. Such "warm glow" benefits are a common feature of models of political regime change, e.g., Persson and Tabellini (2009) and Burno de Mesquita (2010).

[11] We obtain Similar results if, alternatively, we assume that a fraction $\underline{L}$ of workers cannot participate in the revolution for exogenous reasons, e.g., state security in their area is tight; a subset of the remaining fraction $1 - \underline{L}$ may revolt, and if the revolution succeeds, the expropriated capital is distributed evenly among the revolters. The key is that a fraction $\underline{L} > 0$ of workers always work, so that, given competitive markets and Cobb-Douglas production technology, wages are always bounded. In addition to making the model closer to the real world, introducing $\underline{L}$ and $\underline{K}$ allows us to ensure dominance regions in the workers' decision; see the proof of Lemma 1.

nology is Cobb-Douglas $A(\underline{K}+K)^{\alpha}(\underline{L}+L)^{1-\alpha}$, with $\alpha \in (0,1)$, and $\underline{K},\ \underline{L} > 0$ as described above. Let r_d be the domestic return to capital. Because domestic markets are competitive, $r_d = \alpha \left(\frac{\underline{L}+L}{\underline{K}+K}\right)^{1-\alpha}$ and $w = (1-\alpha)\left(\frac{\underline{K}+K}{\underline{L}+L}\right)^{\alpha}$. Alternatively, mobile capital can be invested in foreign markets, e.g., treasury bonds or stocks. The rate of return to capital in foreign markets is r_f, which is a random variable with support $[\underline{f}, \overline{f}]$.[12]

Revolution Technology and Information Structure. The revolution succeeds whenever the measure of revolters exceeds the uncertain regime strength $\theta \in \mathbb{R}$. Capitalists and workers share a prior that $\theta \sim g(\cdot)$, and they receive noisy private signals about θ. Let y_j be a capitalist j's private signal, and x_i a worker i's private signal. $x_i = \theta + \sigma_w\ \epsilon_i$, where $\epsilon_i \sim\ \ iid\ f_{\epsilon}(\cdot)$, and $y_j = \theta + \sigma_c\ \eta_j$, where $\eta_j \sim\ \ iid\ f_{\eta}(\cdot)$. To ensure that signals and the fundamental satisfy the monotone likelihood ratio property, we assume that $f_{\epsilon}(\cdot)$ and $f_{\eta}(\cdot)$ are both log-concave.[13] The capitalists observe r_f, but workers receive a noisy public signal $\tilde{r}_f = r_f + \epsilon_f$ about it, with $\epsilon_f \sim h(\cdot)$, so that they cannot infer the exact value of θ from observing aggregate domestic capital investment K. All the noises $\epsilon_i,\ \eta_j,\ \epsilon_f$ and the fundamental θ are independent of each other, and distributed accordingly to twice continuously differentiable distributions with full support on $\mathbb{R}$.

Timing. Capitalists observe the return to foreign investment r_f and their signals y_j's about the regime's strength θ, and decide how to divide their capital between domestic and foreign markets. Workers observe aggregate domestic capital, a public signal of foreign returns $\tilde{r}_f$, and their signals x_i's about the regime's strength θ, and then decide whether or not to revolt. The success or failure of revolution is determined, payoffs are realized, and the game ends.

Strategies. A pure strategy for a capitalist $j \in [0,1]$ is a mapping $\rho_j : \mathbb{R}^2 \to [0, \overline{K} - \underline{K}]$ from the foreign rate of return r_f and his private signal y_j to a decision of how much capital $k_j \in [0, \overline{K} - \underline{K}]$ to invest domestically. A pure strategy for a worker $i \in [0,1]$ is a mapping $\sigma_i : \mathbb{R} \times \mathbb{R}^2_+ \to \{0,1\}$ from his signals x_i and $\tilde{r}_f$ and the aggregate domestic capital investment K to a decision whether to work or revolt, where $\sigma_i(x_i, \tilde{r}_f, K) = 0$ indicates that he works, and $\sigma_i(x_i, \tilde{r}_f, K) = 1$ indicates that he revolts. We focus on symmetric strategies, so that $\rho_j(\cdot) = \rho(\cdot)$ for all j and $\sigma_i(\cdot,\cdot,\cdot) = \sigma(\cdot,\cdot,\cdot)$ for all i. The equilibrium concept is Perfect Bayesian.

[12] Our goal is to maintain the sequential timing of decisions while preventing the revelation of θ to the workers. Uncertainty about r_f achieves this in the simplest manner.

[13] See de Castro (2010) for the relationship between MLRP (affiliation) and log-concavity.

3 Two Benchmark Models

Before we proceed to the analysis of the model, it is worth considering two benchmark models. In the first benchmark, we maintain our model of economy, but modify the model of collective action by removing uncertainty, and assuming that the regime's strength is known. In the second, we do the opposite. That is, we maintain our collective action model, but assume wages and capital returns are exogenous—effectively, removing our model of the economy.

Benchmark 1: Complete Information. Suppose the regime's strength θ was known. In this complete information setting, if $\theta \geq 1 - \underline{L}$, then even if all potential revolutionaries revolted, the regime would survive. Anticipating this, all capitalists invest all their capital domestically, and no worker revolts. In contrast, if $\theta < 0$, the regime collapses (for exogenous reasons) even absent any significant active revolters. Anticipating this, all capitalists move all their mobile capital abroad, leaving only the immobile capital $\underline{K}$ in the country. Moreover, depending on how many workers revolt, the wage varies between $(1-\alpha)\ (\underline{K}/1)^{\alpha}$ if almost no one revolts, to $(1-\alpha)\ (\underline{K}/\underline{L})^{\alpha}$ if almost all potential revolutionaries revolt. Then, a worker's decision of whether to revolt or work depends on the comparison between his forgone wages versus the rewards s that he gets from participating in a successful revolution. For example, if $s > (1-\alpha)\ (\underline{K}/\underline{L})^{\alpha}$, then a worker would revolt no matter what other workers choose to do. To simplify the analysis we maintain the following assumption throughout our analysis.

Assumption 1 *If a worker is sure that the revolution succeeds, then he has a dominant strategy to revolt:* $s > (1-\alpha)\ \left(\frac{\overline{K}}{\underline{L}}\right)^{\alpha}$.

Assumption 1 states that the payoff from participating in a successful revolution s is larger than the upper bound on the wages that obtain if the supply of capital is at its maximum $\overline{K}$ and the supply of labor is at its minimum $\underline{L}$. Together with the above arguments, this assumption delivers a simple characterization of equilibrium behavior when is no uncertainty about the regime's strength.

Proposition 1 *Consider the complete information setting where the regime's strength* θ *is known. There are multiple equilibria:*

- *If $\theta \geq 1 - \underline{L}$, there is a unique equilibrium in which capitalists invest all their capital domestically, no worker revolts, and there is no regime change.*

- *If $\theta < 0$, there is a unique equilibrium in which capitalists move all their mobile capital abroad, all potential revolutionaries revolt, and there is a regime change.*

- *For intermediate values of regime strength when $\theta \in [0, 1 - \underline{L})$, both equilibria coexist.*

Multiple equilibria hinder empirical predictions. Moreover, assuming that the regime's strength is certain or known is unreasonable. To resolve these problems, we take a global games approach (Carlsson and van Damme 1993; Morris and Shin 1998, 2003) by adding small amount of noise to the information of citizens about the regime's strength. This approach integrates a key aspect of the real world (uncertainty about the regime's strength) into our model, and as we will show, leads to a unique equilibrium and sharper predictions.

Benchmark 2: Incomplete Information with an Exogenous Economy. Now, suppose domestic capital returns (r_d) and wages (w) are exogenous, but the regime's strength is uncertain, and capitalists and workers receive noisy private signals about it—as described in the model. We assume $s > w$ and $r_d > r_f$ to avoid trivial cases where no worker ever revolts, or no capitalist ever invests domestically. The workers have a coordination problem among themselves, but their problem is now independent of the behavior of the capitalists.

Now, the workers' problem is a standard global game model of regime change with a well-known solution. To simplify exposition, we focus on symmetric cutoff strategies. Suppose a potential revolutionary worker revolts whenever his signal about the regime's strength is below a threshold: $x_i < x_e$. Then, for any given regime strength θ, the measure of revolters is $Pr(x_i < x_e|\theta)\ (1 - \underline{L})$. This measure is decreasing in θ, crossing the 45 degree line at a unique point. Calling that point θ_e, the measure of revolters exceeds the regime's strength for all $\theta < \theta_e$, causing a regime change. Otherwise, the regime survives. Conversely, for a given regime change threshold θ_e, a worker must be indifferent between revolting and working at his critical threshold $x_i = x_e$. Thus, the equilibrium of the workers' game is characterized by a pair (x_e, θ_e) that satisfy the following conditions.

$$Pr(x_i < x_e|\theta_e)\ (1 - \underline{L}) = \theta_e \quad \text{and} \quad Pr(\theta < \theta_e|x_i = x_e)\ s = w. \tag{1}$$

Critically, as Morris and Shin (2003) show, if the prior about the fundamental θ is uniform (improper prior) or the noise in private signals is vanishingly small, we have:

$$Pr(x_i < x_e|\theta_e) = 1 - Pr(\theta < \theta_e|x_i = x_e), \quad \text{for all } \; x_e \text{ and } \theta_e \quad \text{(Morris and Shin 2003).} \quad (2)$$

Using this statistical property in equilibrium conditions (1), we obtain a unique equilibrium with the regime change threshold:

$$\theta_e = (1 - \underline{L})\ (1 - w/s). \quad (3)$$

The capitalists' problem is even simpler. Because their behavior (individual or aggregate) has no effect on the likelihood of regime change, the capitalists' problems become completely disentangled from each other. Given θ_e that comes from the anticipation of the workers' behavior, each capitalist simply estimates the likelihood of regime change (and his expected returns) and decides how to allocate his capital. It immediately follows that a capitalist moves all his mobile capital abroad if and only if his signal y_i falls below a threshold. In equilibrium, he must be indifferent between keeping his capital in or out of the country. Thus, a capitalist's equilibrium threshold y_e satisfies the following indifference condition that uniquely identifies it.

$$Pr(\theta \geq \theta_e|y_i = y_e)\ r_d = r_f.$$

Critically, neither foreign returns (r_f) nor the magnitude of capital mobility $\overline{K} - \underline{K}$ affect the likelihood of regime change. Indeed, the political risk of revolt affects the capitalists behavior: when θ_e is higher, more capital moves abroad. However, with no model of economy to determine wages and capital returns endogenously, the economic decisions of capital allocations have no influence on political risk—and there is no coordination problem among the capitalists.

4 Workers' Problem

Having analyzed a benchmark model with no information friction and one with no model of economy, we return to analyze our main model. We begin with the workers' problem. As we described in the model, a fraction $\underline{L}$ of workers never revolt. The others must decide whether to work or revolt. However, their uncertainty about the regime's strength and their strategic uncertainty about each others' behavior hinder their ability to coordinate. Each worker observes his private signal x_i about the regime's strength, a public signal $\tilde{r}_f$ about foreign returns and the aggregate domestic capital investment K. For any given $\tilde{r}_f$ and K, a lower private signal suggests a weaker regime—and indicates that others, too, are more likely to believe that the regime is weaker. Thus, we focus on the natural class of symmetric monotone strategies, so that for a given $\tilde{r}_f$ and K, a worker i's strategy is to revolt if and only if his signal is bellow a threshold: $x_i < x^*$. This has two implications. First, for a given θ, the measure of revolters is $m(\theta) = Pr(x_i < x^*|\theta)\ (1-\underline{L})$. As θ traverses from $-\infty$ to ∞, the measure of revolters falls from almost $1 - \underline{L}$ to almost zero. Therefore, there exists a θ^{**} at which $m(\theta^{**}) = \theta^{**}$, so that the revolution succeeds if and only if $\theta < \theta^{**}$. Second, for a given θ, the aggregate labor of potential revolutionary workers is $L(\theta) = Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})$, which is increasing in θ. That is, less workers attempt revolution when the regime is stronger, dedicating their efforts to economic production, raising labor supply and suppressing wages.

Given his signals x_i and $\tilde{r}_f$, and the aggregate capital level K, a worker i revolts if and only if:

$$Pr(\theta < \theta^{**}|x_i, \tilde{r}_f, K) \times s > E[w(\theta)|x_i, \tilde{r}_f, K]. \tag{4}$$

The left hand side is the expected gains from revolt, and the right hand side is the expected opportunity costs of revolt. A worker with signal x_i assigns a probability $Pr(\theta < \theta^{**}|x_i, \tilde{r}_f, K)$ that the revolution succeeds, in which case he receives s from participating in the revolution. However, by participating in revolutionary activities he forgoes the wages he could earn from economic activities. This wage depends on the behavior of other workers and the capitalists that determine the aggregate supply of labor and capital in the economy, $w = (1-\alpha)\left(\frac{\underline{K}+K}{\underline{L}+L}\right)^{\alpha}$. A worker observes the aggregate supply of capital K, but he has to estimate the aggregate supply of labor by anticipating other workers' equilibrium strategies. If the worker knew θ, he could anticipate the aggregate supply of labor $\underline{L} + L(\theta) = \underline{L} + Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})$. But he does not observe θ, and hence uses all information available to him to form expectation about his wage:

$$Pr(\theta < \theta^{**}|x_i, \tilde{r}_f, K)\ s > (1-\alpha)\ E\left[\left(\frac{\underline{K} + K}{\underline{L} + Pr(x_j \geq x^*|\theta)\ (1 - \underline{L})}\right)^{\alpha} \middle| x_i, \tilde{r}_f, K\right]. \tag{5}$$

It is worth mentioning that a worker's incentives to revolt do not stem from predatory incentives to confiscate capital—because once revolution succeeds, capital is (nationalized and) distributed evenly among *all* workers. The presence of such predatory incentives would introduce an additional force for capital flight: more domestic capital in the country would raise the workers' incentives to revolt through this channel, generating a force for strategic substitutes between the capitalists' best responses.

The interactions between the workers feature two conflicting strategic forces. When other workers are more likely to revolt, the revolution is more likely to succeed, increasing a worker's incentive to revolt. This corresponds to an increase in θ^{**}, and hence to the left-hand side of equation (4). This generates a force for strategic complements. However, when other workers are more likely to revolt, this reduces the aggregate supply of labor in the economy. In turn, low labor supply raises the wage, and hence reduces a worker's incentives to revolt by raising the opportunity costs of revolt. This corresponds to an increase in $w(\theta)$, and hence to the right-hand side of equation (4). This generates a force for strategic substitutes. These conflicting forces imply that best responses and net expected payoff from revolting (versus not revolting) need not be monotone. We show that if a worker has a dominant strategy to revolt when he is sure that the revolution will succeed (Assumption 1), then net expected payoff from revolting (versus not revolting) still retains the single-crossing property, and hence the best response to a monotone strategy is a monotone strategy.

Lemma 1 *Suppose all workers except possibly i take a cutoff strategy in which they revolt whenever their private signals are below a finite threshold x^*. Then, worker i's best response takes the cutoff strategy in which he revolts whenever his signal is below a finite threshold.*

Therefore, given a level of aggregate domestic capital $\underline{K} + K$, worker behavior in any symmetric monotone equilibrium is characterize by the indifference condition at the cutoff x^* and the consistency of their beliefs with equilibrium behavior:

$$Pr(\theta < \theta^{**}|x_i = x^*, \tilde{r}_f, K) \times s = E[w(\theta)|x_i = x^*, \tilde{r}_f, K]. \tag{6}$$

$$w(\theta) = (1-\alpha) \left(\frac{\underline{K} + K}{\underline{L} + Pr(x_i \geq x^*|\theta)(1-\underline{L})} \right)^{\alpha}. \tag{7}$$

$$Pr(x_i < x^*|\theta^{**}, \tilde{r}_f, K)\ (1-\underline{L}) = \theta^{**}. \tag{8}$$

In contrast to the benchmark models, each worker must now use his information to estimate how other workers' decisions affect the likelihood of regime change as well as the aggregate labor supply and wages. A key observation is that in the limit when noise in workers' signal become vanishingly small, the marginal worker's (with the critical signal x^*) estimate of the expected wage is independent of his signal. With such an accurate private signal, workers discard their public information $\tilde{r}_f$ and K.[14] Moreover, as we described in equation (2), the following statistical property holds:

$$Pr(x_i \geq x^*|\hat{\theta}) = Pr(\theta \leq \hat{\theta}|x_i = x^*), \quad \text{for all } \; x^* \text{ and } \hat{\theta}. \tag{9}$$

This statistical result implies that $\frac{dPr(x_i \geq x^*|\hat{\theta})}{d\hat{\theta}} = \frac{dPr(\theta \leq \hat{\theta}|x_i = x^*)}{d\hat{\theta}} = pdf(\hat{\theta}|x_i = x^*)$, allowing for a change of variables that significantly simplifies the calculation of the expected wage:

$$E[w(\theta)|x_i = x^*] = \int_{\theta=-\infty}^{\infty} (1-\alpha) \; \left(\frac{\underline{K} + K}{\underline{L} + Pr(x_i \geq x^*|\theta)(1 - \underline{L})} \right)^{\alpha} \; pdf(\theta|x_i = x^*) \; d\theta \tag{10}$$

In fact, integration yields:[15]

$$E[w(\theta)|x_i = x^*] = (\underline{K} + K)^{\alpha} \; \frac{1 - \underline{L}^{1-\alpha}}{1 - \underline{L}}.$$

Thus, the expected wage is increasing in invested capital $\underline{K} + K$, and decreasing in the fraction of workers who never revolt $\underline{L}$. This latter effect reflects the fact that increases in the fraction of these workers raise the aggregate labor supply both directly and through changing the strategic behavior of other workers.

Proposition 2 *Fix the aggregate domestic capital. When the noise in the workers' signals becomes vanishingly small, there is a unique (x^*, θ^{**}) satisfying the equilibrium conditions (6)-(8). In particular, the revolution succeeds whenever $\theta < \theta^{**}(K) \in (0,1)$, where*

$$\theta^{**}(K) = (1 - \underline{L}) \; (1 - w^{**}(K)/s), \; \textit{with } w^{**}(K) = (\underline{K} + K)^{\alpha} \; (1 - \underline{L}^{1-\alpha})/(1 - \underline{L}). \tag{11}$$

[14] More specifically, $\tilde{r}_f$ and K together are a public signal of θ. To see this, suppose capitalists' strategies take a cutoff form so that each capitalist keeps his capital in the country whenever his signal is above a threshold that depends on the foreign return on capital: $y_j \geq y^*(r_f)$, where $y^*(r_f)$ is increasing in r_f. Then, $K(\theta) = Pr(y_j \geq y^*(r_f)|\theta) \; (\overline{K} - \underline{K})$. If r_f was known to the workers, they could infer θ from $K(\theta)$. However, they only observe a noisy signal $\tilde{r}_f$ about r_f. They can use Bayes rule to calculate $pdf(\theta|K, \; \tilde{r}_f)$. That requires calculating $pdf(K|\theta, \; \tilde{r}_f) = pdf(Pr(y_j \geq y^*(r_f)|\theta)|\tilde{r}_f) = pdf(1 - F_\eta([y^*(r_f) - \theta]/\sigma_c)|\tilde{r}_f)$, which amounts to calculating the distribution of a monotone function of the random variable r_f given $\tilde{r}_f$.

[15] We obtain the same results if instead of vanishingly small noise, we assume that θ is distributed uniformly (improper prior) and that workers do not make inferences about θ from aggregate capital.

5 Capitalists' Problem

We analyzed the workers' problem for a given level of domestic capital that they observe. But that is a partial equilibrium analysis: aggregate domestic capital is the endogenous outcome of a multitude of capitalists' decisions of allocating their capital into domestic and foreign markets. Here, we analyze the capitalists' decisions, and characterize the equilibrium of the full general equilibrium model.

Suppose all capitalists except possibly capitalist j adopt a finite-cutoff strategy, so that a capitalist i with signal y_i invests all his mobile capital domestically if and only if $y_i \geq y^*$. Then, $K(\theta) = \int \rho(y_i) f(y_i|\theta) dy_i$, and $K(\theta)$ is increasing in θ with $\lim_{\theta \to -\infty} K(\theta) = 0$ and $\lim_{\theta \to \infty} K(\theta) = \overline{K} - \underline{K} > 0$. Thus, as θ traverses the real line from $-\infty$ to ∞, $\theta^{**}(K)$ from Proposition 2 falls from $\theta^{**}(0)$ to $\theta^{**}(\overline{K} - \underline{K})$. This implies that there exists a unique $\theta^* \in (0, 1)$ such that the regime collapses if and only if $\theta < \theta^*$, where

$$\theta^* = (1 - \underline{L})\ (1 - w^{**}(K(\theta^*))/s). \tag{12}$$

Given the strategy of other capitalists and the workers, a capitalist i with signal y_i maximizes his expected payoff:

$$\max_{k_i \in [0, \overline{K} - \underline{K}]} r_f\ (\overline{K} - \underline{K} - k_i) + Pr(\theta \geq \theta^*|y_i) \times E[r_d(\theta)|\theta \geq \theta^*, y_i] \times (\underline{K} + k_i). \tag{13}$$

A higher private signal of the regime's strength, y_i, suggests that the regime is more likely to survive: $Pr(\theta \geq \theta^*|y_i)$ is higher, raising a capitalist's incentive to invest domestically. However, conditional on the regime's survival, the expected capital returns $E[r_d(\theta)|\theta \geq \theta^*, y_i]$ also change, possibly falling, and thus reducing a capitalist's incentive to invest domestically. In estimating these conditional expected returns, a capitalist must take into account the behavior of other capitalists and the workers that determine the supply of labor and capital.

Benchmark 3: Exogenous Domestic Capital Returns and Endogenous Wage. As a third benchmark, we consider a simplified model in which domestic capital returns are exogenous and known: $r_d(\theta) = r_d$. Then, a capitalist's problem, expression (13) simplifies to:

$$\max_{k_i \in [0, \overline{K} - \underline{K}]} \{Pr(\theta \geq \theta^*|y_i) \times r_d - r_f\} \times k_i. \tag{14}$$

We assume $r_d > r_f$, so that capitalists have incentives to invest domestically if they believe that their capital will not be confiscated. With exogenous returns, as other capitalists become more likely to move their capital abroad, the workers' wages fall, increasing the likelihood of revolution, thereby raising a capitalist's incentives to also move his capital abroad. That is, the capitalists' best responses feature strategic complements. Moreover, when a capitalist's signal increases so that he believes that θ is higher, two effects arise. He expects the regime to be more stable. He also expects other capitalists to invest more domestically, raising wages, and further reducing the likelihood of revolution. Both these effects increase a capitalist's incentives to invest domestically. Therefore, as is clear from expression (14), a capitalist's best response to other capitalists' cutoff strategy is also a cutoff strategy. Thus, the equilibrium is characterized by:

$$Pr(\theta \geq \theta^* | y_i = y^*) = \frac{r_f}{r_d}. \tag{15}$$

$$K(\theta) = Pr(y_j \geq y^* | \theta) \ (\overline{K} - \underline{K}).$$

$$\theta^* = (1 - \underline{L}) \ \left(1 - \frac{w^{**}(K(\theta^*))}{s}\right), \text{ with } w^{**}(K(\theta)) = \frac{(\underline{K} + K(\theta))^{\alpha} \ (1 - \underline{L}^{1-\alpha})}{(1 - \underline{L})}.$$

Recall that $y_j = \theta + \sigma_c \ \eta_j$. With uniform prior, or if $\sigma_c \to 0$, the same statistical result as (9) allows us to explicitly calculate $K(\theta^*)$ from the first two equations:

$$K(\theta^*) = Pr(y_j \geq y^* | \theta^*) \ (\overline{K} - \underline{K}) = Pr(\theta < \theta^* | y^*) \ (\overline{K} - \underline{K}) = (\overline{K} - \underline{K}) \ (1 - \frac{r_f}{r_d}). \tag{16}$$

Then, substituting this $K(\theta^*)$ into the last equation yields θ^*:

$$\theta^* = (1 - \underline{L}) \ \left(1 - \frac{w^*}{s}\right), \text{ with } w^* = [\ (1 - r_f/r_d) \ \overline{K} + (r_f/r_d) \ \underline{K}\ ]^{\alpha} \ \frac{1 - \underline{L}^{1-\alpha}}{1 - \underline{L}}. \tag{17}$$

Comparing what one would obtain with exogenous capital in Proposition 2 with the above result (17) is interesting. Endogenizing the decision of capitalists when interest rates are exogenous implies that domestic capital must be a weighted average of the lower and upper bounds on domestic capital: $(1 - r_f/r_d) \ \overline{K} + (r_f/r_d) \ \underline{K}$. This result is based on equation (16), which shows that when the noise in the capitalists' signals is small, they invest a fraction $(1 - \frac{r_f}{r_d})$ of their mobile capital $\overline{K} - \underline{K}$. In turn, this yields a total domestic investing of $(\overline{K} - \underline{K}) \ (1 - \frac{r_f}{r_d}) + \underline{K} = (1 - r_f/r_d) \ \overline{K} + (r_f/r_d) \ \underline{K}$. Because of the complementarities between capital and labor, increases in either the total available capital or the immobile capital both increase equilibrium wage, raising the revolution threshold.

Full Model. However, domestic returns to capital are not exogenous; they are determined in the markets as a result of strategic decisions of capitalists and workers that yield aggregate supplies of labor and capital. Given the strategies of other capitalists, y^*, and the workers, x^*, and given his private signal y_i, a capitalist problem (13) becomes:

$$\max_{k_i \in [0, \overline{K} - \underline{K}]} \{Pr(\theta \geq \theta^* | y_i) \ E[r_d(\theta) | \theta \geq \theta^*, y_i] - r_f\} \times k_i$$
$$\text{with} \quad d(\theta) = \alpha \left(\frac{\underline{L} + Pr(x_k \geq x^* | \theta) \ (\overline{L} - \underline{L})}{\underline{K} + Pr(y_j \geq y^* | \theta) \ (\overline{K} - \underline{K})} \right)^{1-\alpha}$$

With endogenous returns to capital, strategic interactions between the capitalists feature forces for both strategic complements and substitutes. When other capitalists are more likely to move their capital abroad, the workers' productivity and hence their wages fall, increasing the likelihood of revolution, and raising a capitalist's incentives to move his capital abroad. However, the smaller supply of domestic capital raises its return, increasing a capitalist's incentives to invest domestically. This implies that best responses and net expected payoff from investing domestically or abroad need not be monotone. In fact, as a capitalist's signal y_i increases, so that he expects θ to be higher, four different effects influence his expected payoffs from domestic investment. (1) The direct non-strategic effect is that he expects the regime to be more stable and his investment safer. But there are also strategic effects. (2) He expects other capitalists to invest more capital domestically, thereby (2.1) reducing the returns to domestic investment, and (2.2) increasing the return to labor, and hence reducing the workers' incentives to revolt. Finally, (3) the capitalist expects the workers, too, to receive higher signals about the regime's strength and to have more incentives to work instead of to revolt, increasing the marginal productivity of capital, and hence its domestic returns. However, we show that if a capitalist has a dominant strategy to invest domestically when he is sure that no one will revolt (Assumption 2), his net expected payoff from investing domestically (versus abroad) still features single-crossing property. As a result, the best response to (symmetric) monotone strategies is a monotone strategy.[16]

[16] We can replace Assumption 2 with a stronger assumption that $\overline{f} < \alpha(\underline{L}/\overline{K})^{1-\alpha}$, meaning that a capitalist has a dominant strategy to invest domestically when he is sure that capital will not be expropriated.

Assumption 2 $\overline{f} < \alpha(1/\overline{K})^{1-\alpha}$.

Lemma 2 *Suppose the noise in the workers' signals is vanishingly small, and all capitalists except possibly capitalist i take a cutoff strategy in which they invest their mobile capital domestically whenever their private signals are above a finite threshold y^*. Then, capitalist i's best response also takes a cutoff form in which he invests all his capital domestically whenever his signal is above a finite threshold.*

Equilibrium. The equilibrium is described by the tuple $(x^*, y^*, \theta^*, L(\theta), K(\theta), w(\theta), r_d(\theta))$, where x^* and y^* determine $L(\theta)$ and $K(\theta)$ via $L(\theta) = Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})$ and $K(\theta) = Pr(y_l \geq y^*|\theta)\ (\overline{K} - \underline{K})$, and $w(\theta)$ and $r_d(\theta)$ are determined in the competitive market. The equilibrium behaviors of the workers generate $\theta^{**}(K)$ and $x^*(K)$, and the equilibrium behaviors of the capitalists generate θ^*. Each capitalist anticipates the equilibrium behavior of the workers and other capitalists and optimizes accordingly.

$$Pr(\theta \geq \theta^*|y_j = y^*)\ E[r_d(\theta)|\theta \geq \theta^*, y_j = y^*] = r_f. \tag{18}$$

$$r_d(\theta) = \alpha \left(\frac{\underline{L} + Pr(x_k \geq x^*|\theta)\ (\overline{L} - \underline{L})}{\underline{K} + Pr(y_j \geq y^*|\theta)\ (\overline{K} - \underline{K})} \right)^{1-\alpha}. \tag{19}$$

$$\theta^* = (1 - \underline{L}) \left(1 - \frac{w^{**}(K(\theta^*))}{s}\right), \text{with } w^{**}(K(\theta)) = \frac{(\underline{K} + K(\theta))^{\alpha}\ (1 - \underline{L}^{1-\alpha})}{(1 - \underline{L})}, \tag{20}$$

where x^* comes from the second stage in which the workers observe K. From equations (6) to (8), when σ_w approaches 0, for a given K, we have:

$$Pr(\theta < \theta^{**}|x_i = x^*) \times s = E[w(\theta)|x_i = x^*].$$

$$w(\theta) = (1 - \alpha) \left(\frac{\underline{K} + K}{\underline{L} + Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})} \right)^{\alpha}.$$

$$Pr(x_i < x^*|\theta^{**})\ (1 - \underline{L}) = \theta^{**}. \tag{21}$$

Further, from equation (11), recall that

$$\theta^{**} = (1 - \underline{L})\ (1 - w^{**}(K)/s), \text{ with } w^{**}(K) = (\underline{K} + K)^{\alpha}\ (1 - \underline{L}^{1-\alpha})/(1 - \underline{L}). \tag{22}$$

This would simplify the proof of Lemma 2, but would complicate the proof of capital control when the interest rate is endogenous.

Proposition 3 shows that there is a unique symmetric monotone equilibrium characterized by cutoffs (x^*, y^*, θ^*) that satisfy the above equilibrium conditions. It further provides a closed form solution for the equilibrium regime change threshold θ^*.

Proposition 3 *When the noise in private signals becomes vanishingly small, there is a unique equilibrium in which the regime collapses if and only if $\theta < \theta^*$, where*

$$\theta^* = (1 - \underline{L})\ (1 - w^*/s),\ \textit{with}\ w^* = (\overline{K}^{\alpha} - (\overline{K} - \underline{K})\ r_f)\ (1 - \underline{L}^{1-\alpha})/(1 - \underline{L}). \tag{23}$$

Comparing equations (17) with (23) is instructive. In effect, endogenizing domestic returns on capital replaces $[\ (1 - r_f/r_d)\ \overline{K} + (r_f/r_d)\ \underline{K}\ ]^{\alpha}$ with $(\overline{K}^{\alpha} - (\overline{K} - \underline{K})\ r_f)$. When there are no foreign returns on capital ($r_f = 0$), all capital is invested domestically no matter what the interest rate is, and hence endogenous or exogenous cases coincide. More generally, one can define an *effective domestic capital return* by equating these terms. This effective domestic return on capital takes a simple form when foreign return r_f is very small. Then, using the Taylor expansion we have:

$$\begin{aligned} [\ (1 - r_f/r_d)\ \overline{K} + (r_f/r_d)\ \underline{K}\ ]^{\alpha} &= [\ \overline{K} - (r_f/r_d)\ (\overline{K} - \underline{K})\ ]^{\alpha} \\ &= \overline{K}^{\alpha} - \alpha\ \overline{K}^{\alpha-1}\ (r_f/r_d)\ (\overline{K} - \underline{K}), \end{aligned}$$

This expression equals $\overline{K}^{\alpha} - (\overline{K} - \underline{K})\ r_f$ if and only if $r_d = \alpha\ (1/\overline{K})^{1-\alpha}$. Thus, we have:

Remark. When foreign return on capital is small ($r_f \approx 0$), the model with exogenous domestic capital returns yields the same results as the full model for $r_d = \alpha\ (1/\overline{K})^{1-\alpha}$. This *effective domestic capital return* is the competitive return on capital when no worker revolts—so that all workers engage in economic activity and all capital is invested domestically.

Remark. When $\underline{L}$ and $\underline{K}$ are small: $\theta^* \approx 1 - \frac{\overline{K}^{\alpha} - r_f\ \overline{K}}{s}$.

Corollary 1 *Increases in immobile capital $\underline{K}$ or total capital $\overline{K}$ both decrease the likelihood of regime change. In contrast, increases in the foreign returns to capital r_f or the warm-glow from participating in a successful revolution s both raise the likelihood of regime change.*

$$\frac{\partial \theta^*}{\partial \underline{K}},\ \frac{\partial \theta^*}{\partial \overline{K}},\ \frac{\partial \theta^*}{\partial \underline{L}} < 0 < \frac{\partial \theta^*}{\partial r_f},\ \frac{\partial \theta^*}{\partial s}. \tag{24}$$

The effects of global economy r_f and capital mobility $\underline{K}$ are of particular interest. Improvements in the global markets that increase the return to foreign investments (r_f) raise the capitalists' incentives to move their capital abroad; and increases in capital mobility (smaller $\underline{K}$) enables them to do so. Both these changes raise the likelihood of regime change domestically. Thus, globalization and market integration that reduce the costs of moving capital or economic development that changes the focus of the economy from, e.g., relatively immobile agricultural sector to more mobile service/finance sectors can ironically amplify the likelihood of social conflict and revolutions. Moreover, our results suggest that globalization and economic development have threshold effects, so that small changes can yield sudden and significant social and economic changes.

It is worth emphasizing that our analysis so far applies as much to decisions of foreign investors to invest in a country as to decisions of domestic capitalists whether to send their capital abroad. In the following section, we focus on the latter interpretation (capital flight), and investigate the capitalists' decisions to give the state authority over their decisions in order to remedy their collective action problem in capital flight.

6 Capital Control

When a capitalist decides whether to invest domestically or to move his capital abroad, he does not take into account the effect of his decision on other capitalists. In particular, a capitalist does not internalize that reductions in domestic capital reduce wages and increase the likelihood of revolution, thereby potentially hurting the capitalists who invest domestically. Even though the externality of any single capitalist's decision is negligible, the sum of these externalities can be significant. To remedy this, the capitalists ex-ante before they receive their private information, may decide to give the state the authority to impose capital control.

To investigate whether and when the capitalists want to impose capital control on themselves, we extend the game to include an earlier stage in which the capitalists, before observing their private information, decide whether to impose capital control on themselves. At this stage, the capitalists are identical, and maximize their expected payoff using their prior information about the regime's strength, anticipating the equilibrium behavior that follows. If capital control is imposed, the state will not allow capital to move abroad, and hence all the capital will be invested domestically. Otherwise, the capitalists are free to move their capital abroad. After the capitalists decide whether to impose capital control on themselves, all players (capitalists and workers) receive their private information. If capital control has been imposed, all capital is invested domestically, the workers observe the level of capital, and decide whether to work or to revolt. If capital control has not been imposed, the subgame that follows is identical to our original game.

Let $\gamma \in \{0, 1\}$ capture capital control, where $\gamma = 0$ means that capitalists can move their capital with no restrictions, and $\gamma = 1$ means that capital is not allowed to move abroad. Capital control determines the effective mobility of intrinsically mobile capital: without capital control, mobile capital is $\overline{K} - \underline{K}$, while with capital control mobile capital becomes $(\overline{K} - \underline{K})\ (1 - \gamma)$. This logic allows us to deduce the critical threshold from Proposition 3 to account for capital control, by multiplying $(\overline{K} - \underline{K})$ by $(1 - \gamma)$:

$$\theta^*_\gamma = (1 - \underline{L})\ (1 - w^*_\gamma/s),\ \text{with}\ w^*_\gamma = (\overline{K}^\alpha - (\overline{K} - \underline{K})\ (1 - \gamma)\ r_f)\ (1 - \underline{L}^{1-\alpha})/(1 - \underline{L}),$$

where θ^*_γ and w^*_γ capture the dependence of the regime change threshold and effective wage on capital control. Inspection of w^*_γ reveals that capital control can also be interpreted as changing the effective foreign return on capital, changing r_f to $r_\gamma \equiv (1 - \gamma)\ r_f$,[17] so that:

$$\theta^*_\gamma = (1 - \underline{L})\ (1 - w^*_\gamma/s),\ \text{with}\ w^*_\gamma = (\overline{K}^\alpha - (\overline{K} - \underline{K})\ r_\gamma)\ \frac{1 - \underline{L}^{1-\alpha}}{1 - \underline{L}}\ \text{ and }\ r_\gamma = (1 - \gamma)\ r_f.$$

Clearly, $0 < \theta^*_1 < \theta^*_0 < 1$. That is, capital control reduces the likelihood of regime change. This is the benefit of capital control for the capitalists. However, capital control also prevents capitalists who, based on their subsequent private information, believe that revolution is likely from moving their capital abroad. This is the costs of capital control for the capitalists. We next study whether and when the benefits dominate the costs, so that the capitalists empower the state to impose capital control.

Capital Control in the Simplified Model of Benchmark 3. As before, begin with a simplified model in which $r_d(\theta) = r_d$ is exogenous and known, so that:

$$\theta^*_\gamma = (1 - \underline{L})\ \left(1 - \frac{w^*_\gamma}{s}\right),\ \text{with}\ w^*_\gamma = [\overline{K} - (\overline{K} - \underline{K})\ (1 - \gamma)\ r_f/r_d]^\alpha\ \frac{1 - \underline{L}^{1-\alpha}}{1 - \underline{L}}. \quad (25)$$

[17] Note that this effective foreign return still satisfies Assumption 2.

With capital control, a capitalist's expected payoff is:

$$U_1 \equiv [Pr(\theta \geq \theta_1^*)\ r_d]\ \overline{K}. \tag{26}$$

Without capital control, a capitalist's expected payoff is:

$$U_0 \equiv [Pr(\theta \geq \theta_0^*, y_i \geq y^*)\ r_d + Pr(y_i < y^*) r_f]\ \overline{K}. \tag{27}$$

To tease out the tradeoffs, observe that subtracting (27) from (26) yields:

$$\begin{aligned} \frac{1}{\overline{K}}\,[U_1 - U_0] &= Pr(\theta < \theta_1^*, y_i < y^*)(-r_f) \\ &+ Pr(\theta_1^* \leq \theta < \theta_0^*, y_i < y^*)\ (r_d - r_f) + Pr(\theta_1^* \leq \theta < \theta_0^*, y_i \geq y^*)\ r_d \\ &+ Pr(\theta_0^* \leq \theta, y_i < y^*)\ (r_d - r_f). \end{aligned}$$

The first term captures the expected loss from imposing capital control: if the regime collapses, some capitalists who wanted to move their capital based on their signals are not allowed to jump ship. Other terms capture the gains from capital control, stemming from two sources. First, the likelihood of regime change falls, raising the capital returns by $r_d - r_f$ for those who would have been lucky enough to have moved their capital, or r_d for those who would have stayed. Second, those who wanted to move their capital because they *mistakenly* believed that the regime would sink are not allowed to move.

Moreover, it is easy to see that when $r_f = 0$, capitalists have no incentive to move their capital, and hence $y^*(r_f = 0) = -\infty$. Similarly, when $r_f = r_d$, capitalists have no incentive *not* to move their capital, and hence $y^*(r_f = r_d) = \infty$. Therefore,

$$U_1(r_f = 0) = U_0(r_f = 0) \ \text{ and } \ U_1(r_f = r_d) < U_0(r_f = r_d). \tag{28}$$

As foreign returns r_f increase, the direct non-strategic costs of imposing capital control $(-r_f)$ increase, while (direct non-strategic) gains $(r_d - r_f)$ fall. This observation together with (28) suggest that there can be a threshold on foreign returns below which the capitalists want to impose capital control, and above which they do not. However, analyzing the capitalists' expected payoffs for interior values of foreign returns $(0 < r_f < r_d)$ is more elaborate due to strategic responses. As we will show, an additional assumption (Assumption 3) is required to deliver a modified version of this intuition (Proposition 4) that accounts for the interaction between foreign returns r_f and the degree of capital mobility $\overline{K} - \underline{K}$.

Higher foreign returns raise capitalists' incentives to move their capital, increasing the likelihood of regime change. This strategic response increases the gains from capital control. Clearly, when $\overline{K} - \underline{K} \approx 0$, so that capital is intrinsically immobile, then such a strategic response is negligible. In fact, from equation (25),

$$\frac{\partial}{\partial \Delta K} \frac{\partial \theta_0^*}{\partial r_f} > 0, \quad \text{where} \quad \Delta K \equiv \overline{K} - \underline{K} > 0,$$

implying that the strategic response to raises in r_f is increasing with ΔK. Moreover, when the likelihood of revolution is already high, further strategic response has a relatively low impact on the capitalists' expected payoff.[18] In particular, starting from $r_f = 0$, where there is no capital flight, the likelihood of revolution $G(\theta_0^*)$ must be small for the strategic response of increases in r_f to be strong. Assumption 3 combines these observations to ensure that the strategic response can dominate so that capital control can be optimal ($U_0 < U_1$) when foreign returns are low. Let $g(\theta)$ be the density of the regime's strength θ, and let $G(\theta)$ be its cdf.

Assumption 3 $G(\theta_{0,m}^*) - g(\theta_{0,m}^*)\ \frac{1-\underline{L}^{1-\alpha}}{s}\ \alpha\ \overline{K}^{\alpha} < 0$, *where*

$$\theta_{0,m}^* \equiv \theta_0^*(r_f = 0, \Delta K = \overline{K}) = 1 - \underline{L} - \frac{1-\underline{L}^{1-\alpha}}{s}\ \overline{K}^{\alpha}.$$

Proposition 4 characterizes exactly when capital control is optimal.

Proposition 4 *Fix a level of aggregate capital $\overline{K}$, and suppose the distribution of fundamental $g(\theta)$ is log-concave and the noise in private signals is vanishingly small.*[19] *Capitalists ex-ante want the state to impose capital control if and only if foreign returns on capital are low and aggregate mobile capital is high. That is, there exist $\widehat{K} \in (0, \overline{K})$ and $\hat{r}_f \in (0, r_d)$ such that the $\gamma^* = 1$ if and only if $\underline{K} < \widehat{K}$ and $r_f < \hat{r}_f$.*[20]

Full Model. Of course, domestic returns to capital r_d are endogenous and determined in the market. Now, from Proposition 3,

$$\theta_\gamma^* = (1 - \underline{L})\ (1 - w^*/s), \text{ with } w^* = (\overline{K}^{\alpha} - (\overline{K} - \underline{K})\ (1-\gamma)\ r_f)\ (1 - \underline{L}^{1-\alpha})/(1 - \underline{L}). \quad (29)$$

[18]This logic presumes log-concavity of the distribution of θ, $g(\theta)$, that we use to rule out wiggliness of $U_0(r_f)$. Lemma 3 in the Appendix shows that with log-concavity of $g(\theta)$, $U_0(r_f)$ is either increasing or U-shaped.

[19]Throughout the rest of the paper we first take the limit $\sigma_w \to 0$, followed by the limit $\sigma_c \to 0$. This allows us to use the earlier expressions for the expected domestic return to capital, and hence to use our previous equilibrium characterization.

[20]$\hat{r}_f$ can depend on $\underline{K}$, but $\widehat{K}$ does not depend on r_f.

Mirroring the calculations and logic of Proposition 4, one can show that similar results are obtained when domestic returns to capital are endogenous.

Proposition 5 *Fix a level of aggregate capital $\overline{K}$, and suppose $g(\theta)$ is log-concave and the noise in private signals is vanishingly small. Capitalists ex-ante want the state to impose capital control if and only if foreign returns on capital are low* <u>*and*</u> *aggregate mobile capital is high. That is, there exist $\widehat{K}_{en} \in (0, \overline{K})$ and $\hat{\hat{r}}_f \in (0, \alpha \overline{K}^{\alpha-1})$ such that the $\gamma^* = 1$ if and only if $\underline{K} < \widehat{K}_{en}$* <u>*and*</u> *$r_f < \hat{\hat{r}}_f$.*[21]

7 Capital Control and Labor Repression: Complements or Substitutes?

To reduce the threat of revolution, states can use repressive measures to raise the costs of revolt. We model the degree of state repression by an expected direct cost of revolt c that a worker incurs if he revolts. Now, in addition to choosing capital control, the capitalists ex-ante decide the state's repression level c at a cost of $R(c)$, with $R(0) = R'(0) = 0$, $R'(c),\ R''(c) > 0$ for $c > 0$. From (4), it is easy to see that having a cost c amounts to raising the wages by c.[22] Thus, with appropriately adjusted assumptions, we have:

$$\theta^*_\gamma(c) = (1 - \underline{L}) \left(1 - \frac{w^*_\gamma + c}{s}\right),$$

where we recall that $\gamma = 1$ corresponds to capital control and $\gamma = 0$ corresponds to no capital control. Differentiating $\theta^*_\gamma(c)$ with respect to c yields:

$$\frac{\partial \theta^*_\gamma(c)}{\partial c} = -\frac{1 - \underline{L}}{s} < 0. \tag{30}$$

As expected, raising repression reduces the likelihood of revolution. We investigate the (ex-ante) optimal level of repression from the capitalists' perspective with and without capital control.

Simplified Model. Incorporating the possibility of repression into (26) and (27), we have:

$$U_0(c) = [(1 - G(\theta^*_0(c)))\ r_d + G(\theta^*_0(c))\ r_f]\ \overline{K} - R(c) \quad \text{and} \quad U_1(c) = [1 - G(\theta^*_1(c))]\ r_d\ \overline{K} - R(c).$$

[21] $\hat{\hat{r}}_f$ can depend on $\underline{K}$, but $\widehat{K}$ does not depend on r_f.

[22] The left hand side will have an additional term of $-c$, which can be moved to the right hand side and be added to $w(\theta)$ in the expectation.

Differentiating with respect to c yields:

$$\frac{\partial U_0(c)}{\partial c} = -g(\theta_0^*)\ \frac{\partial \theta_0^*(c)}{\partial c}\ (r_d - r_f)\ \overline{K} - R'(c) \quad \text{and} \quad \frac{\partial U_1(c)}{\partial c} = -\ g(\theta_1^*)\ \frac{\partial \theta_1^*(c)}{\partial c}\ r_d\ \overline{K} - R'(c).$$

The marginal cost of repression $R'(c)$ is increasing, and from equation (30), the marginal benefits of repression are constant. Therefore, letting c_1^* and c_0^* be optimal repression levels with and without capital control, we have:

$$c_0^* > c_1^* \quad \Leftrightarrow \quad g(\theta_0^*)\ r_f < [g(\theta_0^*) - g(\theta_1^*)]\ r_d. \tag{31}$$

The term $g(\theta_0^*)\ r_f$ captures that, absent capital control, less capital remains in the country, reducing the marginal value of raising repression to prevent revolution. In the extreme case where $r_f = r_d$, all the capital moves abroad and repression will have no value to the capitalists. We call this the *Boix Effect*, capturing the idea that capital mobility reduces the elite's resistance to regime change by alleviating its confiscatory consequences for the elite (Boix 2003). However, absent capital control, the equilibrium likelihood of regime change is higher $G(\theta_0^*) > G(\theta_1^*)$. When higher likelihood of revolution ($G(\theta_0^*) > G(\theta_1^*)$) translates into higher *margins* of reducing the equilibrium thresholds, $g(\theta_0^*) > g(\theta_1^*)$, it raises the marginal value of raising repression without capital control relative to the case with capital control. We call this the *Marx Effect*, capturing the idea that freer movements of capital cause higher repression of labor. When this substitution effect dominates, the state uses higher level of repression when it does not impose capital control. To see when this happens, consider a case where $g(\theta)$ is strictly unimodal with low variance, and a mode slightly to the right of θ_0^*. Then, $g(\theta)$ rises sharply from $g(\theta_1^*)$ to $g(\theta_0^*)$, so that the Substitution effect dominates the Boix effect.

Full Model is the same as the simplified model except that (31) becomes:

$$c_0^* > c_1^* \quad \Leftrightarrow \quad g(\theta_0^*)\ r_f < [g(\theta_0^*) - g(\theta_1^*)]\ \alpha \overline{K}^{\alpha-1}.$$

Although the exact equilibrium thresholds θ_0^* and θ_1^*, and hence optimal repressions are different from the simplified model, the qualitative results remain the same.

Remark. When there is little prior knowledge about the regime's strength (θ is distributed almost uniformly, so that $g(\theta_0^*) \approx g(\theta_1^*)$), repression is higher under regimes that impose capital control: capital control and labor repression are complements.

8 Conclusion

Political risk of potential expropriation hurt the economy. But when the economy falls, political risk rises. This intimate relationship between politics and the economy is problematic for partial equilibrium analyses that either take political risk as given and study the economy, or take economic parameters as given and study political risk. But how can we simultaneously endogenize political risk and the key aspects of the economy? Even if such an exercise proved tractable, would the self-fulfilling nature of such a setting lead to multiple equilibria, rendering predictions difficult? Finally, if uniqueness is obtained under reasonable assumptions, what substantive lessons can be learned from it? These are the basic questions addressed in this paper.

We combined a model that includes the main aspects of the economy (production technology and markets) with a model of collective action that captures the key aspects of a political regime change (coordination and information frictions). Indeed, in general, multiple equilibria could arise, and the presence of several conflicting strategic forces would make the analysis intractable. However, we showed that under mild assumptions, by adapting a global games approach, these difficulties can be overcome to obtain a simple characterization of a unique equilibrium.

We focused on three substantive results. First, the (ex-ante) likelihood of regime change is increasing in the expected foreign returns and capital mobility. Further, regime change features a threshold effect: small changes in foreign returns or capital mobility can cause a regime change with the economic and political changes that accompany it. Globalization and market integration foster capital mobility and reduce its costs; so, too, does reallocation of capital from the relatively immobile agricultural sector to financial and service sectors that often accompany economic development. Thus, ironically, such desirable progress also generates forces that undermine its continuation, indeed, work to make it undone. Second, capitalists face a coordination problem. To remedy this, they may voluntarily relinquish part of their property rights (the right to move their capital), giving the state the right to impose capital control. We show that they do so whenever foreign returns are low, but capital mobility is high. Third, when a state that represents the interests of the capitalist class attempts to prevent regime change by using the two instruments of capital control (economic coercion) and repression of labor (political coercion), two conflicting effects are in play. One effect (Boix Effect) tends to make economic and political coercions substitutes, so that they are negatively correlated, as in Latin American military regimes. The other (Marx Effect) goes the opposite way and tends to make economic and political coercions complements, so that they are positively correlated, as in the Nazi regime in Germany. We identify conditions under which each effect dominates.

From a broader perspective, the logic put forth in this paper points to a natural alliance between the capitalists (the rich) and strong authoritarian governments even when such governments involve corrupt and uninformed officials that hinder innovations and productivity. The disruptions associated with government changes and improvements in the status quo can temporarily weaken the regime's coercive power both in realm of the economy (capital control) and politics (state repression). This in turn can invoke the strategic complementarities involved in capital flight and revolution that can unravel into a regime change. That is, a form of "politics of fear" (Padro i Miquel 2007) underlies the "capitalists-dictator" alliance, well-documented in Latin America, the Philippines, modern Russia and other former Soviet Union countries.

There are two distinct grad explanations for why the the rich support dictators with strong coercive power. They do so either (a) to protect their wealth and status from the poor (a Rousseauian approach that emanates through Marxist theories), or (b) to protect themselves from their own attrition (Greif and Laitin 2004; Guriev and Sonin 2009)—a Hobbesian approach to central authority. This paper combines these two channels and reveals the nature of their intimate relationship.

9 Appendix: Proofs

Proof of Lemma 1: Let $\Delta(x_i;x^*)$ be worker i's net expected payoff from revolting versus not revolting. We show that as x_i traverses the real line from $-\infty$ to ∞, $\Delta(x_i;x^*)$ changes sign at a unique point.

$$\begin{aligned}
\Delta(x_i;x^*) &= Pr(\theta<\theta^{**}|x_i,\tilde{r}_f,K)\times s-(1-\alpha)\ E\left[\left(\frac{\underline{K}+K}{\underline{L}+Pr(x_j\geq x^*|\theta)(1-\underline{L})}\right)^{\alpha}\Bigg|x_i,\tilde{r}_f,K\right]\\
&= \int_{\theta=-\infty}^{\infty}\left(\mathbf{1}_{\{\theta<\theta^{**}\}}\ s-(1-\alpha)\ \left(\frac{\underline{K}+K}{\underline{L}+Pr(x_j\geq x^*|\theta)(1-\underline{L})}\right)^{\alpha}\right)\ f(\theta|x_i,\tilde{r}_f,K)\ d\theta\\
&= \int_{\theta=-\infty}^{\infty}\pi(\theta)\ f(\theta|x_i,\tilde{r}_f,K)\ d\theta,
\end{aligned}$$

where $\mathbf{1}_{\{\cdot\}}$ is the indicator function, and $\pi(\theta)\equiv\mathbf{1}_{\{\theta<\theta^{**}\}}\ s-(1-\alpha)\ \left(\frac{\underline{K}+K}{\underline{L}+Pr(x_j\geq x^*|\theta)(1-\underline{L})}\right)^{\alpha}$. Observe that

$$\begin{aligned}
\lim_{\theta\to-\infty}\pi(\theta) &= s-(1-\alpha)\ \left(\frac{\underline{K}+K}{\underline{L}}\right)^{\alpha}>s-(1-\alpha)\ \left(\frac{\overline{K}}{\underline{L}}\right)^{\alpha}>0.\ \text{(Assumption 1)}\\
\lim_{\theta\to\infty}\pi(\theta) &= -(1-\alpha)\ \left(\frac{\underline{K}+K}{1}\right)^{\alpha}<0.
\end{aligned}$$

Moreover, inspection of $\pi(\theta)$ reveals that $\pi(\theta)$ changes sign from positive to negative at a unique point.

Next, because $f(\theta|x_i,\tilde{r}_f,K)$ is TP_2 (i.e., has MLRP between θ and x_i), by Karlin's theorem, $\Delta(x_i;x^*)$ has, at most one sign change. Finally, the inspection of $\Delta(x_i;x^*)$ reveals that $\lim_{x_i\to-\infty}\Delta(x_i;x^*)>0>\lim_{x_i\to\infty}\Delta(x_i;x^*)$. Thus, $\Delta(x_i;x^*)$, indeed, has one sign change from positive to negative. □

Proof of Proposition 2. First, observe that in the limit $pdf(\theta|x_i,\tilde{r}_f,K)=pdf(\theta|x_i)$. Then,

$$\begin{aligned}
E[w(\theta)|x_i=x^*] &= (1-\alpha)\ (\underline{K}+K)^{\alpha}\int_{-\infty}^{\infty}\frac{1}{[\underline{L}+(1-Pr(x_i<x^*|\theta))(1-\underline{L})]^{\alpha}}\ pdf(\theta|x_i=x^*)\ d\theta\\
&= (1-\alpha)\ (\underline{K}+K)^{\alpha}\int_{0}^{1}\frac{dz}{(\underline{L}+z(1-\underline{L}))^{\alpha}}\\
&= (1-\alpha)\ \frac{(\underline{K}+K)^{\alpha}}{1-\underline{L}}\left[\frac{(\underline{L}+z(1-\underline{L}))^{1-\alpha}}{1-\alpha}\right]_0^1\\
&= (\underline{K}+K)^{\alpha}\ \frac{1-\underline{L}^{1-\alpha}}{1-\underline{L}}, \qquad (32)
\end{aligned}$$

where we have used the change of variable $z=1-Pr(x_i<x^*|\theta)$, so that $\frac{dz}{d\hat{\theta}}=\frac{d[1-Pr(x_i<x^*|\hat{\theta})]}{d\hat{\theta}}=\frac{dPr(\theta<\hat{\theta}|x_i=x^*)}{d\hat{\theta}}=pdf(\hat{\theta}|x_i=x^*)$, recognizing that when $\sigma_w\to 0$, $z=1-Pr(x_i<x^*|\hat{\theta})\approx$

$Pr(\theta < \hat{\theta}|x_i = x^*)$. Next, using the same logic from equations (6) and (8), we have $Pr(\theta < \theta^{**}|x^*) = 1 - Pr(x_i < x^*|\theta^{**})$. Thus, $1 - \frac{\theta^{**}}{1-\underline{L}} = \frac{E[w(\theta)|x_i=x^*]}{s}$. Substituting from equation (32) yields the result for $\theta^{**}(K)$. Moreover, given this $\theta^{**}(K)$ and equation (32), there is a unique x^* that satisfies the indifference condition, equation (6).

$\theta^{**}(K)$ is decreasing in K and clearly $\theta^{**}(K) < 1$. To see that $\theta^{**}(K) > 0$, note that $\frac{1-\underline{L}^{1-\alpha}}{1-\underline{L}} < \frac{1-\alpha}{\underline{L}^{\alpha}}$, and hence $\frac{(\underline{K}+K)^{\alpha}\ (1-\underline{L})^{1-\alpha}}{1-\underline{L}} < (1-\alpha)\left(\frac{\overline{K}}{\underline{L}}\right)^{\alpha} < s$, where the last inequality follows from Assumption 1. $\square$

Proof of Lemma 2: Let $\Gamma(y_i; y^*)$ be a capitalist's net expected payoff from investing one unit of capital in the country versus abroad, given his private signal y_i and given the strategies of other capitalists (y^*) and workers (x^*). We show that $\Gamma(y_i; y^*)$ has single-crossing property.

$$\begin{aligned}\Gamma(y_i; y^*) &= Pr(\theta \geq \theta^*|y_i)\ E[r_d(\theta)|\theta \geq \theta^*, y_i] - r_f \\ &= \int_{-\infty}^{\infty} \left[\mathbf{1}_{\{\theta \geq \theta^*\}}\ \alpha \left(\frac{\underline{L} + Pr(x_k \geq x^*|\theta)\ (1-\underline{L})}{\underline{K} + Pr(y_j \geq y^*|\theta)\ (\overline{K} - \underline{K})}\right)^{1-\alpha} - r_f \right]\ f(\theta|y_i)\ d\theta \\ &= \int_{-\infty}^{\infty} \Pi(\theta) f(\theta|y_i) d\theta, \end{aligned} \tag{33}$$

where $\Pi(\theta) \equiv \mathbf{1}_{\{\theta \geq \theta^*\}}\ \alpha \left(\frac{\underline{L}+Pr(x_k \geq x^*|\theta)\ (1-\underline{L})}{\underline{K}+Pr(y_j \geq y^*|\theta)\ (\overline{K}-\underline{K})}\right)^{1-\alpha} - r_f$. Observe that:

$$\lim_{\theta \to -\infty} \Pi(\theta) = -r_f < 0 \text{ and } \lim_{\theta \to \infty} \Pi(\theta) = \alpha \left(\frac{1}{\overline{K}}\right)^{1-\alpha} - r_f > 0, \tag{34}$$

where the last inequality follows from Assumption 2 that $\overline{f} < \alpha(1/\overline{K})^{1-\alpha}$, where we recall that $r_f \in [\underline{f}, \overline{f}]$. From (33) and (34), $\lim_{y_i \to -\infty} \Gamma(y_i; y^*) < 0 < \lim_{y_i \to \infty} \Gamma(y_i; y^*)$. Thus, $\Gamma(y_i; y^*)$ has at least one sign change.

Next, we show that when $\sigma_w \to 0$, $\Gamma(y_i; y^*, \sigma_w)$ cannot have more that one sign change—we have made the dependence of Γ on σ_w explicit.[23] To show this, observe that:

$$\lim_{\sigma_w \to 0} \Pi(\theta; \sigma_w) = \mathbf{1}_{\{\theta > \theta^*\}}\ \alpha \left(\frac{1}{\underline{K} + Pr(y_j \geq y^*|\theta)\ (\overline{K} - \underline{K})}\right)^{1-\alpha} - r_f,$$

where we have made explicit the dependence of Π on σ_w, which enters through $Pr(x_k \geq x^*|\theta)$. The logic is that when $\theta > \theta^*$, so that the regime survives, all workers work in the limit where

[23]A stronger assumption, $\overline{f} < \alpha(\underline{L}/\overline{K})^{1-\alpha}$, immediately implies that $\Pi(\theta)$ switches sign from negative to positive at the unique point θ^*. Then, because $f(\theta|y_i)$ is TP_2 (i.e., has MLRP between θ and y_i), by Karlin's theorem, $\Gamma(y_i; y^*)$ has, at most one sign change.

their information about the regime strength is very precise: $\lim_{\sigma_w \to 0} Pr(x_k \geq x^*|\theta) = 1$ for $\theta > \theta^*$.

Now, observe that $\lim_{\sigma_w \to 0} \Pi(\theta; \sigma_w) = -r_f < 0$ for $\theta < \theta^*$, and *decreasing* for $\theta > \theta^*$, approaching a positive number by (34). Therefore, $\lim_{\sigma_w \to 0} \Pi(\theta; \sigma_w)$ switches sign from negative to positive at the unique point θ^*. Because $f(\theta|y_i)$ is TP_2 (i.e., has MLRP between θ and y_i), by Karlin's theorem, $\lim_{\sigma_w \to 0} \Gamma(y_i; y^*, \sigma_w)$ has, at most one sign change. $\square$

Proof of Proposition 3: First, we calculate a the expected payoff from domestic investment for a capitalist whose signal is at the equilibrium threshold $y_j = y^*$. The left hand side of equation (18) is:

$$
\begin{aligned}
& Pr(\theta \geq \theta^*|y_j = y^*)\ E[r_d(\theta)|\theta \geq \theta^*, y_j = y^*] \\
= \ & Pr(\theta \geq \theta^*|y_j = y^*)\ \alpha \int_{-\infty}^{\infty} \left(\frac{\underline{L} + Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})}{\underline{K} + Pr(y_l \geq y^*|\theta)\ (\overline{K} - \underline{K})} \right)^{1-\alpha} pdf(\theta|\theta \geq \theta^*, y_j = y^*)\ d\theta \\
= \ & Pr(\theta \geq \theta^*|y_j = y^*)\ \alpha \int_{\theta^*}^{\infty} \left(\frac{\underline{L} + Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})}{\underline{K} + Pr(y_l \geq y^*|\theta)\ (\overline{K} - \underline{K})} \right)^{1-\alpha} \frac{pdf(\theta|y_j = y^*)}{Pr(\theta \geq \theta^*|y_j = y^*)}\ d\theta \\
= \ & \alpha \int_{\theta^*}^{\infty} \frac{[\underline{L} + Pr(x_i \geq x^*|\theta)\ (1 - \underline{L})]^{1-\alpha}}{[\underline{K} + Pr(y_l \geq y^*|\theta)\ (\overline{K} - \underline{K})]^{1-\alpha}}\ pdf(\theta|y_j = y^*)\ d\theta \\
= \ & \alpha \int_{\theta^*}^{\infty} \frac{1}{[\underline{K} + Pr(y_l \geq y^*|\theta)\ (\overline{K} - \underline{K})]^{1-\alpha}}\ pdf(\theta|y_j = y^*)\ d\theta, \quad \text{(because } \lim_{\sigma_w \to 0} Pr(x_i \geq x^*|\theta > \theta^*) = 1\text{)} \\
= \ & \alpha \int_{z(\theta^*)}^{1} \frac{1}{[\underline{K} + (\overline{K} - \underline{K})\ z]^{1-\alpha}}\ dz, \quad \text{(change of variable from } \theta \text{ to } z = Pr(y_l \geq y^*|\theta)\text{)} \qquad (35) \\
= \ & \alpha\ \frac{1}{\overline{K} - \underline{K}} \left[\frac{[\underline{K} + (\overline{K} - \underline{K})\ z]^{\alpha}}{\alpha} \right]_{z = z(\theta^*)}^{1} \\
= \ & \frac{1}{\overline{K} - \underline{K}} \{\overline{K}^{\alpha} - [\underline{K} + (\overline{K} - \underline{K})\ z(\theta^*)]^{\alpha}\} \\
= \ & \frac{\overline{K}^{\alpha} - [\underline{K} + K(\theta^*)]^{\alpha}}{\overline{K} - \underline{K}}. \qquad (36)
\end{aligned}
$$

Substituting from equation (36) into equation (18) yields:

$$
[\underline{K} + K(\theta^*)]^{\alpha} = \overline{K}^{\alpha} - (\overline{K} - \underline{K})\ r_f. \qquad (37)
$$

Substituting from equation (37) into equation (20) yields the result for θ^*. Finally, we show that y^* exists and is unique. Recalling that $K(\theta^*) = Pr(y_j \geq y^*|\theta^*)\ (\overline{K} - \underline{K})$. From equation (37), for a given θ^*, as y^* traverses the real line from $-\infty$ to ∞, the left hand side (strictly) falls from $\overline{K}^{\alpha}$ to $\underline{K}^{\alpha}$. Clearly, $\overline{K}^{\alpha} > \overline{K}^{\alpha} - (\overline{K} - \underline{K})\ r_f$. Next, we show $\underline{K}^{\alpha} < \overline{K}^{\alpha} - (\overline{K} - \underline{K})\ r_f$, i.e., $\frac{\overline{K}^\alpha - \underline{K}^\alpha}{\overline{K} - \underline{K}} > \alpha \frac{1}{\overline{K}^{1-\alpha}} > \overline{f}$, where the last inequality is from Assumption 2. To see the first in equality, observe that from (35) and (36) we have:

$$\begin{aligned}
\frac{\overline{K}^\alpha - \underline{K}^\alpha}{\overline{K} - \underline{K}} &= \lim_{y^* \to \infty} \frac{\overline{K}^\alpha - [\underline{K} + K(\theta^*)]^\alpha}{\overline{K} - \underline{K}} \\
&= \lim_{y^* \to \infty} \alpha \int_{z(\theta^*)}^{1} \frac{1}{[\underline{K} + (\overline{K} - \underline{K})\ z]^{1-\alpha}}\ dz \\
&= \alpha \int_0^1 \frac{1}{[\underline{K} + (\overline{K} - \underline{K})\ z]^{1-\alpha}}\ dz \geq \alpha\ \frac{1}{\overline{K}^{1-\alpha}} > \overline{f} \geq r_f.
\end{aligned}$$

Thus, there is a unique y^* that satisfies equation (37) and hence equation (18). $\square$

Proof of Corollary 1: From Proposition 3,

$$\frac{\partial \theta^*}{\partial \underline{L}} = -1 + \frac{1}{s}\ (1-\alpha)\ \left(\frac{\underline{K} + K(\theta^*)}{\underline{L}}\right)^\alpha \leq -1 + \frac{1}{s}\ (1-\alpha)\ \left(\frac{\overline{K}}{\underline{L}}\right)^\alpha < 0,$$

where the last inequality follows from Assumption 1. $\frac{\partial \theta^*}{\partial \overline{K}} > 0$ follows from Assumption 2. Other results are immediate. $\square$

Proof of Proposition 4: First, we prove a lemma.

Lemma 3 *Suppose $\sigma_c \to 0$ and $g(\theta)$ is log-concave. For $r_f \in [0, r_d]$, either $U_0(r_f)$ is increasing or it has a unique minimum.*

Proof of Lemma 3: Differentiating equation (27) yields:

$$\begin{aligned}
\frac{1}{\overline{\overline{K}}} \frac{dU_0(r_f)}{dr_f} &= \frac{\partial U_0(r_f)}{\partial \theta_0^*} \frac{\partial \theta_0^*}{\partial r_f} + \frac{\partial U_0(r_f)}{\partial y^*} \frac{\partial y^*}{\partial r_f} + \frac{\partial U_0(r_f)}{\partial r_f} \\
&= \frac{\partial U_0(r_f)}{\partial \theta_0^*} \frac{\partial \theta_0^*}{\partial r_f} + \frac{\partial U_0(r_f)}{\partial r_f} \\
&= Pr(y_j < y^*) - r_d\ g(\theta_0^*)\ Pr(y_j \geq y^* | \theta_0^*)\ \frac{\partial \theta_0^*}{\partial r_f},
\end{aligned}$$

where we have used the equilibrium condition that $\frac{\partial U_0(r_f)}{\partial y^*} = 0$.[24] When $\sigma_c \to 0$, $y^* \to \theta^*$,

[24] Alternatively, explicit calculations yields $\frac{\partial U_0(r_f)}{\partial y^*} = pdf(y^*)\ (r_f - r_d\ Pr(\theta \geq \theta_0^* | y^*))$, which is 0 from equation (15).

the distribution of y_j approaches that of θ, and $Pr(y_j \geq y^*|\theta_0^*) = Pr(\theta < \theta_0^*|y_j = y^*)$. Thus,

$$\begin{aligned} \frac{1}{\overline{\overline{K}}} \frac{dU_0(r_f)}{dr_f} &= G(\theta_0^*) - r_d\ g(\theta_0^*)\ Pr(\theta < \theta_0^*|y_j = y^*)\ \frac{\partial \theta_0^*}{\partial r_f} \\ &= G(\theta_0^*) - r_d\ g(\theta_0^*) \left(1 - \frac{r_f}{r_d}\right) \frac{\partial \theta_0^*}{\partial r_f}, \quad \text{(from the equilibrium condition (15))} \\ &= G(\theta_0^*) - g(\theta_0^*)\ (r_d - r_f)\ \frac{\partial \theta_0^*}{\partial r_f}. \end{aligned} \tag{38}$$

Thus, $\frac{dU_0(r_f)}{dr_f} > 0$ if and only if $\frac{G(\theta_0^*)}{g(\theta_0^*)} > (r_d - r_f)\ \frac{\partial \theta_0^*}{\partial r_f}$. From equation (17),

$$\frac{\partial \theta_0^*}{\partial r_f} = \frac{1 - \underline{L}^{1-\alpha}}{s}\ \frac{\alpha\ \Delta K}{r_d} \left(\underline{K} + \Delta K\left(1 - \frac{r_f}{r_d}\right)\right)^{\alpha-1}, \tag{39}$$

and hence $\frac{dU_0(r_f)}{dr_f} > 0$ if and only if

$$\frac{G(\theta_0^*)}{g(\theta_0^*)} > \frac{1 - \underline{L}^{1-\alpha}}{s}\ \alpha\ \Delta K \left(1 - \frac{r_f}{r_d}\right) \left(\underline{K} + \Delta K\left(1 - \frac{r_f}{r_d}\right)\right)^{\alpha-1}. \tag{40}$$

As r_f increases from 0 to r_d, the right hand side decreases from a positive number to 0. Moreover, from equation (17), θ_0^* increases, and hence the left hand side increases by log-concavity of $g(\theta)$. Further, $\frac{dU_0(r_f)}{dr_f}\Big|_{r_f=r_d} > 0$. Thus, $U_0(r_f)$ is either increasing or has a unique extremum, which is a minimum. □

Next, we show that fixing $\overline{K}$, given Assumption 3, $\frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K=\overline{K}} < 0$. Recall that, from equation (25),

$$\theta_0^*(r_f = 0) = 1 - \underline{L} - \frac{\overline{K}^\alpha\ (1 - \underline{L}^{1-\alpha})}{s}. \tag{41}$$

Moreover, from equation (39),

$$\frac{\partial \theta_0^*}{\partial r_f}\Big|_{r_f=0} = \frac{1 - \underline{L}^{1-\alpha}}{s}\ \frac{\alpha\ \Delta K}{r_d}\ \overline{K}^{\alpha-1} = \frac{1 - \underline{L}^{1-\alpha}}{s}\ \frac{\alpha}{r_d}\ \Delta K\ \overline{K}^{\alpha-1}. \tag{42}$$

Substituting from equation (42) into (38) yields:

$$\begin{aligned} \frac{1}{\overline{\overline{K}}} \frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K=\overline{K}} &= G(\theta_{0,m}^*) - \frac{\partial \theta_0^*}{\partial r_f}\Big|_{r_f=0,\Delta K=\overline{K}}\ g(\theta_{0,m}^*)\ r_d \\ &= G(\theta_{0,m}^*) - g(\theta_{0,m}^*)\ \frac{1 - \underline{L}^{1-\alpha}}{s}\ \alpha\ \overline{K}^\alpha < 0, \end{aligned}$$

where the inequality follows from Assumption 3. Thus,

$$\frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K=\overline{K}} < 0 < \frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K=0}, \tag{43}$$

where the last equality follows from (40).

Next, we show that as $\underline{K}$ falls from $\overline{K}$ to 0, so that ΔK increases from 0 to $\overline{K}$, $\frac{dU_0(r_f,\Delta K)}{dr_f}\Big|_{r_f=0}$ can cross zero at most once. From equation (38),

$$\frac{1}{\overline{K}}\frac{dU_0(r_f,\Delta K)}{dr_f} = G(\theta_0^*) - g(\theta_0^*)\ \frac{\partial\theta_0^*}{\partial r_f}\ (r_d - r_f).$$

Now, observe that from equation (39),

$$\begin{aligned} r_d\ \frac{\partial^2\theta_0^*}{\partial\Delta K\partial r_f}\Big|_{r_f=0,\overline{K}=constant} &= -r_d\ \frac{\partial^2\theta_0^*}{\partial\underline{K}\partial r_f}\Big|_{r_f=0} \\ &= -\frac{\partial}{\partial\underline{K}}\left[\frac{1-\underline{L}^{1-\alpha}}{s}\ \alpha\ \Delta K\ \left(\underline{K} + \Delta K\left(1 - \frac{r_f}{r_d}\right)\right)^{\alpha-1}\right]_{r_f=0} \\ &= \frac{1-\underline{L}^{1-\alpha}}{s}\ \alpha\ \overline{K}^{\alpha-1}. \end{aligned} \tag{44}$$

Moreover, from equation (25),

$$\frac{\partial\theta_0^*}{\partial\Delta K}\Big|_{r_f=0} = 0 \tag{45}$$

Thus, from equations (44) and (45), differentiating $\frac{dU_0(r_f,\Delta K)}{dr_f}$ with respect to ΔK (while keeping $\overline{K}$ constant) evaluated at $r_f = 0$ simplifies to:

$$\frac{d^2U_0(r_f,\Delta K)}{d\Delta K\ dr_f}\Big|_{r_f=0} = -\overline{K}\ g(\theta_{0,m}^*)\ \frac{\partial^2\theta_0^*}{\partial\Delta K\partial r_f}\Big|_{r_f=0} r_d = -g(\theta_{0,m}^*)\ \frac{1-\underline{L}^{1-\alpha}}{s}\ \alpha\ \overline{K}^{\alpha} < 0.$$

This together with (43) imply that there exists a $\widehat{\Delta K} \in (0,\overline{K})$ such that $\frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K} < 0$ if and only if $\Delta K > \widehat{\Delta K}$. In turn, together with Lemma 3, this implies that $U_0(r_f)$ is U-shaped if and only if $\Delta K > \widehat{\Delta K}$. The result follows from observing (expressions in (28)) that $U_1(r_f = 0) = U_0(r_f = 0)$ and $U_1(r_f = r_d) < U_0(r_f = r_d)$. $\square$

Proof of Proposition 5: With capital control, a capitalist's expected payoff is:

$$U_1 \equiv Pr(\theta \geq \theta_1^*)\ \alpha\ \overline{K}^{\alpha}, \tag{46}$$

where we used $\lim_{\sigma_w\to 0} Pr(x_i \geq x^*|\theta \geq \theta_1^*) = 1$. Without capital control, a capitalist's expected payoff is:

$$\begin{aligned} U_0(r_f) &= Pr(\theta \geq \theta_0^*, y_i \geq y^*)\ \alpha\ E\left[\left(\frac{1}{\underline{K} + Pr(y_j \geq y^*|\theta)\ (\overline{K} - \underline{K})}\right)^{1-\alpha}\Bigg|\theta \geq \theta_0^*, y_i \geq y^*\right]\ \overline{K} \\ &\quad + Pr(y_i < y^*) r_f\ \overline{K} \\ &= Pr(\theta \geq \theta_0^*, y_i \geq y^*)\ \alpha\ \left(\frac{1}{\overline{K}}\right)^{1-\alpha}\ \overline{K} + Pr(y_i < y^*)\ r_f\ \overline{K}\ \text{(because } \sigma_c \to 0\text{)} \\ &= (1 - G(\theta_0^*))\ \alpha\ \overline{K}^{\alpha} + G(\theta_0^*)\ r_f\ \overline{K}\ \text{(we used } \lim_{\sigma_c\to 0} y^* = \theta_0^*\text{)}. \end{aligned} \tag{47}$$

Differentiating $U_0(r_f)$ from (47) with respect to r_f yields:[25]

$$\frac{dU_0(r_f)}{dr_f} = G(\theta_0^*)\ \overline{K} - \frac{\partial \theta_0^*}{\partial r_f}\ g(\theta_0^*)\ \left(\alpha\ \overline{K}^{\alpha} - r_f\ \overline{K}\right). \tag{48}$$

Comparing equations (48) and (38) reveals that they behave similarly with $\alpha\ \overline{K}^{\alpha-1}$ playing the role of exogenous r_d. Mirroring the calculations of Lemma 3, $\frac{dU_0(r_f)}{dr_f} > 0$ if and only if $\frac{G(\theta_0^*)}{g(\theta_0^*)} > \frac{\partial \theta_0^*}{\partial r_f}\ (\alpha\ \overline{K}^{\alpha-1} - r_f)$. As r_f increases from 0 to $\alpha\ \overline{K}^{\alpha-1}$ (the upper bound of r_f is from Assumption 2), the left hand side is increasing, while the right hand side is decreasing because, from equation (29), $\frac{\partial \theta_0^*}{\partial r_f} > 0$ and does not depends on r_f. Thus, mirroring the calculations of Lemma 3 we have:

Lemma 4 *Suppose $\sigma_c \to 0$ and $g(\theta)$ is log-concave. For $r_f \in \left[0, \alpha\ \overline{K}^{\alpha-1}\right]$, either $U_0(r_f)$ is increasing or it has a unique minimum.*

Moreover, note that at $r_f = 0$, θ_0^* is the same with endogenous or exogenous returns on domestic capital. Substituting from equations (41) and (42) into (38) yields:

$$\begin{aligned}
\frac{1}{\overline{K}}\ \frac{dU_0(r_f)}{dr_f}\bigg|_{r_f=0,\Delta K=\overline{K}} &= G(\theta_{0,m}^*) - \frac{\partial \theta_0^*}{\partial r_f}\bigg|_{r_f=0,\Delta K=\overline{K}} g(\theta_{0,m}^*)\ \alpha\ \overline{K}^{\alpha-1} \\
&= G(\theta_{0,m}^*) - g(\theta_{0,m}^*)\ \frac{1-\underline{L}^{1-\alpha}}{s}\ \Delta K\bigg|_{\Delta K=\overline{K}}\ \alpha \overline{K}^{\alpha-1} \\
&= G(\theta_{0,m}^*) - g(\theta_{0,m}^*)\ \frac{1-\underline{L}^{1-\alpha}}{s}\ \alpha \overline{K}^{\alpha}.
\end{aligned}$$

Thus, by Assumption 3, $\frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K=\overline{K}} < 0$. Thus,

$$\frac{dU_0(r_f)}{dr_f}\bigg|_{r_f=0,\Delta K=\overline{K}} < 0 < \frac{dU_0(r_f)}{dr_f}\bigg|_{r_f=0,\Delta K=0}, \tag{49}$$

where the last equality follows from $\frac{\partial \theta_0^*}{\partial r_f}\Big|_{\Delta K=0} = 0$, which follows from equation (29).

Next, we show that as ΔK increases from 0 to $\overline{K}$, $\frac{dU_0(r_f,\Delta K)}{dr_f}\Big|_{r_f=0}$ can cross zero at most once. Because $\frac{\partial \theta_0^*}{\partial \Delta K}\Big|_{r_f=0}$=0, differentiating $\frac{dU_0(r_f,\Delta K)}{dr_f}$ with respect to ΔK (while keeping $\overline{K}$ constant) evaluated at $r_f = 0$ simplifies to:

$$\frac{d^2U_0(r_f,\Delta K)}{d\Delta K\ dr_f}\bigg|_{r_f=0} = -\alpha\ \overline{K}^{\alpha}\ g(\theta_{0,m}^*)\ \frac{\partial^2 \theta_0^*}{\partial \Delta K \partial r_f}\bigg|_{r_f=0} = -\alpha\ \overline{K}^{\alpha}\ g(\theta_{0,m}^*)\ \frac{1-\underline{L}^{1-\alpha}}{s} < 0.$$

[25]Results are the same if one differentiates first, and then takes the limit.

This together with (43) imply that there exists a $\widehat{\Delta K}_{en} \in (0, \overline{K})$ such that $\frac{dU_0(r_f)}{dr_f}\Big|_{r_f=0,\Delta K} < 0$ if and only if $\Delta K > \widehat{\Delta K}_{en}$. In turn, together with Lemma 3, this implies that $U_0(f)$ is U-shaped if and only if $\Delta K > \widehat{\Delta K}_{en}$. The result follows from observing (expressions in (28)) that $U_1(r_f = 0) = U_0(r_f = 0)$ and $U_1(r_f = r_d) < U_0(r_f = r_d)$. $\square$

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