

Optimal Financing Contracts, Investor Protection, and Growth.*

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Abstract

Recent empirical evidence has suggested a positive association between various measures of investor protection and financial market development, and between financial market development and economic growth. We introduce investor protection in a simple extension of the two-period overlapping generations model of capital accumulation. We use such structure in order to develop predictions for the effects of investor protection on economic growth. Young individuals (entrepreneurs) are endowed with investment projects that need to be financed by outside investors. The quality of each project is random and unknown at the time of financing. Ex-post, once production is carried out, entrepreneurs observe their cash-flows, but financiers do not. Thus agents have an incentive to misreport their cash-flows and appropriate part of them. We capture the degree of investor protection as the extent to which this appropriation is possible. For a closed economy, our results show that, contrary to conventional wisdom, better investor protection is generally detrimental to capital accumulation and economic growth. The standard argument says that if investors are risk-averse, better investor protection results in larger demand for capital. In addition to this effect, we show that the aggregate supply of capital decreases with better investor protection, and we find that this second effect generally dominates the first. With international capital mobility, instead, better investor protection does promote financial market development and output growth. The key mechanism is an increase in the net inflow of capital from abroad, suggesting a specific channel through which investor protection affects the economy.

Key words. Optimal Financing Contract, Investor Protection, Growth, Overlapping Generations.

JEL Codes: D52, D82, D91, D92, E44.

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1 Introduction

Recent work by La Porta et al. (1998) has pointed out large cross-country differences in most indicators of *investor protection*. These indicators attempt to measure the extent to which commercial law and the quality of its enforcement protect outside investors from expropriation by insiders. The focus is on shareholder rights and creditor rights. Importantly, La Porta et al. (1997) have found that countries with poorer investor protections have smaller and narrower financial markets. That is, relative to the size of the economy, individuals in these countries trade less often in financial markets, the value of publicly traded securities is lower, and the overall number of market participants is also lower. On the other hand, work by King and Levine (1993a,b) and Levine and Zervos (1998) has found that well-functioning financial markets are positively associated with long-run economic growth. Using micro data, Rajan and Zingales (1998) and Demirgüç and Maksimovic (1998) have documented the same type of association. Combining the results of the two sets of studies, one obtains a link between investor protection and growth. To our knowledge, the existence of such link has not been established at the theoretical level.

In this paper we attempt at closing this gap, by investigating the effects of investor protection on growth in a simple extension of the overlapping generations model of capital accumulation due to Diamond (1965). In our setup, each individual, when young, has access to a decreasing returns to scale production technology. Differently from Diamond, we assume that the outcome of the production process is stochastic and i.i.d. across individuals. Further, such outcome is assumed to be observable only to the owner of the technology. Lacking any initial endowments, young individuals borrow capital from the old, via financial intermediaries. In any period, intermediaries transfer resources from the old to the young, borrowing from the former at the equilibrium rental rate and lending to the latter by means of optimal lending contracts, whose terms are contingent on all public information. As it is standard in the literature on optimal contracts with hidden information, we model the interaction between intermediaries and young agents as a message game. It is straightforward to show that in our environment the Revelation Principle holds. As a consequence, it is without loss of generality that we restrict our attention to mechanisms that condition agents' repayments on their report to the intermediary and impose truthful revelation.

The recent *Law and Finance* literature, whose main findings we have briefly summarized at the beginning of this section, considers a large set of indicators of investor protection. For the sake of simplicity, here we take a reduced-form approach. The level of investor protection in our model is measured by the deadweight loss that an agent would incur, should he decide to misreport his outcome. In other words, we assume that a fraction of the resources hidden to investors gets wasted in the process.¹ If hiding is costless, we say that investor protection is absent. If all resources hidden get wasted, investor protection is said to be perfect.²

It is straightforward to show that the degree of risk-sharing implied by the optimal contract is monotone in the level of investor protection. The larger the deadweight loss (the cost of hiding), the lower the risk borne by borrowers. Therefore, for all purposes, worse investor protection can be associated with lower risk-sharing.

We show that, under very general conditions, in the simple closed-economy extension of Diamond's model that we have just introduced, better investor protection leads to *lower* growth rates and *lower* steady-state values for both capital and output. The economic intuition behind this result is quite simple. For a given aggregate capital stock, better investor protection implies that borrowers bear less risk. They are thus willing to pay a higher average return to investors. With standard assumptions on preferences, the fact that borrowers end up with lower average income implies lower savings and lower capital accumulation. Seemingly, our result goes counter to the common wisdom. The standard reasoning is that in any sensible model of investment with risk-averse entrepreneurs, better risk-sharing leads to an increase in the demand for capital and that, eventually, such increase translates into higher capital accumulation. This argument, however, is based on a partial-equilibrium approach that completely disregards the supply side. The mechanism just described, implying a positive effect of an increase in risk-sharing opportunities on the demand for capital, is present in our model. However, for most cases the effect on the supply of capital turns out to be of opposite sign, and dominates the more celebrated demand effect. Better investor protection, by lowering the average income of entrepreneurs, has the

¹Our *hiding cost* resembles the *falsification cost* considered by Lacker and Weinberg (1989).

²Our assumption is amenable to several real-world interpretations. For example, the empirical evidence shows that accounting standards vary greatly across countries, implying that firms have different abilities to misreport their results to investors, depending on which country's law they are subject to. The cost of misreporting in our model might proxy for the penalty inflicted to companies that misreport their cash flows to their outside investors.

effect of decreasing the supply of capital. Clearly, the welfare of every generation is larger, the better the investor protection. It is true that expected consumption is decreasing in the level of investor protection, but the positive effect induced by the associated reduction in consumption volatility dominates.

We conclude that our baseline model cannot account for the positive association between investor protection and growth that has been uncovered by the empirical literature. Actually, it predicts the opposite. That is, a closed economy should experience faster capital accumulation, the worse the degree of investor protection. Rather than interpreting the empirical evidence as a rejection of the theory, we wish to emphasize the role that the theory may have as a guide for empirical research, in particular as a way to identify the transmission mechanisms that should be subject to more careful investigation. Our analysis suggests that for countries that show a positive association between investor protection and growth, one or more of our assumptions should be violated. In order to identify such assumptions, we study two extensions of our baseline model. Our objective is to verify the robustness of our findings to the relaxation of two of our hypothesis.

We first consider a scenario in which production depends not only on physical capital, but on labor as well. In this economy, young individuals choose optimally whether to become entrepreneurs or work for a wage. As a result, the fraction of entrepreneurs is determined endogenously. A worsening in investor protection can now be accommodated, at least in part, by an increase in the fraction of entrepreneurs. Such an increase would have the effect of lowering the capital stock allocated to each entrepreneur in equilibrium. In turn, this would mitigate the increase in risk borne by the entrepreneurs themselves and therefore the increase in expected return they require. We show that the economy does make use of the new adjustment margin. However, in general, the negative association between investor protection and capital accumulation still holds.

Next, we reconsider the baseline model, but we assume that agents can trade at no cost with the rest of the world. We assume that the economy under analysis constitutes a small part of the world economy, so that individuals take the worldwide interest rate as given. It is straightforward to see that in such a model capital and output do not display any dynamics. The economy is on its steady state at all dates. We show that in this setup better investor protection is associated with

larger capital stock and income levels. The intuition is simple. Since the interest rate is constant, better investor protection (larger risk-sharing) is associated with a larger level of capital invested by domestic entrepreneurs. In turn, this translates into larger income to the entrepreneurs themselves, and thus larger savings. An interesting corollary to our analysis is that the level of capital outflows is negatively correlated with the level of investor protection. In other words, our model predicts that, among the countries with low impediments to capital flows, we should observe a negative correlation between indicators of investor protections and the magnitude of capital outflows.

Our paper can be seen as part of a large theoretical literature that analyzes the relation between imperfections in financial markets and capital accumulation. Particularly close to ours are those papers that investigate the effects of imperfect risk-sharing on savings in general equilibrium. The most cited work in the area is probably by Aiyagari (1994). Aiyagari studies the effects of market incompleteness on the steady-state capital stock, in a version of the standard growth model. In his setup, agents receive idiosyncratic labor endowment shocks that are uninsured. Facing the possibility of being borrowing constrained in future periods, agents end up accumulating excess capital in order to smooth consumption. Thus, in his framework, the precautionary motive is the reason for the positive effect of incomplete insurance on savings. A similar mechanism is at work in Devereux and Smith (1994), who study a multi-country model in which each country faces income risk, but there is no uncertainty at the world level. Devereux and Smith compare two market structures: one that allows for international diversification of country-specific income risk, and one that does not. Growth rates in all countries turn out to be lower in the case in which diversification is allowed. Once again, this happens because the ability to trade lowers the importance of the precautionary motive. Our framework differs from the Aiyagari's and Devereux and Smith's along several important dimensions. First of all, in their models individuals borrow for the purpose of consumption smoothing, while in ours they raise funds in order to finance investment. Secondly, in our scenario there is no precautionary motive, since second-period income is known to agents at the moments in which they take their saving decision. Finally, in our model the degree of market incompleteness is endogenous.

Our contribution is also closely tied to papers by Marcet and Marimon (1992)

and Khan and Ravikumar (2001). Both of these papers consider scenarios in which infinitely-lived households are hit by idiosyncratic shocks, whose magnitude is private information. Individuals share risk with competitive intermediaries through long-term contracts, which allow for partial insurance. While in Marcet and Marimon (1992) imperfect risk-sharing has no effect on capital accumulation, Khan and Ravikumar (2001) find that the economy with private information (and partial insurance) displays lower growth rates of capital and output than the economy with symmetric information (and full insurance). In a nutshell, the reason for their result is that, since borrowers are risk-averse, the cost to the intermediary of providing them with a given utility increases with the size of the capital stock. This implies that the return on investment is lower than in the case of full insurance, so that capital accumulation slows down. The crucial difference between our setup and the ones considered by Marcet and Marimon and Khan and Ravikumar, is that we consider an OLG structure, while they study models with infinitely lived agents.

The remainder of the paper is organized as follows. The model is introduced in Section 2. In Section 3 we characterize the allocation that would be chosen by a social planner that attaches geometrically decreasing weights to generations' utilities. Such allocation will be useful as a benchmark for what we call our market allocation, i.e. the allocation that emerges from the imposition of the market structure outlined at the beginning of this section. The market allocation is characterized in Section 4. In Section 5 we consider a generalization of our baseline model. In this new setup production depends on both capital and labor, and individuals are free to choose between being entrepreneurs and working for a wage. We show that our main results carry through. Finally, Section 7 concludes.

2 The Model.

We consider a simple extension of the standard two-period Overlapping Generations Model. The population is constant and the measure of each cohort is normalized to one. Individuals are assumed to be risk-averse. Their preferences are time-separable and satisfy the quasi-homotheticity restriction.³ Period utility is denoted by $u(c_t)$,

³We restrict the analysis to the case of quasi-homothetic preferences, because they deliver consumption functions which are linear in lifetime income. This fact will simplify dramatically the analysis. The class of utility functions representing quasi-homothetic preferences includes only CARA, CRRA, and quadratic utility functions (see Chatterjee (1994) and Pollack (1971)). To avoid having

while $\beta, \beta \in (0, 1)$, denotes the discount factor. In the first period of their lives, individuals are endowed with investment opportunities described by the production technology $y_t = z_t f(k_t)$, where k denotes physical capital. We assume that f is C^2 and satisfies $f(0) = 0$, $f' > 0$, $f'' < 0$, $\lim_{k \rightarrow 0} f'(k) = \infty$ and $\lim_{k \rightarrow \infty} f'(k) = 0$. Capital depreciates at the constant rate $\delta \in (0, 1)$. The random variable z determines the quality of the investment project. For simplicity, we assume that for every t , $z_t \in \{z_l, z_h\}$, with $\text{prob}\{z_t = z_h\} = \rho$, $\rho \in (0, 1)$. We shall often refer to individuals in the first period of their lives as entrepreneurs. In the second period, individuals are not productive and consume out of the assets accumulated when young.

Since entrepreneurs are born with no endowment, they will be able to undertake their projects only if the old generation finances them. Importantly, we assume that the realization of the random variable z_t is private information for the entrepreneurs. This implies that entrepreneurs have the option of hiding part of their cash-flows to their financiers. Hiding, however, is costly. For every unit of cash-flow hidden, an entrepreneur gets to consume only a fraction $\xi \in [0, 1]$. The remaining fraction $(1 - \xi)$ constitutes a dead-weight loss. Therefore, the parameter ξ defines the level of protection awarded to the financiers. The larger its value, the lower the protection. The two extreme values identify the cases of complete absence of protection ($\xi = 1$) and perfect protection ($\xi = 0$).

3 The Planner's Problem.

In this section we characterize the allocation that would be chosen by a social planner that attaches a weight γ^t , $\gamma \in (0, 1)$, to the utility of the generation born in period t . It is worth reminding that such allocation is indeed Constrained Pareto-Optimal. Given an initial capital stock $k_0 > 0$, the optimization problem of the planner reads as follows.⁴

$$\max_{\{k_{t+1}, (c_{i,t}^y, c_{i,t+1}^o)_{i=h,l}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \gamma^t \left[\rho u(c_{h,t}^y) + \beta u(c_{h,t+1}^o) + (1-\rho) u(c_{l,t}^y) + \beta u(c_{l,t+1}^o) \right]$$

to deal with corner solutions, we further restrict attention to the CARA and CRRA cases.

⁴Since every generation consists of a measure one of ex-ante identical individuals, the capital assigned to every entrepreneur must equal aggregate capital. For this reason, we use the same notation for the two variables.

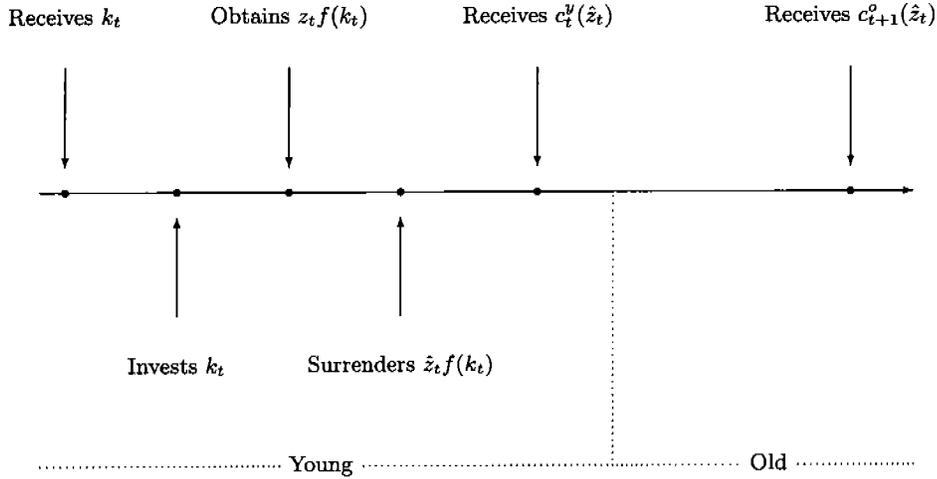


Figure 1: Timing in Planner's Problem.

subject to

$$\rho \overset{\mathbf{i}}{c}_{h,t}^y + \overset{\mathbf{m}}{c}_{h,t}^o + (1 - \rho) \overset{\mathbf{i}}{c}_{l,t}^y + \overset{\mathbf{m}}{c}_{l,t}^o = \bar{z}f(k_t) + (1 - \delta)k_t - k_{t+1}, \quad (1)$$

$$u \overset{\mathbf{i}}{c}_{h,t}^y + \overset{\mathbf{m}}{c}_{h,t+1}^o + \beta u \overset{\mathbf{a}}{c}_{h,t+1}^o \geq u \overset{\mathbf{i}}{c}_{l,t}^y + \overset{\mathbf{m}}{c}_{l,t+1}^o + \beta u \overset{\mathbf{a}}{c}_{l,t+1}^o. \quad (2)$$

For every t , the pair $(c_{h,t}^y, c_{l,t}^y)$ denotes the consumption allocation intended for agents born at time t , conditional on high and low reports, respectively. We assume that once the production process is completed, each agent reports his outcome to the planner, and then surrenders it in order to receive a consumption allocation in exchange. The pair $(c_{h,t}^o, c_{l,t}^o)$ denotes the time t consumption allocation intended for agents born at time $t - 1$, again conditional on their report (issued at time $t - 1$). Figure 1 describes the timing of the lifetime relationship between the planner and an individual born at time t . At the beginning of time t , the planner makes a capital advancement k_t . Its investment yields $z_t f(k_t)$, where z_t is the quality of the investment project. Then, the agent reports $\hat{z}_t \in \{z_l, z_h\}$, and accordingly surrenders $\hat{z}_t f(k_t)$ to the planner. Finally, the planner assigns a lifetime consumption allocation $\overset{\mathbf{c}}{c}_t^y(\hat{z}_t), \overset{\mathbf{c}}{c}_{t+1}^o(\hat{z}_t)$. Notice that the allocation is contingent on the report, rather than on the true realization of the random variable z_t , which is not observable to the planner by assumption.

Equation (1) is the resource constraint. At any t , total consumption must be equal

to production minus gross investment. Condition (2) is the incentive compatibility constraint, conditional on high outcome. If an agent obtains a high outcome ($z = z_h$) and decides to misreport, he will get to consume the consumption allocation intended for the low types $c_{l,t}^y$, plus a fraction ξ of the output hidden from the planner, i.e. $\xi \Delta f(k_t)$, where $\Delta = z_h - z_l$. In case of low outcome, incentive compatibility holds in a trivial way, since the entrepreneur is unable to surrender a high level of output to the planner. It is easy to show that (2) will always be binding. To see this, assume that (2) does not bind. Then the solution can be obtained ignoring this constraint. By strict concavity of u , full insurance is necessary for optimality. That is $c_t^y \equiv c_{h,t}^y = c_{l,t}^y$ and $c_t^o \equiv c_{h,t}^o = c_{l,t}^o$ for every t . However, this clearly violates (2).

For $\xi = 0$, our model becomes a very simple extension of Diamond's, the only difference being that individuals face idiosyncratic risk. In this case, the planner's solution is again to provide full insurance. The presence of idiosyncratic risk becomes immaterial to the determination of the efficient allocation. In fact, the following holds at all times:

$$u'(c_t^y) = \beta[\bar{z}f'(k_{t+1}) + (1 - \delta)]u'(c_{t+1}^o)$$

and

$$u'(c_t^y) = \frac{\beta}{\gamma}u'(c_t^o).$$

Finally, the steady-state capital stock is determined by the modified golden rule condition

$$\bar{z}f'(k) = \frac{1}{\gamma} - (1 - \delta),$$

where $\bar{z} = \rho z_h + (1 - \rho)z_l$. Let us now turn to the more interesting case of $\xi > 0$. Let λ_t and μ_t be the multipliers associated with the constraints (1) and (2), respectively. Then one can show that the planner's optimal resource allocation satisfies the following conditions:

$$\frac{\overset{\mathbf{i}}{u'} \overset{\mathbf{m}}{c_{h,t}^y}}{\overset{\mathbf{i}}{u'}(c_{h,t+1}^o)} = \frac{\beta\lambda_t}{\gamma\lambda_{t+1}},$$

$$\frac{(1 - \rho)\overset{\mathbf{i}}{u'} \overset{\mathbf{m}}{c_{l,t}^y} - \mu_t \overset{\mathbf{i}}{u'} \overset{\mathbf{m}}{c_{l,t}^y} + \xi \Delta f(k_t)}{[(1 - \rho) - \mu_t] \overset{\mathbf{i}}{u'}(c_{l,t+1}^o)} = \frac{\beta\lambda_t}{\gamma\lambda_{t+1}},$$

where $\mu_t > 0$. Given our assumption that $u'' < 0$, we conclude that

$$\frac{u' \overset{\mathbf{i}}{c}_{l,t}^y \overset{\mathbf{m}}{c}_{l,t}^y}{u' \left(c_{l,t+1}^o \right)} < \frac{u' \overset{\mathbf{i}}{c}_{h,t}^y \overset{\mathbf{m}}{c}_{h,t}^y}{u' \left(c_{h,t+1}^o \right)}. \quad (3)$$

Equation (3) is just the restatement of a general result due to Rogerson (1985). The efficient allocation prescribes that, upon realization of the low state, individuals consume *too much* in the first period of their life. If they could, they would transfer resources to the second period of their lives.

A further necessary condition for optimality is that

$$\gamma \frac{\lambda_{t+1}}{\lambda_t} \overset{\mathbf{c}}{\bar{z}} f'(k_{t+1}) + 1 - \delta^{\mathbf{g}} = 1 + \gamma \frac{\mu_{t+1}}{\lambda_t} \xi \Delta f'(k_{t+1}) u' \overset{\mathbf{i}}{c}_{l,t+1}^y \overset{\mathbf{m}}{c}_{l,t+1}^y + \xi \Delta f(k_{t+1}).$$

Since $\mu_{t+1} > 0$, it follows that

$$\gamma \frac{\lambda_{t+1}}{\lambda_t} \overset{\mathbf{c}}{\bar{z}} f'(k_{t+1}) + 1 - \delta^{\mathbf{g}} > 1.$$

Finally, this condition implies that the steady-state capital stock satisfies

$$\bar{z} f'(k) > \frac{1}{\gamma} - (1 - \delta).$$

Hence, with private information the social planner accumulates less capital than in the case of symmetric information. This result is analogous to the one reached by Khan and Ravikumar (2001). The intuition is also the same. When choosing the level of investment, the planner internalizes that a larger capital stock will make the incentive compatibility constraint tighter for future generations. In other words, a larger capital stock will imply less risk sharing and thus lower marginal returns. The optimal response is to choose a lower capital stock than in the case of $\xi = 0$.

4 Competitive Equilibrium.

It is well known that in the case of the basic 2-period OLG model, there exists a simple market mechanism that allocates consumption across the two periods of each individual's life in exactly the same way a benevolent planner would do. A first question we ask is the following: under which conditions does such a mechanism exist in the more general model we analyze in this paper? In other words, we ask whether there exists a decentralization such that the intertemporal allocation of resources

satisfies condition (3). In the case of $\xi = 0$, such decentralization exists and it is very simple. It is achieved by introducing intermediaries that borrow from the old and lend to the young by means of a contract that looks very much like an equity contract. Such contract will offer full insurance to the entrepreneurs and make the intermediaries residual claimants on the projects' cash-flows.

When $\xi > 0$, however, a market mechanism that replicates (3) exists only under strong assumptions about the capabilities of financial intermediaries. This decentralization would be possible, for instance, if either one of the following conditions were satisfied:

1. Each individual can commit to entertain a relation with only one intermediary during his lifetime. (*Exclusivity* assumption.)
2. All output realizations' reports are available to all intermediaries and the intermediaries can commit to quote to old agents interest rates that are contingent on their first-period reports. (*No-anonymity* assumption.)

In the case in which the *exclusivity* assumption is satisfied, at birth individuals can sign life-time financing and risk-sharing contracts with institutions (intermediaries). Agents are provided with capital at the beginning of their lives, surrender their output to the intermediaries, and are then assigned consumption allocations in each period that are contingent on their report. It is easy to show that the resulting consumption allocation satisfies (3). If individuals cannot commit to exclusive life-time contracts, then the allocation will satisfy (3) only if financial institutions can perfectly monitor the agents' use of alternative borrowing and lending opportunities.⁵ In fact, consider the case in which individuals can engage in unmonitored intertemporal borrowing and lending at a given rate r . After receiving the first-period allocations from their intermediary, individuals will trade until their consumption allocations satisfy

$$\frac{u' \overset{\mathbf{i}}{c}_{i,t}^y}{u' \left(c_{i,t+1}^o \right)} = \frac{u' \overset{\mathbf{i}}{c}_{h,t}^y}{u' \left(c_{h,t+1}^o \right)} = \beta (1 + r). \quad (4)$$

Alternatively, if first-period reports are available to everybody in the economy and provided that intermediaries can commit to quote to old agents interest rates

⁵A similar point is made by Allen (1985) and Atkeson and Lucas (1992).

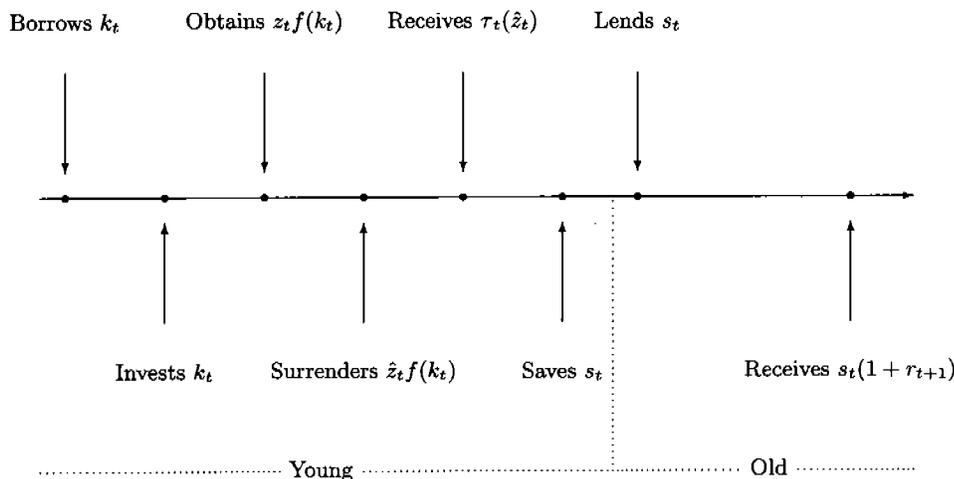


Figure 2: Timing in Competitive Equilibrium.

contingent on their reports, the planner's allocation can be achieved by means of one-period contracts. Unless both of these conditions are met, the consumption allocation resulting when only one-period contracts are offered will satisfy (4).

In this paper we therefore study the scenario in which neither of the above assumptions holds. We introduce financial intermediaries that can only offer one-period contracts. These contracts allow for intergenerational trade and (limited) infra-generational risk-sharing.

In each period, intermediaries rent capital from the old cohort at the ongoing equilibrium rental rate and lend it to entrepreneurs by means of optimal financing contracts. We assume that the intermediation sector is characterized by perfect competition and free-entry. This implies that intermediaries are price takers and make zero profits in every period.

Figure 2 provides a graphic representation of our timing convention. At the beginning of their young age, individuals borrow an amount of capital k_t from intermediaries, invest, and produce an amount $z_t f(k_t)$, which constitutes private information for them. At this point, they decide how much output to surrender to the intermediary, and receive a transfer τ_t which is contingent on the output surrendered. Therefore, a financing contract consists of a capital advancement k_t and contingent

transfers from the intermediary to the entrepreneur, denoted by τ_{ht} and τ_{lt} .⁶

At the end of the first period, individuals will end up with a certain income, which we denote as m_t . In case of low outcome, then $m_t = \tau_{lt}$. Conditional on high outcome instead, $m_t = \tau_{ht}$ in case of truthful report, and $m_t = \tau_{ht} + \xi \Delta f(k_t)$ otherwise.

At the end of the first stage of their lives, agents consume part of their income and save the rest. At the beginning of the second stage, they lend their savings to intermediaries at the market rate. Intermediaries will channel those funds to the new cohort of young people. Finally, at the end of the period, agents receive and consume principal and interest.

We begin our analysis by considering the simple consumption-saving problem that agents solve at the end of the first stage of their lives. Let $v(m_t, r_{t+1})$ denote the indirect utility of an agent born at time t , conditional on having received an income m_t and on facing an interest rate r_{t+1} . Then,

$$v(m_t, r_{t+1}) = u[m_t - s(m_t, r_{t+1})] + \beta u[(1 + r_{t+1})s(m_t, r_{t+1})], \quad (5)$$

where the optimal saving function $s(m_t, r_{t+1})$ is

$$s(m_t; r_{t+1}) = \arg \max_s \{u(m_t - s) + \beta u[(1 + r_{t+1})s]\}. \quad (6)$$

We define an optimal contract as the triple $(k_t, \tau_{ht}, \tau_{lt})$ that solves the following optimization problem:

$$\max_{k_t, \tau_{ht}, \tau_{lt}} \rho v(\tau_{ht}, r_{t+1}) + (1 - \rho) v(\tau_{lt}, r_{t+1}), \quad (P1)$$

subject to

$$v(\tau_{ht}, r_{t+1}) \geq v(\tau_{lt} + \xi \Delta f(k_t), r_{t+1}), \quad (7)$$

and to the zero-profit condition for intermediaries

$$\bar{r}_t \equiv \rho \tau_{ht} + (1 - \rho) \tau_{lt} = \bar{z} f(k_t) - (r_t + \delta) k_t. \quad (8)$$

We now provide our definition of competitive equilibrium

Definition 1 *Given an initial capital stock $k_0 > 0$, a competitive equilibrium for this economy consists of sequences of contracts $\{(k_t, \tau_{ht}, \tau_{lt})\}_{t=0}^{\infty}$ and interest rates $\{r_t\}_{t=0}^{\infty}$ such that*

⁶In Appendix A we show that there is an equivalence between this representation of the contract and a more conventional one, where entrepreneurs keep their production but pay contingent returns to the financial intermediary.

1. $c_0^o = \max\{k_0, k_0(1 + r_0)\}$,
2. contracts are optimal (i.e. they solve the problem (P1)) at all $t \geq 0$,
3. the goods market clears at all $t \geq 0$, i.e.

$$k_{t+1} = \rho s(\tau_{ht}; r_{t+1}) + (1 - \rho) s(\tau_{lt}; r_{t+1}). \quad (9)$$

In the remainder of this section we characterize the evolution over time of our simple economy, starting from an arbitrary capital stock k_0 . We then investigate how the path of variables such as capital, output, and financial claims change, when we change the value of the parameter ξ .

4.1 A benchmark: The case of $\xi = 0$.

At every t , for given interest rate r_t , the demand for capital satisfies the optimality condition

$$\bar{z} f'(k_t) - \delta = r_t. \quad (10)$$

Furthermore, strict concavity of the utility function implies that $\tau_{ht} = \tau_{lt}$. The optimal contract provides the entrepreneurs with full insurance. In turn, this makes the intermediaries residual claimants on the projects' cash-flows. From the zero-profit condition together with (10), transfers are functions of capital only, and are given by

$$\tau_t = \tau(k_t) = \bar{z}^c f(k_t) - f'(k_t) k_t^g.$$

The gross return on investment for the intermediaries R_{it} is given by

$$R_{it} = \frac{z_i f(k_t) - \tau_t}{k_t} \quad \text{for } i = h, l,$$

and it follows that

$$R_{ht} - R_{lt} = \frac{\Delta f(k_t)}{k_t}.$$

The financial claim held by the intermediary resembles an equity claim.

Then, for a given initial capital stock $k_0 > 0$, the behavior of the economy is completely described by (10), along with the nonlinear difference equation

$$k_{t+1} = s[\tau(k_t); r_{t+1}].$$

The economy displays the same behavior as a standard OLG economy with constant productivity \bar{z} , competitive markets for capital and labor, and inelastic labor supply. The only difference is that the young generation's income consists of the transfer τ_t , rather than the wage.

4.2 The case of $\xi \in (0, 1]$.

In this section we show that when $\xi > 0$, our market mechanism implies that capital accumulation can be increasing or decreasing in the parameter ξ , depending on the utility specification. It is very interesting that for very common specifications (logarithmic utility and Cobb-Douglas production, for example), worse investor protection leads to more investment and more accumulation. The intuition is as follows. For given capital stock, larger ξ (worse investor protection) implies less risk-sharing. That is, entrepreneurs have to bear more risk. In order to induce them to accept the greater risk, the intermediaries have to compensate them with a larger expected return. In most cases, larger income implies larger savings and thus larger accumulation.

It is easy to show that (7) must bind and that $v(\tau_t, r_{t+1})$ is strictly increasing in τ_t for any r_{t+1} . Thus condition (7) implies that $\tau_{ht} = \tau_{lt} + \xi \Delta f(k_t)$ for any t . By the zero-profit condition (8), transfers are then given by

$$\tau_{lt} = \tau_l(k_t, r_t) = (\bar{z} - \rho \xi \Delta) f(k_t) - (r_t + \delta) k_t, \quad (11)$$

$$\tau_{ht} = \tau_h(k_t, r_t) = (\bar{z} + (1 - \rho) \xi \Delta) f(k_t) - (r_t + \delta) k_t. \quad (12)$$

The gross return on investment to the intermediary is given by

$$R_{it} = \frac{z_i f(k_t) - \tau_{it}}{k_t} \text{ for } i = h, l,$$

and it follows that

$$R_{ht} - R_{lt} = \frac{(1 - \xi) \Delta f(k_t)}{k_t}.$$

For $\xi > 0$, risk-sharing is no longer perfect. The entrepreneurs bear part of the risk. In the extreme case of $\xi = 1$, the returns are non-contingent (equal to $r_t + \delta$) and the financial contract held by the intermediary is a standard debt contract.

The optimal capital advancement is then the solution to

$$\max_{k_t} V \equiv \rho v[\tau_h(k_t, r_t), r_{t+1}] + (1 - \rho) v[\tau_l(k_t, r_t), r_{t+1}].$$

Let $\bar{\tau}_t = \rho \tau_{ht} + (1 - \rho) \tau_{lt}$. Using the incentive compatibility condition, one can reformulate the problem as

$$\max_{\bar{\tau}_t, k_t} V \equiv \rho v[\bar{\tau}_t + (1 - \rho) \Delta \xi f(k_t), r_{t+1}] + (1 - \rho) v[\bar{\tau}_t - \rho \Delta \xi f(k_t), r_{t+1}],$$

subject to

$$\bar{\tau}_t = \bar{z} f(k_t) - (r_t + \delta) k_t. \quad (\text{BC})$$

For given r_t , the optimal pair $(k_t, \bar{\tau}_t)$ must solve the system of equations given by the budget constraint (BC) and by the tangency condition

$$\frac{d\bar{\tau}_t}{dk_t} \Big|_{BC} = \frac{d\bar{\tau}_t}{dk_t} \Big|_V. \quad (13)$$

Using the envelope theorem, we obtain the following expressions for the slopes of budget constraint and indifference curves:

$$\begin{aligned} \frac{d\bar{\tau}_t}{dk_t} \Big|_{BC} &= \bar{z}f'(k_t) - (r_t + \delta), \\ \frac{d\bar{\tau}_t}{dk_t} \Big|_V &= -\rho(1-\rho)\xi\Delta f'(k_t) \frac{u'(c_{ht}) - u'(c_{lt})}{\rho u'(c_{ht}) + (1-\rho)u'(c_{lt})} > 0. \end{aligned}$$

The consumption allocations are given by

$$c_{it} = \tau_i(k_t) - s(\tau_i(k_t); r_{t+1}) \quad \text{for } i = h, l.$$

The reason why we restrict ourselves to utility functions that exhibit either CRRA or CARA is that such specifications deliver consumption functions which are linear in transfers, or

$$c_{it} = \kappa_0(r_{t+1}) + \kappa_1(r_{t+1})\tau_{it} \quad \text{for } i = h, l$$

for some functions κ_0 and κ_1 . In turn, this implies that at any date the optimal pair $(k_t, \bar{\tau}_t)$ (and the aggregate demand for capital) do not depend on r_{t+1} .

For given $k_0 > 0$, the evolution over time of this economy is then completely characterized by the conditions (13) and (BC), which define the demand for capital $k_t = D(r_t; \xi)$, together with (9), which defines the supply of capital $k_{t+1} = S(k_t, r_t, r_{t+1})$.

Proposition 1 establishes that the aggregate demand for capital is decreasing in both r_t and ξ .

Proposition 1 *The function $D(r_t, \xi)$ is strictly decreasing in both k_t and ξ .*

Proof. Let's prove first that $D(r_t; \xi)$ is decreasing in r_t . Figure 3 clarifies the argument. Start with an optimal k_t^0 . The corresponding interest rate will be $r_t^0 = D^{-1}(k_t^0, \xi)$. Now consider any $r_t^1 > r_t^0$. Since $\frac{\partial^2 \bar{\tau}_t}{\partial k_t \partial r_t} \Big|_{BC} = -k_t < 0$, this implies a shift of the budget constraint from BC_0 to BC_1 . To show that the optimal capital advancement associated with the higher interest rate is $k_t^1 < k_t^0$ it is enough to show that $\frac{\partial^2 \bar{\tau}_t}{\partial k_t \partial r_t} \Big|_V \leq 0$. Simple calculations reveal that $\frac{\partial^2 \bar{\tau}_t}{\partial k_t \partial r_t} \Big|_V = -\rho(1 -$

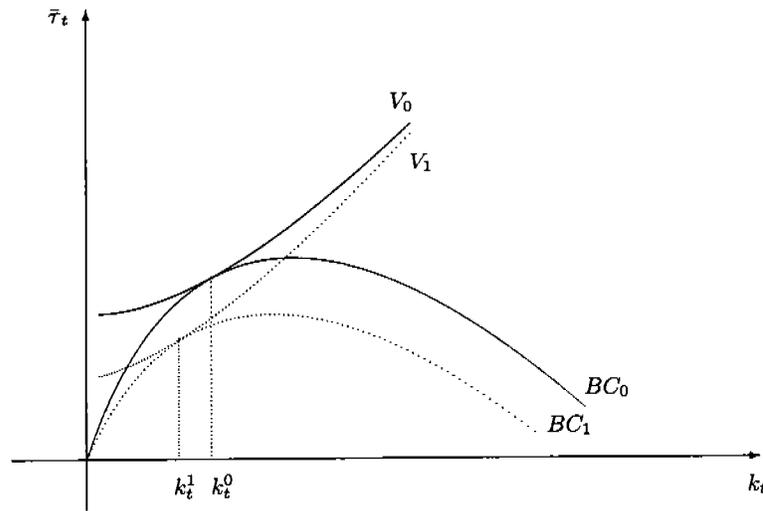


Figure 3: Effect of an increase in r_t .

$\rho)\xi\Delta u'(\tau_{ht})u'(\tau_{lt}) \frac{u''(\tau_{ht})}{u'(\tau_{ht})} - \frac{u''(\tau_{lt})}{u'(\tau_{lt})}$. Notice that $\frac{u''(\tau_{ht})}{u'(\tau_{ht})} - \frac{u''(\tau_{lt})}{u'(\tau_{lt})} = [R_A(\tau_{lt}) - R_A(\tau_{ht})]$, where R_A denotes the coefficient of absolute risk-aversion. Therefore, we conclude that a sufficient condition for $\frac{\partial^2 \bar{\tau}_t}{\partial k_t \partial r_t} \leq 0$ is that the utility function displays non-increasing absolute risk-aversion, a condition satisfied by all utility specifications in the class under consideration.

We now turn to the proof that $D(r_t; \xi)$ is decreasing in ξ . Figure 4 helps understanding our argument. Consider any $\xi = \xi_0 \in (0, 1)$. Let k_t^0 denote the corresponding optimal capital advancement. Now consider any $\xi_1 > \xi_0$. The budget constraint BC is invariant to such modification. On the other hand, simple algebra shows that risk-aversion implies $\frac{\partial^2 \bar{\tau}_t}{\partial k_t \partial \xi} \geq 0$. For given r_t , since $\frac{\partial \bar{\tau}_t}{\partial k_t} > 0$ and $\frac{\partial^2 \bar{\tau}_t}{\partial k_t^2} > 0$, the new optimal capital advancement k_t^1 must be strictly lower than k_t^0 . ■

In the remainder of this section we study the dynamics implied by our model in two economies differing only in terms of ξ . Let ξ and $\hat{\xi}$ be the degrees of investor protection in the two economies, and suppose $\hat{\xi} > \xi$. Consider date $t = 0$ first. Since the capital stock is given, the supply of capital by the old generation is completely inelastic at k_0 . The demand schedule in the $\hat{\xi}$ -economy has a lower intercept. The result, illustrated in Figure 5, is that the interest rate r_0 is lower in the economy with worse investor protection, and the expected income of entrepreneurs $\bar{\tau}_0$ is higher. The economic intuition underlying this result is straightforward. Since the number of

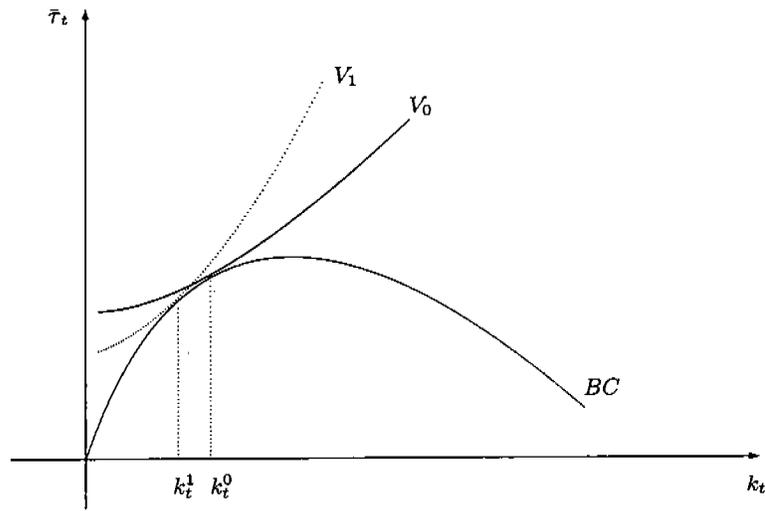


Figure 4: Effect of an increase in ξ .

entrepreneurs is constant, the capital per entrepreneur must be k_0 in both economies. In the economy with poorer investor protection, the optimal contract allows for less risk-sharing. For the young to accept the greater risk, their expected return $\bar{\tau}_0$ must be larger. Finally, the budget constraint dictates that this can happen only if r_0 is lower.

The evolution of capital over time depends on the interaction between demand and supply. Because of Proposition 1, at any time t the demand schedule will be lower, the higher the parameter ξ . The evolution of k_t , however, will depend crucially on the interest-rate elasticity of the supply curve. A larger value of $\bar{\tau}_0$ implies an outward shift of the supply curve. This can result on an higher or lower value of k_1 , depending on the relative slopes of demand and supply, as well as on the amount by which both curves shift.

If the income effect deriving from an interest rate change barely dominates the substitution effect, in such a way that in absolute value the the slope of the supply curve is higher than the slope of the demand curve, then it will be the case that $k_t(\xi) < k_t(\hat{\xi})$ for all $t \geq 1$. In particular, it is easy to see that this is the case when the utility function is logarithmic. With such preferences, income and substitution effects exactly offset each other. As a result, savings are a constant proportion of

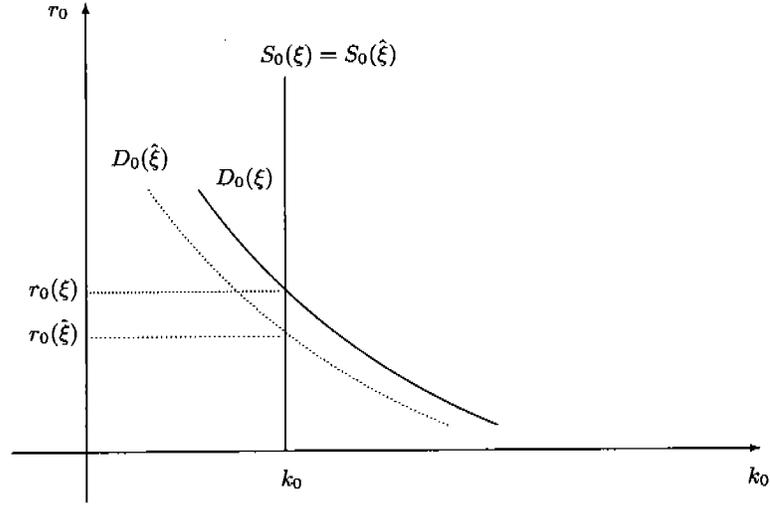


Figure 5: Date $t = 0$.

transfers. At any time t the supply of capital is inelastic and given by

$$k_{t+1} = \frac{\beta}{1 + \beta} \bar{r}_t.$$

We have just argued that for any pair $(\xi, \hat{\xi})$ such that $\hat{\xi} > \xi$, $\bar{r}_0(\hat{\xi}) > \bar{r}_0(\xi)$. Figure 6 shows that it will also be the case that $k_1(\hat{\xi}) > k_1(\xi)$, $r_1(\hat{\xi}) < r_1(\xi)$, and therefore $\bar{r}_1(\hat{\xi}) > \bar{r}_1(\xi)$. Repeating the same argument at any time t , one can show that capital accumulation is always higher in the economy with worse investor protection.

It turns out that if the production function takes the form $f(k) = k^\alpha$, for most parameterizations the level of capital is strictly increasing in the parameter ξ at all dates. Figure 12 shows the dynamics of capital, interest rate, entrepreneurial income, and welfare, in a scenario with CRRA utility and $\sigma \neq 1$. However, there are parameterizations for which we obtain the opposite result. For instance, this is the case when utility is CRRA and the following values are assigned to the parameters: $\alpha = 1/3$, $\delta = 0.05$, $z_h = 1.2$, $\bar{z} = 1$, $\rho = 0.7$, $\beta = 0.15$, $\sigma = 0.5$.

5 A Model with Occupational Choice.

A limitation of the model we have analyzed so far is that the fraction of entrepreneurs in the economy is exogenously set at 1. In other words, young agents do not have an outside option. In this section we endogenize the fraction of individuals that act

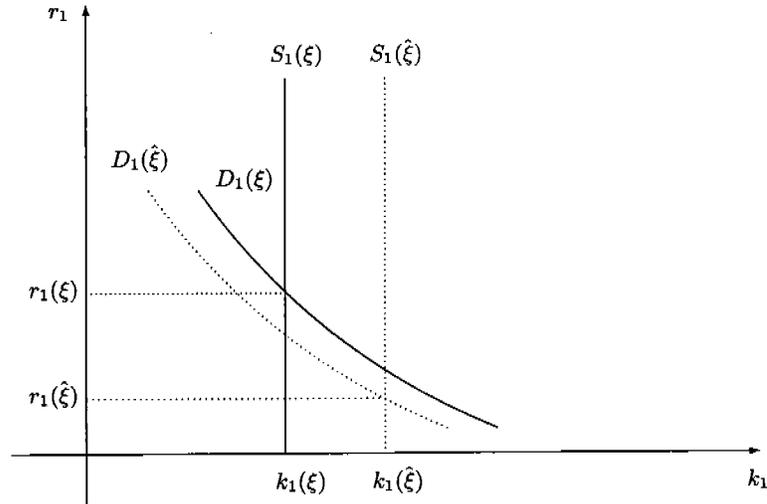


Figure 6: Date $t = 1$.

as entrepreneurs, so that a larger value of ξ (a worse risk-sharing technology) can be accommodated along two margins: prices (as in the baseline model) and quantities (i.e. by expanding the fraction of entrepreneurs, thereby reducing the amount of capital invested by each of them). Our main objective is to understand to what extent this new adjustment margin is used in equilibrium. In particular, we would like to understand whether our main result from Section 4 carries through to the more general case under analysis here.

We assume that the production function is of the form $f(k, n)$, where n denotes labor input. We assume that f is homogeneous of degree $\lambda < 1$, so that output is not exhausted if capital and labor are paid at their marginal productivities (as it is the case for $\xi = 0$). The population still consists of a measure one of ex-ante identical individuals. Differently from above, however, we assume that each individual is endowed with a unit of time and decides how to allocate it. He can either become an entrepreneur and hire labor, or work for a wage. Therefore, ex-post, every cohort will be split between *workers* and *entrepreneurs*.

We assume that labor is freely mobile ex-post, so that, at any t , a single wage rate w_t must prevail in equilibrium. The lifetime utility of a worker is given by $v(w_t, r_{t+1})$, where the indirect utility function v is defined by (5). By assumption, leisure is not valued.

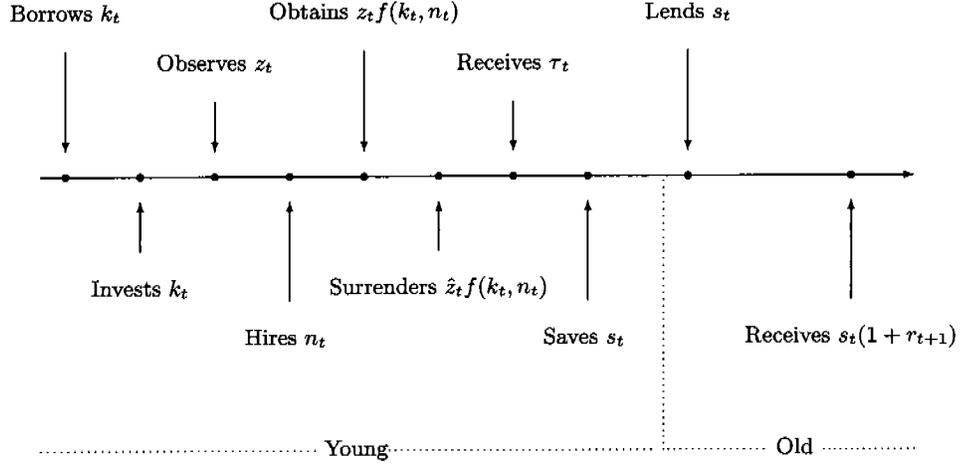


Figure 7: Timing in Model with Occupational Choice.

The problem of the entrepreneur is basically the same as in the previous section. His expected lifetime utility is given by

$$V(\tau_{ht}, \tau_{lt}; r_{t+1}) \equiv \rho v(\tau_{ht}; r_{t+1}) + (1 - \rho) v(\tau_{lt}; r_{t+1}),$$

where v is again defined as in (5).

Figure 7 describes the timing of choices for entrepreneurs. As it is standard in the macroeconomics literature, we assume that capital must be put in place at the beginning of the period (i.e. before the value of the variable z is observed). Workers, instead, are hired after z is observed. A contract between an intermediary and an entrepreneur is now given by a capital advancement k_t , contingent transfers τ_{it} , $i = h, l$, and hiring recommendations n_{it} , $i = h, l$. We assume that the employment level chosen by the entrepreneur is public information. Thus, in case an entrepreneur decides to misreport his production outcome, he needs to hire labor at a level that is consistent with his report. The maintained assumption is that only a fraction ξ of the difference in gross profits may be appropriated if the entrepreneur decides to misreport. Optimal contracts now solve the following problem:

$$\max_{k_t, n_{ht}, n_{lt}, \tau_{ht}, \tau_{lt}} V(\tau_{ht}, \tau_{lt}; r_{t+1}), \quad (\text{P2})$$

subject to

$$v(\tau_{ht}; r_{t+1}) \geq v[\tau_{lt} + \xi \Delta f(k_t, n_{lt}); r_{t+1}], \quad (14)$$

$$\begin{aligned} \bar{\tau}_t \equiv \rho \tau_{ht} + (1 - \rho) \tau_{lt} = \rho [z_h f(k_t, n_{ht}) - w_t n_{ht}] + \\ (1 - \rho) [z_l f(k_t, n_{lt}) - w_t n_{lt}] - (r_t + \delta) k_t, \end{aligned} \quad (15)$$

$$z_i f_2(k_t, n_{it}) = w_t \quad \text{for } i = h, l. \quad (16)$$

Condition (16) imposes renegotiation-proofness. It is easy to prove that if the contract recommended hiring labor at a level different from the efficient one, ex-post it would be in the interest of both parts to change to the latter.⁷

It is immediate that (14) binds. Then, by strict monotonicity of v , we also have that

$$\tau_{ht} = \tau_{lt} + \xi \Delta f(k_t, n_{lt}). \quad (17)$$

Definition 2 *Given an initial aggregate capital stock $K_0 > 0$, a competitive equilibrium for this economy is given by sequences of prices $\{r_t, w_t\}_{t=0}^{\infty}$, aggregate labor force $\{N_t\}_{t=0}^{\infty}$, aggregate capital $\{K_t\}_{t=0}^{\infty}$, individual capital advancements $\{k_t\}_{t=0}^{\infty}$, contingent transfers $\{\tau_{ht}, \tau_{lt}\}_{t=0}^{\infty}$, and individual employment levels $\{n_{ht}, n_{lt}\}_{t=0}^{\infty}$ such that*

1. $c_0^o = \max\{k_0, k_0(1 + r_0)\}$,

2. *Contracts are optimal, i.e. $(k_t, \tau_{ht}, \tau_{lt}, n_{ht}, n_{lt})$ solves Problem (P2),*

3. *Young agents are ex-ante indifferent between the two occupational choices:*

$$v(w_t; r_{t+1}) = V(\tau_{ht}, \tau_{lt}; r_{t+1}), \quad (18)$$

4. *The labor market clears:*

$$N_t = (1 - N_t) [\rho n_{ht} + (1 - \rho) n_{lt}], \quad (19)$$

5. *The market for renting capital clears:*

$$K_t = (1 - N_t) k_t,$$

6. *The goods market clears:*

$$K_{t+1} = N_t s(w_t; r_{t+1}) + (1 - N_t) [\rho s(\tau_{ht}; r_{t+1}) + (1 - \rho) s(\tau_{lt}; r_{t+1})].$$

⁷If we did not require renegotiation-proofness, it could be optimal for the intermediary to recommend hiring a level of labor n_{it} that is lower than what is ex-post efficient. Such a decision would relax the incentive compatibility constraint, allowing for more risk-sharing (i.e. lower spread in transfers $\tau_{ht} - \tau_{lt}$). In other words, the labor hiring decision would help in providing incentives. The renegotiation-proofness restriction does not allow for this opportunity.

We study the competitive equilibrium for an arbitrary degree of investor protection. Using conditions (15) and (17), the problem (P2) can be reformulated in a way entirely analogous to that of the previous section. The tangency condition (13) is again necessary for optimality. In this case, we have that

$$\begin{aligned} \frac{d\bar{\tau}_t}{dk_t} \Big|_{BC} &= \rho z_h f_1(k_t, n_{ht}) + (1 - \rho) z_l f_1(k_t, n_{lt}) - (r_t + \delta), \\ \frac{d\bar{\tau}_t}{dk_t} \Big|_{V} &= -\rho(1 - \rho) \xi \Delta \left[f_1(k_t, n_{lt}) - f_2(k_t, n_{lt}) \frac{f_{21}(k_t, n_{lt})}{f_{22}(k_t, n_{lt})} \right] \frac{u'(c_{ht}) - u'(c_{lt})}{\rho u'(c_{ht}) + (1 - \rho) u'(c_{lt})}. \end{aligned}$$

Along with the budget constraint, the tangency condition defines the optimal capital advancement at time t . On the other hand, it is easy to verify that condition (18) reduces to

$$u(w_t) = \rho u(\tau_{ht}) + (1 - \rho) u(\tau_{lt}) \quad (20)$$

and is thus independent from τ_{t+1} .

We now turn to the case of Cobb-Douglas technology. We assume that $f(k_t, n_t) = k_t^\alpha n_t^\gamma$ with $\alpha, \gamma \geq 0$ and $\alpha + \gamma < 1$. In this case, transfers turn out to be linear functions of production. As a consequence, the fraction of entrepreneurs is constant not only in the steady-state, but also along the transition path. Proposition 2 establishes this result.

Proposition 2 *If technology is Cobb-Douglas then $N_t = N$ for all t .*

Proof. See Appendix. ■

Proposition 2 allows us to recast the whole problem as if capital were the only input to production. In fact, it turns out that the production function may be rewritten as

$$y_t = \hat{z}_t B k_t^\alpha,$$

where the *project quality* is the product of a stochastic component $\hat{z}_t \in \{z_l, z_h\}$ and a deterministic component B . Both \hat{z}_t and B are complicated functions of the parameters of the model. Importantly for our analysis, only B depends on ξ .

This finding implies that, from a qualitative point of view, the dynamics of this economy for given ξ is the same as in the case of the baseline model. Instead, changes in ξ lead not only to effects on the aggregate demand and supply of capital analogous to those described in Section 4, but also to new effects through the change in B . The

variation of B triggered by the change in ξ captures precisely the adjustment along the *size of entrepreneurial sector* margin that we wish to emphasize.

In order to gauge the importance of this new adjustment, we restrict attention to CRRA utility.

Example 1 Let $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$, with $\sigma > 0$ and $\sigma \neq 1$.

In this case the employment level turns out to be

$$N = \frac{\gamma z_l A_l^{\gamma-1}}{\gamma z_l A_l^{\gamma-1} + [\rho g_h^{1-\sigma} + (1-\rho) g_l^{1-\sigma}]^{1/(1-\sigma)}}.$$

The efficiency parameter B is given by

$$B = \frac{\gamma z_l A_l^{\gamma-1}}{\rho g_h^{1-\sigma} + (1-\rho) g_l^{1-\sigma}},$$

where the parameters A_l , g_h and g_l are defined in the proof of Proposition 2.

Figure 13 shows the effects of an increase in ξ on the time paths of the different variables, in the case of isoelastic utility. Figure 13 reveals that the fraction of entrepreneurs is larger in the economy with worse investor protection. A given amount of aggregate capital may now be spread over a larger number of individuals, thereby reducing the capital advancement made available to each of them. In turn, this reduces the increase in risk and expected transfer $\bar{\tau}$ triggered by an increase in ξ , with the effect of dampening the surge in savings. This finding corroborates our conjecture. An increase in ξ triggers an adjustment both in capital accumulation (via lower interest rates) and in labor force composition. However, from a qualitative point of view, the responses of the interest rate, aggregate capital, and transfers resemble those in the previous section. Despite the introduction of a new margin for adjustment, an increase in ξ still has a positive effect on capital accumulation.

6 A Model with International Capital Mobility

In the benchmark model we analyze a closed economy. The economy responds to poorer investor protection through a decrease in the domestic interest rate, which lowers the income the old generation obtains from renting capital services. In this section we consider instead the case of perfect international mobility of capital. Old agents are thus able to rent capital services to foreigners, and intermediaries may rent

capital services from abroad. This allows us to capture the possibility that capital flight may occur in response to poor investor protection, that is, owners of capital may decide to invest abroad if the risk of expropriation at home is too severe, and the return on capital too low as a consequence.

We assume a small open economy, which means domestic intermediaries must offer the same rental rate as foreign intermediaries. Since any imbalance between domestic and foreign returns to capital is matched by massive international capital flows, the convergence to the steady-state is instantaneous. Therefore, the economy exhibits no dynamics.

Since the interest rate is fixed, all the adjustment to differences in investor protection must occur along the quantity margin. As a consequence, poorer investor protection becomes detrimental to GDP growth. Poorer investor protection also tends to generate capital flight. Capital flight occurs because, since the rental rate is fixed at the worldwide level, the total supply of capital by residents now decreases along with demand in response to poorer investor protection, but it decreases by a lower amount.

Let r be the world interest rate. Further, let k^d be the capital demanded by domestic intermediaries, and employed in production, and let k^s be the total capital supplied by the currently old generation. The difference $k^s - k^d$ corresponds to the net outflow of capital from the domestic economy. The following proposition establishes our result formally.

Proposition 3 *There exist unique capital levels k^* and k^{**} , with $0 < k^{**} < k^*$, such that:*

1. *If $k^d \leq k^*$ then $k^s - k^d \geq 0$;*
2. *If $k^d \leq k^{**}$ then $\frac{\partial(k^s - k^d)}{\partial \xi} \leq 0$.*

Proof. We begin with the first part. Given a level of capital employed in domestic production k^d , we know from Section 4 that the capital level supplied by the old generation is determined by the market-clearing condition $k^s = k^s \frac{a^d}{k^d} \equiv \psi(r) \frac{c}{z} f \frac{a^d}{k^d} - (r + \delta) k^d \frac{g}{k^d}$, for some function ψ . Since $\psi(r)$ is a constant, $k^s \frac{a^d}{k^d}$ has the same shape as the intermediary's budget constraint, which was introduced previously. Figure 8 plots this function together with the 45 degree line. Notice that

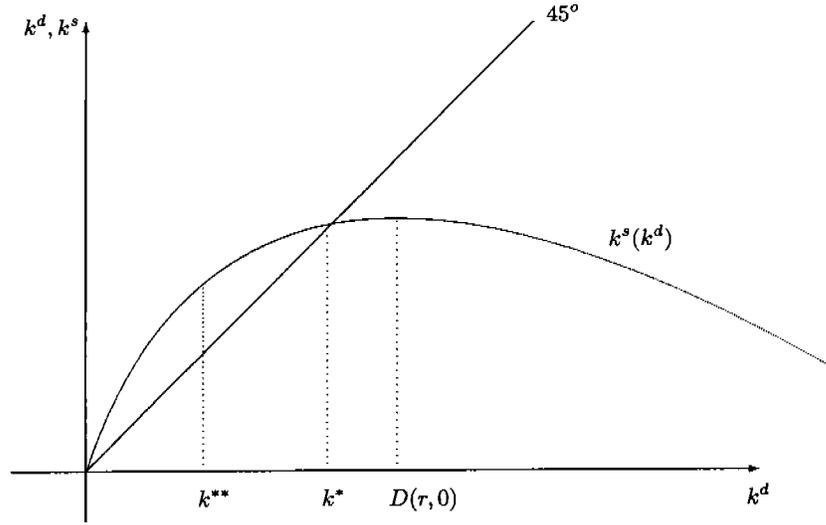


Figure 8: Net Capital Flows.

the vertical difference between k^s and k^d and the 45 degree line corresponds to the net capital outflow from the domestic economy. Define k^* such that $k^* = k^s(k^*)$. It follows that $k^* > 0$ exists and is unique. The first part of the proposition then follows immediately.

We now turn to the second part. Notice first that, by Proposition 1, $k^d = D(r, \xi)$ is strictly decreasing in ξ . Therefore $k^d \leq D(r, 0)$.⁸ Now define k^{**} such that $\partial k^s(k^{**}) / \partial k^d = 1$. It follows that $k^{**} > 0$ exists and is unique. Clearly k^{**} maximizes $k^s - k^d$, and it is also the case that $k^{**} < k^*$. For $k^d \leq k^{**}$ we have $\partial (k^s - k^d) / \partial k^d \geq 0$. Since k^d is strictly decreasing in ξ , the second part of the proposition follows. ■

Proposition 3 implies that there is a tendency towards capital flight associated with poor investor protection. For example, consider a pair of small open economies with ξ and $\hat{\xi}$ such that $\hat{\xi} > \xi$. The two economies are otherwise identical. In particular, they have the same initial capital stock $k_0 < D(r, 0)$. To simplify, consider the case in which the net capital outflow is zero for the economy with better investor protection, so that $k_0^s(\xi) = k_0^d(\xi)$. This happens when the world interest rate r equals the domestic interest rate under autarky for the economy with ξ . From the analysis in

⁸Without loss of generality, Figure 8 depicts the case in which $k^* < D(r, 0)$. Depending on r , in particular, it is possible to have $k^* \geq D(r, 0)$ as well.

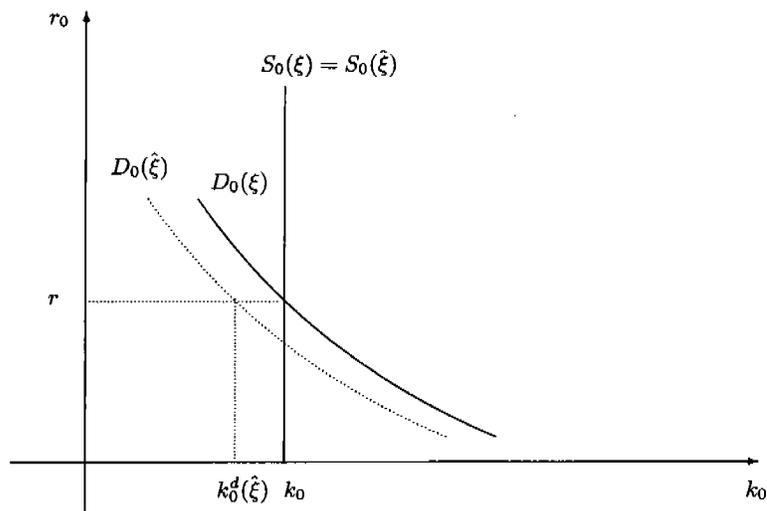


Figure 9: Date $t = 0$.

Section 4 it follows that $r < \bar{z}f'(k_0) - \delta$.

The difference between the two economies in the initial period is depicted in Figure 9. At time $t = 0$ the currently old supply capital inelastically, and so $k_0^s(\xi) = k_0^s(\hat{\xi}) = k_0$. The demand for capital by domestic intermediaries, instead, is lower in the economy with $\hat{\xi}$ due to a worsening of risk-sharing, just as in Section 4. The capital invested domestically in this economy, $k_0^d(\hat{\xi})$, must thus be lower than the capital supplied. The difference $k_0^s(\hat{\xi}) - k_0^d(\hat{\xi})$ corresponds to capital flight.

Since the adjustment to the steady-state is instantaneous, Figure 10 represents the two economies for all $t \geq 1$. For every $t \geq 1$, the demand curves remain unchanged relative to period $t = 0$. The difference is that the supply of capital in the economy with $\hat{\xi}$ now decreases. This reduction in supply occurs because a decrease in capital invested domestically with $r < \bar{z}f'(k_0) - \delta$ fixed must be accompanied by a decrease in $\bar{\tau}_t$. From Proposition 3 it turns out that the demand decreases by a larger amount than the supply, implying that $k_t^s(\hat{\xi}) - k_t^d(\hat{\xi}) > 0$ for all $t \geq 1$. The economy with poorer investor protection will therefore feature a permanent net outflow of capital towards the rest of the world.

Our model predicts that, for a small open economy, lower investor protection is associated with lower levels of capital stock and output, and larger outflow (lower inflow) of capital towards (from) the rest of the world. Our analysis suggests that low

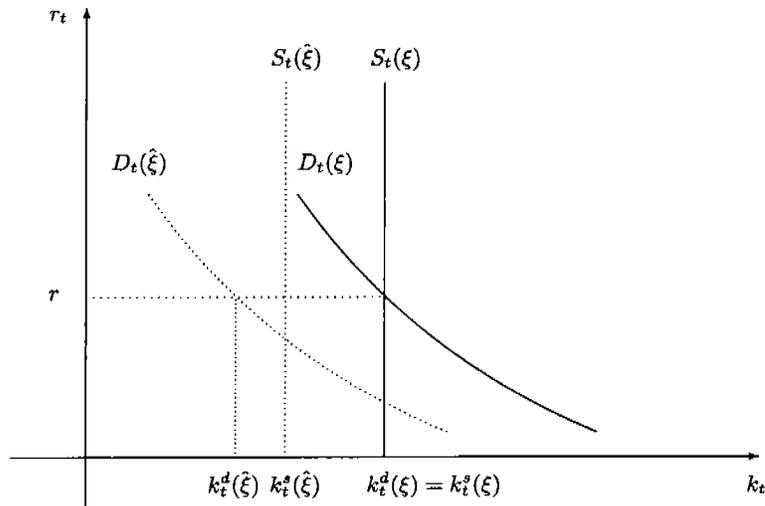


Figure 10: Date $t \geq 1$.

investor protection may also have a detrimental effect on output growth. Given our assumption of perfect capital mobility and absence of adjustment costs, the model presented in this section cannot produce implications for the relation between investor protection and growth. However, by relaxing either one of these simplifying hypothesis, the economy that we have analyzed would display a finite speed of transition to the steady state. The growth rate along such transition would be larger for economies (those with better investor protection) whose steady state capital stock is larger. Furthermore, the negative effect of poor investor protection on output growth would be larger for economies with lower barriers to international capital mobility.

7 Conclusion.

In this paper we have introduced imperfect investor protection in a simple extension of the basic two-period overlapping generations model of capital accumulation. In our model young individuals borrow from old agents via financial intermediaries, in order to undertake risky business projects.

When investor protection is not perfect, it is easy to establish that any financing contract that is consistent with equilibrium in the lending market will offer only partial insurance to entrepreneurs. Moreover, risk-sharing allowed by Constrained-Pareto optimal contracts is increasing in the level of protection.

We have studied the effects of protection on capital accumulation and welfare in the scenario in which intermediaries can offer only one-period contracts. In the case of a closed economy, poorer investor protection is generally growth-enhancing. The reason is that a decrease in the aggregate demand for capital due to lower risk-sharing is generally dominated by an increase in the aggregate supply. For a given project's scale, less risk-sharing implies that entrepreneurs bear more risk and thus command an higher expected return. As a result, a larger fraction of the income produced flows to the young agents, prompting higher savings. This result still holds true when we allow for the size of the entrepreneurial sector to be determined endogenously. In the case of a small open economy with perfect capital mobility, the supply effect disappears. The economy jumps instantaneously on the steady state and poorer investor protection simply implies a larger flow of capital towards the rest of the world. It is important to remark that, no matter the effects on capital accumulation, welfare of all generations is strictly increasing in the level of protection.

Our next goal is to study the intermediate case of a small open economy with imperfect capital mobility. In such case the supply effect described above will still be at work. We conjecture that our model will predict that countries with poorer investor protection grow less to the extent that there is capital flight towards the rest of the world. An empirical assessment of the importance of this channel would have to take the interaction between investor protection and the degree of openness explicitly into account. We believe this would be a fruitful avenue for further research, as some insight would be gained into how exactly investor protection affects the economy.

A Incentive Compatibility.

Throughout the paper, we have maintained the assumption that after production has taken place, the entrepreneur surrenders his output to the intermediary, to receive a transfer in exchange. In this section we show that this representation of the problem implies no loss in generality. The allocation that obtains under more standard assumptions about the contracting environment, is the same as the one obtained in Section 4.

We describe the new environment with the help of Figure 11. Differently from what was postulated in Section 4, now a financing contract consists of a capital advancement k_t by the intermediary and contingent payments from the entrepreneur to the intermediary $R_{ht}k_t$ and $R_{lt}k_t$. Obviously these payments will be contingent on publicly available information only. We assume that, upon observing his output $z_t f(k_t)$, a young individual born at time t issues a report \hat{z}_t to the intermediary. Upon receiving the message, the intermediary will require a transfer $R(\hat{z}_t)k_t$.

As a consequence, an entrepreneur's first-period income is $z_i f(k_t) - R_{it}k_t$, for $i = h, l$, in case of truthful reporting, and $z_i f(k_t) - R_{jt}k_t - (1 - \xi)\Delta f(k_t)$, for $i, j = h, l$ and $i \neq j$ in case he decides to misreport. As before, the term $(1 - \xi)\Delta f(k_t)$ is the deadweight loss associated with misreporting.⁹ The optimum problem of the intermediary writes as follows.

$$\max_{k_t, R_{ht}, R_{lt}} \rho v(z_h f(k_t) - R_{ht}k_t, r_{t+1}) + (1 - \rho)v(z_l f(k_t) - R_{lt}k_t, r_{t+1})$$

subject to

$$v(z_h f(k_t) - R_{ht}k_t, r_{t+1}) \geq v[z_h f(k_t) - R_{lt}k_t - (1 - \xi)\Delta f(k_t), r_{t+1}], \quad (21)$$

$$v(z_l f(k_t) - R_{lt}k_t, r_{t+1}) \geq v[z_l f(k_t) - R_{ht}k_t - (1 - \xi)\Delta f(k_t), r_{t+1}], \quad (22)$$

and to the zero-profit condition for intermediaries

$$\rho R_{ht} + (1 - \rho)R_{lt} = r_t + \delta. \quad (23)$$

Lemma 3 *If $\xi > 0$, then $z_h f(k_t) - R_{ht}k_t > z_l f(k_t) - R_{lt}k_t$.*

⁹Our assumption implies that the cost of misreporting is a constant fraction of the (absolute value of the) gap between actual and misreported output, regardless of its sign. However, it is easy to show that the analysis that follows goes through even in the case in which misreporting in case of low output is costless.

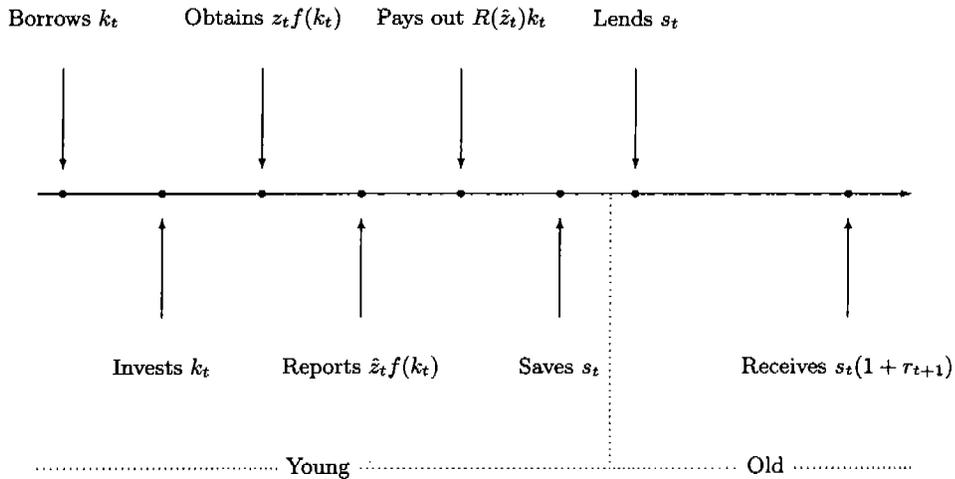


Figure 11: An Alternative Timing Convention.

Proof. By contradiction, assume that $z_h f(k_t) - R_{ht} k_t \leq z_l f(k_t) - R_{lt} k_t$. In turn, this implies that $(R_{ht} - R_{lt}) k_t \geq \Delta f(k_t)$. However, this contradicts incentive compatibility. In fact, by strict monotonicity of v , condition (21) implies that $(R_{ht} - R_{lt}) k_t \leq (1 - \xi) \Delta f(k_t)$. ■

Lemma 4 *If $\xi > 0$, then in the solution constraint (21) binds and constraint (22) is slack.*

Proof. By contradiction, assume that in the solution condition (21) holds with strict inequality. Then, again by strict monotonicity of v , it follows that $R_{lt} > R_{ht} - (1 - \xi) \Delta \frac{f(k_t)}{k_t}$. Since the function v is strictly concave and $z_h f(k_t) - R_{ht} k_t > z_l f(k_t) - R_{lt} k_t$ by Lemma 3, it is possible to raise R_{ht} and lower R_{lt} in such a way that all constraints are still satisfied and the objective function assumes a strictly higher value. Obviously, this contradicts optimality. Thus it must be the case that $R_{ht} - R_{lt} = (1 - \xi) \Delta \frac{f(k_t)}{k_t} > 0$. ■

Obviously, Lemma 4 implies that we can disregard condition (22). Finally, letting $\tau_{ht} \equiv z_h f(k_t) - R_{ht} k_t$ and $\tau_{lt} \equiv z_l f(k_t) - R_{lt} k_t$, we can reformulate the intermediary's optimum problem exactly as (P1).

B Proofs.

Proof of Proposition 2. We start by showing that transfers are linear in production. Observe first that (16) and (19) lead to

$$n_{it} = A_i \frac{N_t}{1 - N_t} \quad \text{for } i = h, l$$

where

$$\begin{aligned} A_h &\equiv \frac{\mathbf{I}}{\rho + (1 - \rho)} \frac{\mathbf{v}}{z_l} \mathbf{e}_{1/(1-\gamma)} \mathbf{P}_{-1} \\ A_l &\equiv \frac{\mathbf{v}}{z_h} \mathbf{e}_{1/(1-\gamma)} A_h. \end{aligned}$$

We now conjecture that

$$\tau_{it} = g_i \hat{y}_t \quad \text{for } i = h, l \quad (24)$$

where

$$\hat{y}_t \equiv k_t^\alpha \frac{\mathbf{v}}{1 - N_t} \mathbf{e}_\gamma$$

for a pair of constants g_i for $i = h, l$. We verify this conjecture by checking that these two variables indeed depend only on parameters. Under the current conjecture

$$\omega \equiv \frac{u'(c_{ht}) - u'(c_{lt})}{\rho u'(c_{ht}) + (1 - \rho) u'(c_{lt})} = \frac{u'(g_h) - u'(g_l)}{\rho u'(g_h) + (1 - \rho) u'(g_l)}$$

and hence ω turns out to be a constant. The optimal contract is then completely described by the tangency condition (13) where

$$\begin{aligned} \frac{d\bar{\tau}_t}{dk_t} \Big|_{\mathbf{C}} &= \alpha \frac{\mathbf{c}}{\rho z_h A_h^\gamma} + (1 - \rho) z_l A_l^\gamma \frac{\mathbf{g}}{k_t} \hat{y}_t - (r_t + \delta) \\ \frac{d\bar{\tau}_t}{dk_t} \Big|_{\mathbf{V}} &= -\rho(1 - \rho) \xi \Delta \omega \frac{\alpha}{1 - \gamma} A_l^\gamma \frac{\hat{y}_t}{k_t} \end{aligned}$$

and by the zero-profit condition

$$\bar{\tau}_t = (1 - \gamma) \frac{\mathbf{c}}{\rho z_h A_h^\gamma} + (1 - \rho) z_l A_l^\gamma \hat{y}_t - (r_t + \delta) k_t$$

together with the definition of transfers

$$g_h \hat{y}_t = \bar{\tau}_t + (1 - \rho) \Delta \xi A_l^\gamma \hat{y}_t \quad (25)$$

$$g_l \hat{y}_t = \bar{\tau}_t - \rho \Delta \xi A_l^\gamma \hat{y}_t. \quad (26)$$

Once ω , $\bar{\tau}_t$ and $r_t + \delta$ are substituted in, the system of equations defined by (25) and (26) determines g_h and g_l as a function of parameters only. This verifies our conjecture. Since wages can be written as

$$w_t = \gamma z_t A_t^{\gamma-1} \hat{y}_t \frac{1 - N_t}{N_t}$$

the result that $N_t = N$ for all t is a direct consequence of (20) and (24). ■

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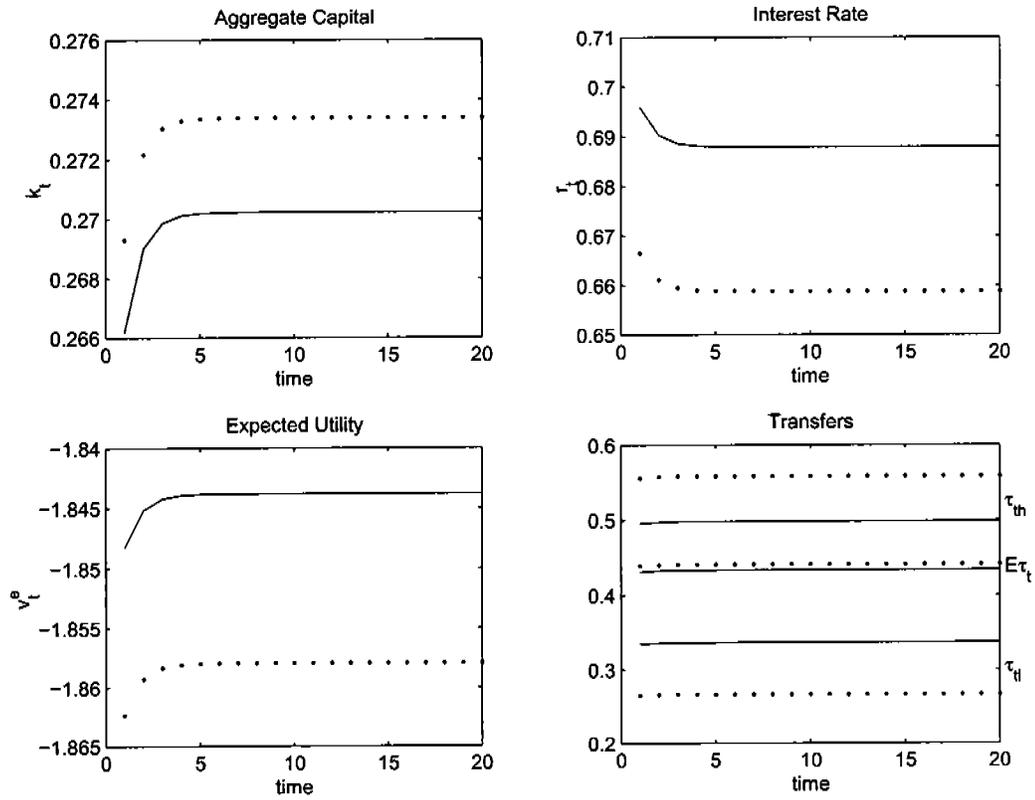


Figure 12: Baseline model (Dotted line = higher ξ).

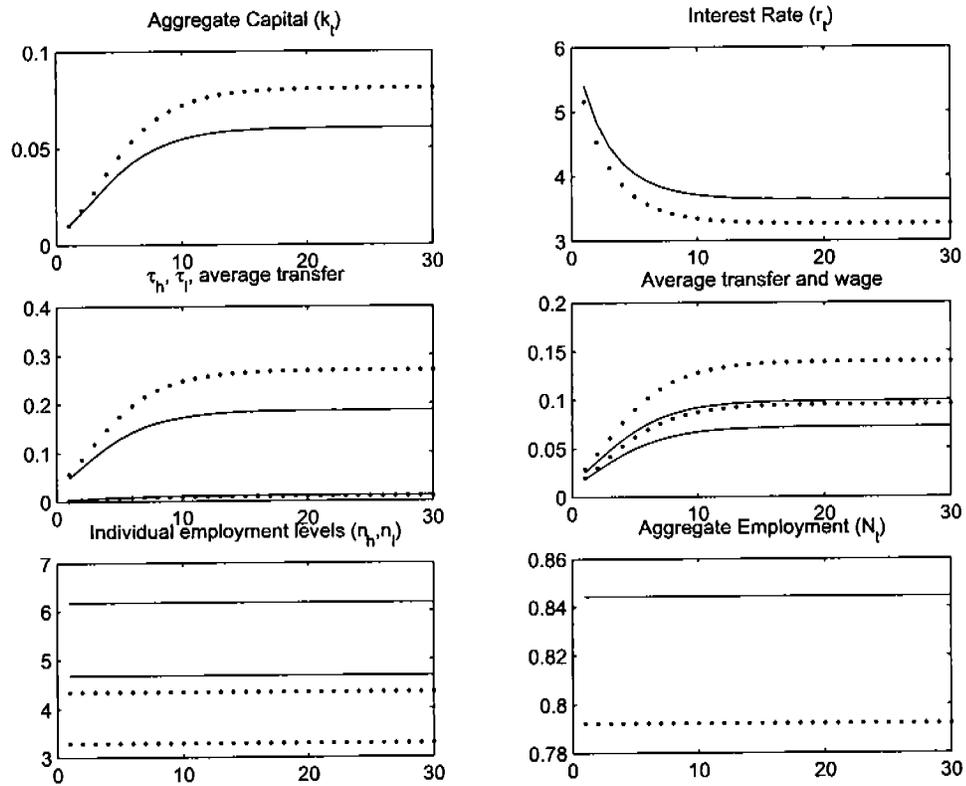


Figure 13: Model with occupational choice (Dotted line = higher ξ)