Financial intermediaries, markets, and growth

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October 2004

Abstract

We build a model in which financial intermediaries provide insurance to households against a liquidity shock. Households can also invest directly on a financial market if they pay a cost. In equilibrium, the ability of intermediaries to share risk is constrained by the market. This can be beneficial because intermediaries invest less in the productive technology when they provide more risk-sharing. Our model predicts that bank-oriented economies should grow slower than more market-oriented economies, which is consistent with some recent empirical evidence. We show that the mix of intermediaries

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and market that maximizes welfare under a given level of financial development depends on economic fundamentals. We also show the optimal mix of two structurally very similar economies can be very different.

Keywords: Financial intermediaries; Financial markets; Risk-sharing; Growth
JEL classification: E44; G10; G20

1 Introduction

An important question related to both growth and finance theory is whether the financial system influences growth in the long-run. We build a model in which financial markets reduce the amount of risk-sharing financial intermediaries can provide but promote investment in a productive technology. Hence, in our model, market-oriented financial systems yield more growth, but provide less risk-sharing than bank-oriented system. Which system provides the highest welfare is ambiguous.

We build on a model by Fecht (forthcoming) in which banks play two different roles: First, as in Diamond and Dybvig (1983), they provide insurance to consumers against preference shocks. Second, as in Diamond and Rajan (2000, 2001), the refinancing from numerous small depositors enables banks - in contrast to other financial institutions - to credibly commit not to renegotiate on the repayment obligations on deposits, because this would immediately trigger a run. While banks can efficiently monitor projects, households have to pay a cost to do so and become a sophisticated investor. As shown in Fecht (forthcoming), a trade-off arises between the ability for the bank to provide risk-sharing and the number of sophisticated depositors. We embed the static model into a dynamic overlapping generations structure, as in Ennis and Keister (2003). In this context a trade-off between the amount of risk-sharing provided by banks and growth arises. An increase in risk-sharing implies less investment in productive assets and less growth, because a higher degree of risk-sharing goes along with larger liquidity holdings in any point in time.

While we believe that this trade-off is important, it should be noted that our model focuses on the liability-side of banks. Thus, because some activities on the asset-side of banks may promote growth, our results could overstate the growth reducing impact of bank-oriented system.[1] Empirical evidence provided by Beck and Levine (2002) and Levine (2002) suggests that a more developed financial system promotes growth. However, they fail to find any evidence that the composition of the financial system, whether it is bank- or market-based, under a given level of financial development influences growth. More recently however, Ergungor (2003) shows that, when the flexibility of the legal system is taken into account, empirical evidence suggests that market-based financial systems promote growth in countries with flexible legal systems compared to bank-based systems.[2] The reason is that activities on the asset-side of banks have less of a growth-enhancing role in countries with flexible legal systems then in countries with inflexible legal systems. Hence, it is not surprising that the growth-reducing effect of bank-oriented system that our paper describes should be more apparent in countries with flexible legal systems.

There is a large literature on the nexus between financial systems and economic growth. See Levine (1997) for a review. However, most of this literature is concerned with the effect of financial development on the efficiency of investments; i.e., on capital productivity. Only a limited number of papers deal with the impact of financial systems on households' saving decisions–the portfolio choice between liquidity holdings and long-term investments–and their effect on economic growth. For instance, Jappelli and Pagano (1994) show that financial market *imperfections* may increase the savings rate and thus growth by limiting households' ability to smooth consumption over the

[1] Chakraborty and Ray (2003) emphasize the asset-side of banks.

[2] Countries with flexible legal systems and market-oriented financial systems include the US and the UK. Those with bank-oriented financial system include Belgium, Finland, and Norway. The extent to which the financial system is bank-oriented in these countries is comparable to Germany. Denmark and the Netherland are slightly less bank-oriented.

life cycle. Thus their findings are closely related to our results. But in our model an increasing efficiency of financial markets restrains banks in providing efficient risk-sharing and thereby increases long-term investment and growth. Levine (1991) studies the effect that the existence of a financial market has on growth in a Diamond-Dybvig setup. He shows that - compared to a situation in which households are autarkic - the possibility to sell long-term financial claims in the case of liquidity needs increases households willingness to invest in these claims ex-ante, increasing investment and growth. Similarly, Bencivenga and Smith (1991) argue that the introduction of a bank in such an economy has an analogous effect on investment and growth. But these papers do not compare the degree of liquidity insurance provided by the market with those provided by the bank. Neither do they consider the interaction of markets and intermediaries. In our paper, in contrast, we focus on the interaction between financial markets and intermediaries. Intermediaries are shown to promote risk-sharing at the cost of growth, while markets have the opposite effect. Thus we derive the optimal mix of banks and markets.

Our paper is also related to those models that are concerned with the optimal degree of bank-dominance at different levels of economic development. Some such papers argue that developing countries have more bank-oriented financial systems and that, in the process of development, a gradual evolution toward a more market-oriented system occurs. The importance of banks in developing countries can be explained by informational asymmetries. A high fixed cost of setting up a well functioning financial market can help explain the evolution towards a more market-oriented system over time. For example, Greenwood and Jovanovic (1990) study a model in which growth spurs the development of financial intermediaries who, in turn, enhance growth. See also Rajan and Zingales (1998, 2001). We provide numerical examples that suggest our model can account for the transition from a bank-oriented system to a market-oriented system. Hence, our paper suggests a different story based on an endogenous trade-off between risk-sharing and growth.

Our paper is also related to a literature which compares the performance of markets and intermediaries (see, for example, Antinolfi and Kawamura 2003, Bhattacharya and Padilla 1996, Chakraborty and Ray 2003, Fulghieri and Rovelli 1998, or Qian, John, and John 2004). The work which is perhaps closest in spirit to our paper is that by Allen and Gale (1997). These authors consider an environment in which a financial intermediary can provide risk-sharing to overlapping generations of households. However, a financial market constrains the ability of intermediaries to provide this risk-sharing. They show that a system with an intermediary and no market can provide a Pareto improvement compared to a system in which the market is active.

Our model differs from theirs in several respects. For example, we do not consider intergenerational risk-sharing of shocks to the return of the production technology. Our model considers a liquidity shock like that in Diamond and Dybvig (1983). Despite these differences, our results are very close to theirs, at least in our static environment. In both their model and ours a bank-oriented system is preferred because it allows more risk-sharing. Further, the extent to which banks can provide risk-sharing is limited by the financial market. However, different conclusions arise when we account for the trade-off between risk-sharing and growth in our dynamic model. Allen and Gale (1997) are unable to study the impact of risk-sharing on growth because their results depend on the assumption that the productive asset is in fixed supply. In contrast, our setup naturally extends to a dynamic case.

This is related to another contribution of our paper. Many models of financial intermediation have the property that markets constrain the amount of risk-sharing intermediaries can offer. This was pointed out by Jacklin (1987) about the Diamond and Dybvig (1983) model. It is also the case in Allen and Gale (1997) and particularly in Diamond (1997). In these models financial markets lower social welfare because they prevent intermediaries from providing as much risk-sharing as they could. Since markets are assumed to provide no alternative benefit, there is no trade-off. In this paper, in contrast, a meaningful trade-off occurs since markets promote growth. Hence markets no longer necessarily reduce welfare.[3]

The remainder of the paper proceeds as follows: Section 2 describes the static environment. Section 3 embeds the static model of section 2 in an OLG framework and describes our main results. Section 4 concludes.

2 Static environment

The environment described in this section is similar to the one in Fecht (forthcoming). The economy takes place at three dates, $t = 0, 1, 2$, and is populated by a mass 1 of households, a large number of banks, and a large number of entrepreneurs. There is a unique good in the economy and, at date 0, households are endowed with 1 unit of this good.

Households learn at date $t = 1$ if they are impatient (with probability q) or patient (with probability $1-q$). In the former case they only derive utility

[3]Although we focus on growth in this paper, it might be the case that financial markets provide other benefits that can be traded off against the constraint they impose on intermediaries. For example, markets offer a more diverse set of investment opportunities. Hence, maybe our model should be considered as illustrative of a more fundamental point. Markets and intermediaries provide different benefits and the optimal mix of those benefits might depend on parameters of the economy considered. Moreover, as we show in Figure 5, it might be the case that two very different combinations of markets and intermediaries provide the same welfare.

from consumption at date 1, and in the later case they only derive utility from consumption at date 2. Expected utility can be written

$$U(c_1, c_2) = qu(c_1) + (1 - q)u(c_2).$$

The function u exhibits CRRA: $u(c) = \frac{c^{1-\alpha}}{1-\alpha}$, with $\alpha > 1$. Whether a household is patient or impatient is private information.

There are two production technologies in the economy: A storage technology, which returns 1 unit of the good at date $t+1$ for each unit invested at date t, $t = 0, 1$, and a productive technology. Both technologies are available to everyone. The productive technology is operated costlessly by entrepreneurs who are not endowed with any goods. Entrepreneurs decide at date 1 either to "behave," in which case the technology has a return of R at date 2 for each unit invested at date 0, or to "shirk," in which case the date 2 return is only γR, with $R > 1 > \gamma R > 0$.

Competition leads entrepreneurs to promise a repayment of R at date 2 for each unit invested at date 0. At date 1 a secondary market is open on which claims to the return on the productive technology can be exchanged for goods. In equilibrium, banks will supply on this market the claims demanded by sophisticated households. At date 2, entrepreneurs pay out the actual return of the project to the holder of the financial claim.

Households can either become sophisticated or remain unsophisticated. Sophisticated households can monitor entrepreneurs perfectly and are able to replace a misbehaving entrepreneur without foregoing any of the expected return of the project. Thus, these households can guarantee themselves a return of R at date 2 if they lend to entrepreneurs. Unsophisticated households are unable to monitor entrepreneurs. Entrepreneurs financed by such households will always shirk and their projects will return only γR at date 2. Households choose whether or not to become sophisticated at date 0. To become sophisticated, a household must pay a utility cost proportional to its expected utility, $(\chi - 1)\left[qu(c_1) + (1-q)u(c_2)\right]$, where $\chi \geq 1$.[4]

There are several ways to think of this cost. It could represent the cost of learning to become a financial analyst or of getting an MBA. Alternatively, it could be the effort spent in order to monitor entrepreneurs. In either case, the cost could be measured in terms of utility, resources, or both. The size of χ could be affected by the development of financial markets, or the extent to which financial instruments are standardized, among other things. We consider the cost χ as exogenously determined but discuss, in the conclusion, some policy implications of our model in the case government policies can influence χ.

Alternatively, households can deposit their endowment in a bank rather than investing directly in the market. Banks invest the deposits they have received in storage or in financial claims on the productive technology. They can also trade in the secondary financial market at date 1. Banks can monitor entrepreneurs costlessly and thus guarantee a return of R for the projects they have invested in.[5] Further, as in Diamond and Rajan (2001), banks can credibly commit to pay this return to a third party by setting up a deposit contract. Such a contract exposes banks to runs if they attempt to renegotiate the repayments they have promised depositors.[6] Thus, one role of banks in this environment is to intermediate investment for unsophisticated households and thus allow them to indirectly invest in the productive technology,

[4] Assuming a proportional cost simplifies the analysis when we study a dynamic economy. However, we expect our results to hold for more general specifications of the cost. Our results hold also for a proportional resource cost as we show below.

[5] Our results do not depend on the assumption that the return banks receive from investing in the long-term technology is the same as the return sophisticated households get for such investment. We assume these return are equal to simplify the exposition.

[6] See Diamond and Rajan (2000) for a more complete exposition of this argument.

as in Diamond and Rajan (2000, 2001). Additionally, in this setup banks can provide liquidity insurance to depositors who do not know whether they will be patient or impatient, as in Diamond and Dybvig (1983). However, if they do so the fragility of deposit financing that enables banks to efficiently intermediate investment for unsophisticated households brings about the existence of a second equilibrium. In this run equilibrium all depositors withdraw their deposits simply because they expect that other depositors will do the same and the bank will therefore run out of funds. In this paper we focus on the good equilibrium and do not consider bank runs.[7]

2.1 Equilibrium allocation

In this section we derive the deposit contract offered by banks. At the beginning of date 0, banks choose the deposit contract they offer households and households decide whether or not to become sophisticated simultaneously.[8] Let d_1 denote the payment banks promise depositors who withdraw at date 1, and d_2 denote the payment banks promise depositors who withdraw at date 2. If banks provide any insurance against the liquidity shock, then $R > d_2 \geq d_1 > 1$. Fecht (forthcoming) shows arbitrage pins the price of claims on the productive technology in the secondary market at 1 and competitive banks will supply the claims demanded by sophisticated depositors.[9]

[7] The effect of bank runs on growth is studied in Ennis and Keister (2003).

[8] If banks are allowed to move first, they can offer a contract under which no household has an incentive to become sophisticated. Our results also hold in this case, as the cost of becoming sophisticated still influences the contract offered by banks, but then the secondary market is inactive.

[9] If the price of claims is smaller than 1, then banks invest only in the storage technology in order to make a profit when they buy claims on the secondary market. The supply of such claims would thus be zero, implying this cannot be an equilibrium. If the price of claims is greater than 1, then banks invest only in the productive technology in order to

Consequently, all households strictly prefer to deposit their endowment in a bank as long as banks provide some liquidity insurance. Indeed, sophisticated depositors can withdraw d_1 at date 1 from the bank. Since $d_1 > 1$ the value of deposits at date 1 is greater than the resale value of claims on the productive technology on the secondary market open at date 1. Hence, at that date, sophisticated patient households choose to withdraw their deposits from the banks and buy claims on the productive technology in the secondary market. For unsophisticated households, depositing in a bank is the only way to benefit from the productive technology.

To summarize, at date 1, all impatient households withdraw and consume. Sophisticated patient households withdraw from the bank and invest on the secondary market since $Rd_1 \geq d_2$, with a strict inequality if banks provide some liquidity insurance. Banks are unable to prevent sophisticated households from withdrawing their deposits since a household's type is private information. Note that even though banks cannot observe if a particular depositor is sophisticated or not, they can infer, in equilibrium, the fraction of sophisticated depositors.

We can now write the problem of a competitive bank. The bank tries to maximize the utility of its unsophisticated depositors subject to a resource constraint.[10] The bank's objective function is

$$qu(d_1) + (1-q)u(d_2) \tag{1}$$

make a profit when they sell these claims on the secondary market to obtain goods for impatient depositors. The supply of goods at date 1 would thus be zero, implying this cannot be an equilibrium.

[10]Fecht (forthcoming) shows that there does not exist a separating equilibrium for this model. A bank trying to maximize the expected utility of sophisticated depositors would not be able to attract any unsophisticated depositors and hence would not be able to provide any liquidity insurance. Consequently, competition leads banks to maximize the expected utility of unsophisticated depositors.

and the resource constraint is

$$[qi + (1-i)]\, d_1 + (1-q)i\frac{d_2}{R} \leq 1, \tag{2}$$

where i denotes the fraction of unsophisticated depositors. The constraint says the bank must have enough resources to pay d_2 to a fraction $1-q$ of unsophisticated depositors at date 2 and d_1 to all sophisticated depositors as well as a fraction q of unsophisticated depositors at date 1.

Contracts that maximize (1) subject to (2) are characterized by

$$d_1 = \frac{R}{R - (R-\Theta)(1-q)i}, \tag{3}$$

$$d_2 = \frac{R\Theta}{R - (R-\Theta)(1-q)i}, \tag{4}$$

where

$$\Theta \equiv \left[\frac{1-(1-q)i}{qi}R\right]^{\frac{1}{\alpha}}. \tag{5}$$

Such a contract will be an equilibrium contract only if it satisfies two incentive constraints. First, it must be the case $\gamma R d_1 \leq d_2$, otherwise unsophisticated depositors would withdraw their deposits to buy financial claims on the secondary market. This constraint is always satisfied since we assumed $1 > \gamma R$. The second constraint, which we refer to as IC_S, is $Rd_1 \geq d_2$. This constraint guarantees that sophisticated patient households are never strictly better off by staying in the bank until date 2. When IC_S holds with equality, $\Theta = R$, and sophisticated patient depositors are indifferent between leaving their deposits in the bank and withdrawing them to invest in the secondary market. In this case, banks offer no more liquidity insurance. Define

$$\underline{i} \equiv \left[qR^{\alpha-1} + (1-q)\right]^{-1}. \tag{6}$$

IC_S binds whenever $i \leq \underline{i}$. If this happens, the contract is given by equations (3) and (4) with $\Theta = R$.

The equilibrium mass of unsophisticated depositors, i, is determined by the condition that depositors must be indifferent between becoming sophisticated or remaining unsophisticated. This condition is

$$qu(d_1) + (1-q)u(d_2) = \chi \left[qu(d_1) + (1-q)u(d_1 R) \right]. \tag{7}$$

We can use equations (3) and (4) to substitute for d_1 and d_2 in that expression. Then, using the fact that u is CRRA, we can write

$$\Theta^{1-\alpha} = \chi R^{1-\alpha} + \frac{q}{1-q}(\chi - 1). \tag{8}$$

Using the definition of Θ, we obtain the following expression for i

$$i = \left\{ (1-q) + \frac{q}{R} \left[\chi \left(R^{1-\alpha} + \frac{q}{1-q} \right) - \frac{q}{1-q} \right]^{\frac{\alpha}{1-\alpha}} \right\}^{-1}. \tag{9}$$

It can easily be seen that an increase in χ, the cost of becoming sophisticated, will lead to an increase in i, the fraction of unsophisticated depositors. As expected, $i = \underline{i}$ if there is no cost of becoming sophisticated, or $\chi = 1$. We can also find the cost above which no depositor becomes sophisticated, denoted by $\bar{\chi}$, by setting $i = 1$ in the above equation. We obtain

$$\bar{\chi} = \frac{(1-q)R^{\frac{1-\alpha}{\alpha}} + q}{(1-q)R^{1-\alpha} + q}. \tag{10}$$

If $\chi \geq \bar{\chi}$ the cost of becoming sophisticated is so high that no depositors chooses to become sophisticated.

We can derive the amount of investment in the productive technology chosen by banks and denoted by K. Part of the investment, $(1-q)i(d_2/R)$, is needed to provide consumption for unsophisticated patient depositors who withdraw at date 2. The rest, $(1-q)(1-i)d_1$ is sold to patient sophisticated depositors on the secondary market. The expression for K is thus

$$K(i) = 1 - \frac{q}{1-(1-q)i(1-\frac{\Theta}{R})}. \tag{11}$$

It is decreasing in i. In particular, $K(i = \underline{i}) = 1 - q$ and

$$K(i=1) = 1 - \frac{q}{1-(1-q)(1-R^{\frac{1-\alpha}{\alpha}})}.^{11} \tag{12}$$

The above model gives us a way to think about financial systems being more bank-based or more market-oriented. When the cost of becoming sophisticated is high, there are few such depositors (i is large) and the secondary market for financial claims is not very active. Banks are able to offer a lot of liquidity insurance but there is relatively little investment in the productive technology. Conversely, when the cost of becoming sophisticated is low, there are many such depositors (i is small) and the secondary market is very active. Banks offer little liquidity insurance, or none at all, but there is more aggregate investment in the productive technology. Hence, when comparing two economies, A and B, with a different fraction of sophisticated depositors, $i_A > i_B$, we say economy A is more bank oriented or, equivalently, economy B is more market oriented.

The model does not provide an obvious way to compare different levels of financial development. Hence, when comparing two economies, we are implicitly assuming that the level of financial development in both economies is the same. Also, banks do not play a special role in enforcing contracts in this paper.[12] Since the model does not emphasize the asset-side of banks, it is more likely to apply to countries that have a flexible legal system as defined by Ergungor (2003).

[11] Alternatively, the level of investment in the long term technology can be derived by considering what is not consumed at date 1; i.e., $K = 1 - qd_1$.

[12] See Chakraborty and Ray (2003) for a model where banks play a role in enforcing contracts.

2.2 The resource-cost case

In this setup, a young household that decides to become sophisticated at the beginning of period t will incur a $(1-C)$ percent consumption loss at the end of period t or the beginning of period $t+1$, for some $C \leq 1$.[13] In this case, equation (7) becomes

$$qu(d_1) + (1-q)u(d_2) = \left[qu(Cd_1) + (1-q)u(Cd_1R)\right]. \tag{13}$$

We can use equations (3) and (4) to substitute for d_1 and d_2. Then, since u is CRRA, we have

$$\Theta^{1-\alpha} = C^{1-\alpha}R^{1-\alpha} + \frac{q}{1-q}(C^{1-\alpha}-1). \tag{14}$$

Using the definition of Θ, we obtain the following expression for i

$$i = \left\{(1-q) + \frac{q}{R}\left[C^{1-\alpha}R^{1-\alpha} + \frac{q}{1-q}(C^{1-\alpha}-1)\right]^{\frac{\alpha}{1-\alpha}}\right\}^{-1}. \tag{15}$$

The remainder of the analysis is similar.

2.3 Comparison with a planner's allocation

It is interesting to compare the equilibrium allocation with the allocation chosen by a planner endowed with the technologies described above. The planner's problem is

$$\max_{c_1,c_2} \quad qu(c_1) + (1-q)u(c_2)$$

subject to

$$qc_1 + (1-q)\frac{c_2}{R} \leq 1. \tag{16}$$

[13]We implicitly assume that, at date 0, when households decide to become sophisticated or not, they are able to commit to paying the resource cost when they receive d_1 from the bank.

The planner's allocation, denoted $\{c_1^*, c_2^*\}$, is given by

$$c_1^* = \frac{1}{1-(1-R^{\frac{1-\alpha}{\alpha}})(1-q)}, \tag{17}$$

$$c_2^* = \frac{R^{\frac{1}{\alpha}}}{1-(1-R^{\frac{1-\alpha}{\alpha}})(1-q)}, \tag{18}$$

It is straightforward to see the equilibrium allocation of an economy with $i = 1$ corresponds to the planner's allocation. This occurs if the cost of becoming sophisticated is sufficiently high. In this static model, because capital accumulation does not matter, the expected utility of households is always (weakly) decreasing as the cost of becoming sophisticated decreases. Hence, welfare is higher when banks are able to provide more risk-sharing between patient and impatient depositors and the financial market is small. We can summarize the results established in this section in the following proposition.

Proposition 1 *In this economy:*
1) The fraction of unsophisticated depositors increases as the cost of becoming sophisticated increases
2) Investment in the long-term technology decreases and risk-sharing increases as the fraction of unsophisticated depositors increase.
3) The planner's allocation is obtained when all households are unsophisticated.

Allen and Gale (1997) study an environment in which the market constrains how much risk-sharing financial intermediaries can provide. In that model, they show that having intermediaries and no financial markets is preferable to a financial market and no intermediaries. As in our static model, the intuition for their result is that more risk sharing is provided in the former case than in the latter.

A key feature of the model in Allen and Gale (1997) is that the productive asset is in fixed supply. Hence it is difficult to extend that environment to include growth. In contrast, it is straightforward to adapt our setup to a dynamic environment. The next section shows there is a real trade-off between risk-sharing and growth in a dynamic environment. Hence, the result that bank-based financial systems are always better is overturned in that context.

3 An OLG environment with growth

In this section, we embed the static model of the previous section in a two-period OLG framework along the lines of Ennis and Keister (2003). This allows us to think about how changes in the number of sophisticated households affect capital accumulation and growth.

For reasons described in the previous section, banks maximize the expected utility of their unsophisticated depositors. Hence we could either assume that banks are long-lived institution or that a new set of banks emerges with each new generation.[14]

At the beginning of each period a mass 1 of two-period lived households is born. Households learn if they are patient or impatient at the end of the first period of their life. Their preferences are described by the same utility function as in the previous section. Each household is endowed with 1 unit of labor when young and nothing when old. Labor is supplied inelastically.

The timing of events is as follows. Each period is divided into two subperiods: in the first subperiod (the beginning), production occurs according to

[14] As in Ennis and Keister (2003), but in contrast to Allen and Gale (1997) or Bhattacharya and Padilla (1996), there is no intergenerational risk-sharing in this model.

an endogenous growth production function, as described below, factors get paid, and young households can deposit their wage income in one of a large number of perfectly competitive banks. Banks can use deposits to purchase existing capital from old households, to invest in new capital, or to invest in storage. In the second subperiod (the end), depositors observe whether they are patient or impatient and they can withdraw their deposits from the bank. The details are presented below.

The beginning of period t: At the beginning of period t each old patient household owns K_t units of capital and young households are endowed with $L_t = 1$ units of time. Competitive entrepreneurs combine the capital and labor to produce a single consumption good Y_t using the following production function: $Y_t = \bar{K}_t^{1-\theta} {L_t}^{1-\theta} {K_t}^{\theta}$, where $\bar{K}_t$ denotes the capital stock of the economy at date t. The assumption of perfect competition in the factor markets, and the fact that labor is supplied inelastically, implies the equilibrium real wage and real capital rental rate in units of the consumption good are given by $w_t = (1-\theta)K_t$ and $r_t = \theta$, respectively.

After the production takes place, old patient households consume an amount equal to the earning from renting their capital and the net-of-depreciation value of that capital. This corresponds to $[r_t + (1-\delta)p_t^-]K_t$ units of consumption good, where p_t^- denotes the price of capital in units of the consumption good in the beginning-of-period capital market. Note, in order for old patient households to be willing to rent their capital to firms before selling to the banks, it must be that $r_t \geq \delta p_t^-$. We show below this condition always holds under our parameter restrictions.

Each young household receives as wages w_t units of consumption good. These households deposit their wage income in a perfectly competitive bank and enter a deposit contract (d_{1t}, d_{2t}) before they find out whether they are patient or impatient.[15] The bank uses part of the deposits to purchase the existing capital $(1-\delta)K_t$, at the price p_t^-, from old households and divides the rest of the deposits between storage and investment in new capital. One unit of consumption placed in storage at the beginning of period t yields one unit of consumption at the end of the same period while one unit of consumption invested in the productive technology at the beginning of period t yields $R > 1$ units of capital at the beginning of period $t+1$. Note, the assumption that only banks engage in purchasing existing capital, investing in new capital, and putting goods in storage at the beginning of the period is innocuous. We impose parameter restrictions so the market for existing capital always clears.

As in the static model, young households decide whether or not to become sophisticated at the same time banks offer the deposit contract (d_{1t}, d_{2t}). Also, entrepreneurs who produce capital using the long-term technology must be monitored if they are not to shirk. We maintain the assumptions of the previous section concerning monitoring. In particular, a young household that decides to become sophisticated must exert some effort and incur a cost of $(\chi - 1)$ percent of lifetime utility, for some $\chi \geq 1$. We consider the case of a proportional resource cost below.

The end of period t: Each young depositor realizes whether she is patient or impatient. Impatient depositors only value consumption in this subperiod when they are young while patient depositors only value consumption in the first subperiod of $t+1$ when they become old. The nature of the deposit contract is such that a depositor who claims to be impatient gets paid d_{1t} in this subperiod, while a depositor who claims to be patient will get paid d_{2t} in the first subperiod of $t+1$. As will be shown, the deposit

[15]It can be shown that it is optimal for household to deposit all of their income in banks.

contract offered by banks induces sophisticated patient depositors to misrepresent themselves as being impatient. Depositors can purchase capital from the banks at a price p_t^+. As was the case in the static model, banks are unable to prevent patient sophisticated depositors from withdrawing because being sophisticated is private information. Further, competition leads banks to supply the financial claims needed to meet the demand from sophisticated households.

Using an arbitrage argument similar to the one presented in footnote 9, it can be shown that the price of existing capital in the first subperiod (primary) capital market under which the banks will be indifferent between purchasing existing capital and investing in new capital is given by

$$p_t^- = R^{-1}, \quad \forall t. \tag{19}$$

Our parameter restrictions to be specified below will ensure that this is the only equilibrium price for the existing capital in the primary market.

For convenience, we introduce the following notation:

$$X \equiv R[r_t + (1-\delta)p_t^-] = R[\theta + (1-\delta)R^{-1}] = R\theta + 1 - \delta. \tag{20}$$

In words, X is the return on capital in each period. One unit of capital at the beginning of a period can be rented to earn r_t. The undepreciated capital can then be sold to banks at the price p_t^-. The proceeds from renting and then selling the capital can then be invested in the long-term technology to produce new capital next period. We choose our parameters such that $X > 1$ and $\gamma X < 1$. Note, $X > 1$ implies $r_t \geq \delta p_t^-$, the condition for old households to strictly prefer renting their capital to firms before selling it to banks.

Given the availability of the storage technology, the equilibrium price of capital in the second subperiod (secondary) capital market must satisfy

$$p_t^+ = R^{-1}, \quad \forall t. \tag{21}$$

With this setup the optimal contract is essentially the same as in the previous section with X replacing R in the expressions below. We have, taking i_t as given, the following problem

$$\begin{aligned}
\max_{d_{1t},d_{2t}} \quad & [qu(d_{1t}) + (1-q)u(d_{2t})] \\
\text{s.t.} \quad & [qi_t + (1-i_t)]d_{1t} + (1-q)i_t \frac{d_{2t}}{X} \leq w_t \qquad (BC) \\
& \max\{1; X\} d_{1t} \geq d_{2t} \qquad (IC_S) \\
& \max\{1; \gamma X\} d_{1t} \leq d_{2t} \qquad (IC_U)
\end{aligned}$$

The definitions of Θ_t and $\underline{i}$ also are very similar.

$$\Theta_t \equiv \left[\frac{1-(1-q)i_t}{qi_t} X\right]^{\frac{1}{\alpha}}, \tag{22}$$

$$\underline{i} \equiv [qX^{\alpha-1} + (1-q)]^{-1}. \tag{23}$$

Solving the maximization problem subject to the (BC) only yields:

$$d_{1t} = \frac{X(1-\theta)K_t}{X-(X-\Theta_t)(1-q)i_t}, \tag{24}$$

$$d_{2t} = \frac{X\Theta_t(1-\theta)K_t}{X-(X-\Theta_t)(1-q)i_t}. \tag{25}$$

Taking the deposit contract as given, i_t is determined by

$$qu(d_{1t}) + (1-q)u(d_{2t}) = \chi[qu(d_{1t}) + (1-q)u(d_{1t}X)]. \tag{26}$$

The expression for $\bar{\chi}$ is now

$$\bar{\chi} = \frac{(1-q)X^{\frac{1-\alpha}{\alpha}} + q}{(1-q)X^{1-\alpha} + q}. \tag{27}$$

We consider $\chi \in [1, \bar{\chi}]$, which guarantees the endogenously determined $i_t \in [\underline{i}, 1]$. To see this, substituting (24) and (25) into (26) to obtain

$$i_t = \frac{X}{(1-q)X + qA}, \tag{28}$$

where A is given by

$$A \equiv \left[\frac{q(\chi-1)+\chi(1-q)X^{1-\alpha}}{1-q}\right]^{\frac{\alpha}{1-\alpha}}. \tag{29}$$

For the remainder of the paper we drop the indexes for i_t and Θ_t since they are time invariant.

We focus on a symmetric equilibrium in which each bank holds the same portfolio. The law of motion for capital is given by

$$\begin{aligned} K_{t+1} &= (1-q)(1-i)\frac{d_{1t}}{p_t^+} + (1-q)i\frac{d_{2t}}{X}R \\ &= \frac{X-(X-\Theta)i}{X-(X-\Theta)(1-q)i}R(1-q)(1-\theta)K_t \\ &= \frac{\Theta-qX+qA}{(1-q)\Theta+qA}R(1-q)(1-\theta)K_t. \end{aligned} \tag{30}$$

It can be verified that the growth rate of the capital stock, defined by

$$\rho = \frac{\Theta-qX+qA}{(1-q)\Theta+qA}R(1-q)(1-\theta), \tag{31}$$

is strictly decreasing in χ. Intuitively, a larger cost to becoming sophisticated results in less sophisticated households participating in the capital market. There is less investment in the productive technology and thus a smaller growth rate.[16] We can summarize this result in the following proposition.

[16] The growth rate is greater than or equal to $1-\delta$ (implying that markets for existing capital clear) for all $\chi \in [1, \bar{\chi}]$ if and only if

$$\frac{R(1-q)(1-\theta)}{1-\delta} \geq (1-q) + qX^{\frac{\alpha-1}{\alpha}}. \tag{32}$$

The necessary and sufficient condition for actual growth, that is, for the growth rate to be greater than or equal to 1 (implying net investment is larger than or equal to replacement capital), for all $\chi \in [1, \bar{\chi}]$ is that

$$R(1-q)(1-\theta) \geq (1-q) + qX^{\frac{\alpha-1}{\alpha}}. \tag{33}$$

Proposition 2 *Economies with a more market-oriented financial system (economies with a small fraction of unsophisticated depositors) grow faster than economies with a more bank-oriented financial system.*

This result is consistent with the empirical evidence found by Ergungor (2003) for countries with flexible legal systems. Our model is more likely to apply to such countries since, in our model, banks do not have an advantage over markets in enforcing contracts.[17] Examples of countries with flexible legal systems and market-oriented financial systems are the US and the UK. Germany is a typical example of a country with a bank-oriented financial system, but Germany does not have a flexible legal system. Examples of countries with a flexible legal system and bank-oriented financial systems comparable to Germany are Belgium, Finland, and Norway.

Our model also predicts that economies with a market-oriented financial system offer less risk-sharing than economies with a more bank-oriented financial system. While it is difficult to measure directly the amount of risk-sharing offered by various systems, one can think of indirect ways to evaluate how much risk sharing is desired in a country. The tax system in the US is usually believed to be relatively less redistributive than the tax system in Norway. This might indicate a greater desire for risk-sharing in Norway compared to the US, which would be consistent with our model.

3.1 Welfare analysis

While we have established that a market-oriented financial system promotes growth in our model economy, there is no guarantee that such a system also

[17] This does not mean that the trade-off we describe in the paper would not apply to countries with inflexible legal systems. However, growth-enhancing activities on the asset-side of banks could make the effect more difficult to observe in the data in such countries.

improves welfare. Indeed, the increase in growth comes at a cost in terms of risk sharing. In this section we consider the mix of banks and markets which provide the highest welfare.

Let $\beta \in (0,1)$ denote the social discount factor. Social welfare is equal to

$$W = \sum_{t=1}^{\infty} \beta^t [qu(d_{1t}) + (1-q)u(d_{2t})] \tag{34}$$

plus the utility of the initial old households given by $u([\theta + R^{-1}(1-\delta)]K_0)$, which will not affect our following analysis and thus will be omitted below.[18] Note,

$$d_{1t} = G\rho^t, \tag{35}$$

$$d_{2t} = \Theta G\rho^t, \tag{36}$$

where

$$G \equiv \frac{X(1-\theta)K_0}{X - (X-\Theta)(1-q)i}. \tag{37}$$

The expression for G is very similar to the expression for d_{1t}, with K_0 taking the place of K_t. Hence, G is related to the amount of investment in the storage technology. The direct effect of an increase in G is to increase consumption, and thus welfare, but such an increase could reduce growth and thus, indirectly, welfare. We call G the level effect. An increase in ρ, the growth effect, increases welfare directly. Clearly, Θ corresponds to the risk-sharing effect. An increase in the value of Θ means a reduction in risk-sharing. The direct effect of this is to reduce welfare since, from equation (36), this reduces d_{2t}. However, an increase in risk-sharing also has indirect

[18]Note that because of equation (26) the expected utility of sophisticated depositors is the same, in equilibrium, to the expected utility of unsophisticated depositors. This is why we can consider only the expected utility of unsophisticated depositors in our objective function.

effects on the repayments on deposits by affecting G and ρ. From equation (37) it is obvious that an increase in the risk-sharing improves the level of repayments on deposits. At the same time it reduces the growth rate as can be seen from equation (31). Note, these three effects, G, Θ, and ρ, are functions of deeper parameters that ultimately determine d_{1t} and d_{2t}.

It is easy to derive the following relations:

$$\rho'(\chi) < 0, \quad \Theta'(\chi) < 0, \quad G'(\chi) > 0, \quad i'(\chi) > 0. \tag{38}$$

While a larger cost to becoming sophisticated–i.e., a larger χ–tends to reduce both d_{1t} and d_{2t} through slowing growth, it tends to increase both d_{1t} and d_{2t} through increasing G. There is thus a tradeoff between the level of consumption households enjoy and the growth rate of the capital stock. An economy can start with a high level of consumption and grow relatively slowly or, instead, start at a lower level of consumption and grow faster. A larger cost also leads to more risk-sharing and more liquidity-insurance and, thus, tends to reduce d_{2t} through decreasing Θ. In this dynamic environment, there is a trade-off between growth and risk-sharing. Increasing one must decrease the other.

We are interested in the effect of a change in the cost χ on welfare and the effects we just described imply that a change in χ may have conflicting effect on social welfare. A given value for χ results in a given mix of markets and banks and we are interested to know which χ corresponds to an optimal structure in the sense that the resulting balance between growth and risk-sharing maximizes the social welfare.

Assuming $\beta < \rho^{\alpha-1}$, we can solve for the social welfare as

$$W = \frac{\beta}{1-\alpha} \frac{G^{1-\alpha}[q + (1-q)\Theta^{1-\alpha}]}{\rho^{\alpha-1} - \beta}. \tag{39}$$

As expected, welfare increases with G, the level effect, and with ρ, the growth effect (recall $\alpha > 1$). An increase in Θ, corresponding to a decrease in risk-sharing, affects welfare positively. To understand this seemingly counterintuitive result it is important to remember that G and ρ, are functions Θ. A decrease in Θ can be consistent with an increase in welfare due to the indirect impact of Θ on G and ρ.

We want to find the value of χ that maximizes W. Such an optimum exists since W is a continuous function on the compact domain of the cost. It is also clear that such an "optimal" cost is a function of $q, X, \theta, \delta, \alpha$, and β, but is independent of the initial capital K_0. An immediate implication is that everything else equal, a country's optimal bank-market mix is independent of its initial wealth.[19]

Given the complexity of the expression for welfare, W, as a function of χ–through equations (39) and the dependence of G, ρ, Θ, and i on χ–it is difficult to obtain analytical results for the value of χ that maximizes this expression. Therefore we look at some numerical simulations to get an idea of the trade-offs between risk-sharing and growth involved here in enhancing welfare. We assume that a period in the model corresponds to approximately 30 years. Parameters for the production function are standard from the macro literature: we choose $\theta = 0.33$ and $\delta = 0.96$. The latter corresponds roughly to a 10 percent annual capital depreciation rate over 30 years. The model imposes $r = \theta$. We also choose $R = 10$, which corresponds to a value of $X = 3.34$. This yields an annual return of capital of about 4.1 percent. Note, the inequality $rR > \delta$ is satisfied as it needs to be. Our baseline for preference parameters is $\alpha = 3$, $q = 0.2$, and $\beta = 0.55$. We did extensive

[19]Although this result may seem counterintuitive, it should be kept in mind that, by assumption, the development of the financial system is held equal in all comparisons. In actual economies one might expect the development of a country's financial system to be correlated with that county's wealth.

robustness checks over the parameter space and find that our results are not sensitive to our choice of parameters.[20]

Our first numerical exercise concerns the effect of risk-sharing on the optimal trade-off between financial intermediaries and the market. We use the baseline parameters for all variables except for the coefficient α which we let vary. In each figure, we provide two graphs. The top graph shows the evolution of Θ, G, and ρ for different values of i. Here, i is determined endogenously as χ varies between 1 and $\bar{\chi}$.[21] The bottom graph shows the evolution of welfare for different values of i.

As can be seen in Figures 1, 2, and 3, the maximum amount of welfare is reached for a higher level of the cost χ as the value of α increases. When the coefficient of risk aversion is low ($\alpha = 2$), as in Figure 1, welfare is maximized when the cost of becoming sophisticated is zero and banks offer no risk-sharing. For a higher coefficient or risk aversion ($\alpha = 3$), as in Figure 2, the optimal cost χ belongs to the interval $(1, \bar{\chi})$. It is optimal for banks to offer some risk-sharing, but less than in the static case. Finally, for an even higher coefficient of risk aversion ($\alpha = 5$), as in Figure 3, the optimal cost is high enough that no household becomes sophisticated. In this case banks are not constrained in the amount of risk-sharing they can provide but growth is slow.

The graphs representing Θ, G, and ρ are very similar in each case. As expected, the growth effect decreases with i as there is less investment in the productive technology. An increase in i also means a decrease in Θ which corresponds to an increase in risk-sharing as the difference between d_{1t} and d_{2t} decreases. Finally, an increase in i is accompanied by an increase in the

[20] We use Matlab to compute the numerical solutions to the model. The code is available from the authors upon request.

[21] There is a bijective mapping between χ and i.

level effect G.

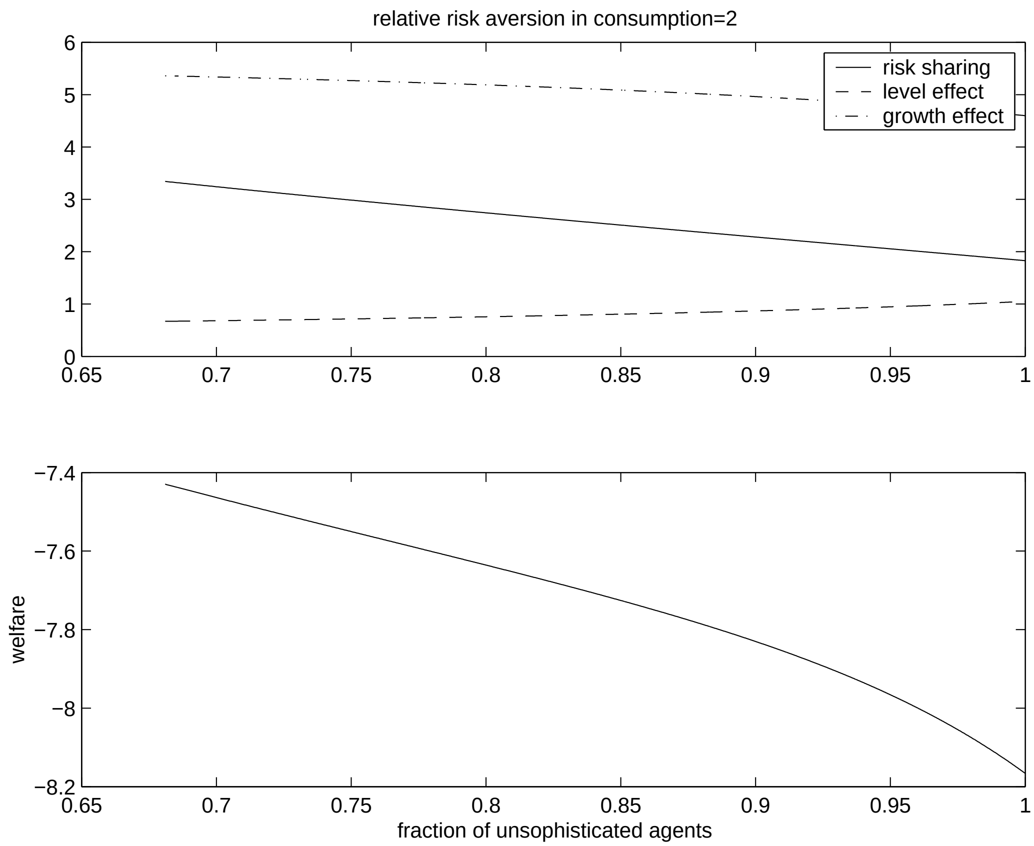

Figure 1. The case with a utility cost

By looking at the individual effects, it is possible to get an idea of how the overall welfare changes. Comparing Figures 1, 2, and 3, the main difference, for small values of i (corresponding to small values of χ), is in the risk-sharing effect. The increase in the amount of risk-sharing provided by banks, as i increases from low values, is much faster in Figure 1 than in Figure 2 and in Figure 2 than in Figure 3. Comparing the same Figures, the main differences for large values of i (corresponding to large values of χ) are in the growth and the level effect.

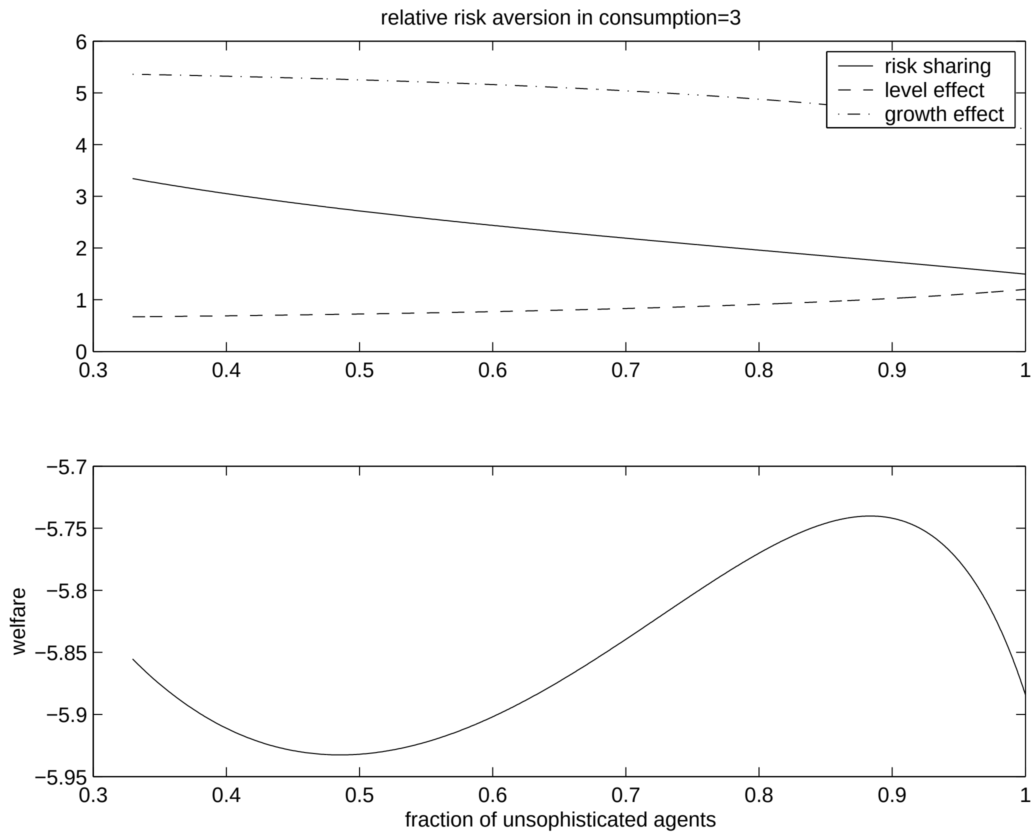

Figure 2. The case with a utility cost

This helps explain the shape of welfare as a function of i. For low values of i, an increase in the coefficient of risk aversion increases the effect on risk-sharing. This means that the effect on welfare from an increase in χ gradually changes from being negative to becoming positive. The main driving force of the changes for higher values of i is the changes in the growth and the level effect. These go in opposite direction and it is hard to see from the graphs that the growth effect becomes relatively less important as the coefficient of risk aversion increases. Nevertheless, for a high enough value of this coefficient, welfare is maximized if no household becomes sophisticated.

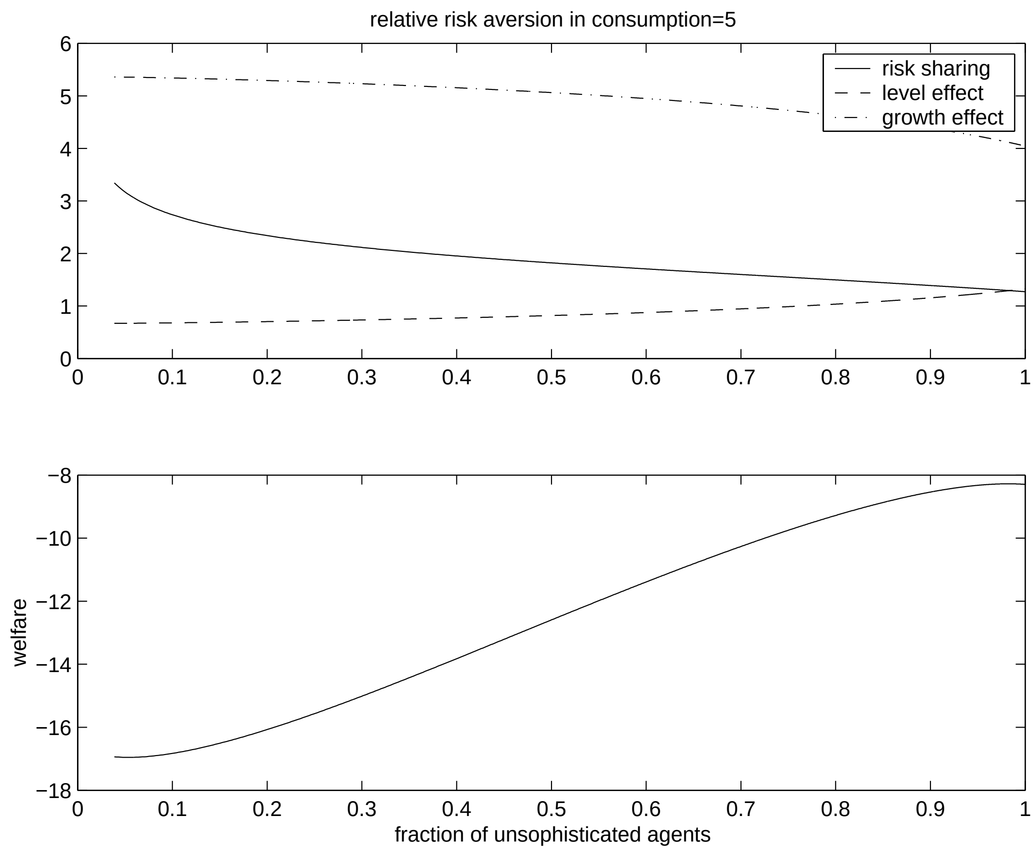

Figure 3. The case with a utility cost

To summarize the results from our numerical exercises, we can say that if two economies A and B are populated by households who have coefficients of risk aversion α_A and α_B, respectively, where $\alpha_A > \alpha_B$, then households in economy A prefer a more bank oriented system than households in economy B. As a consequence, economy A will have a lower level of capital than economy B. When α is sufficiently small, the optimal system is such that banks provide no risk-sharing. Intuitively, if consumers are not very risk-averse they do not value risk-sharing very much and an increase in risk-sharing cannot compensate for a decrease in the level of consumption that accompanies a reduction of the capital stock. Conversely, if households are sufficiently risk-averse the optimal system is such that banks are not constrained in the amount of risk-sharing they provide.

In the appendix we report the result of another experiment where we change the value of q, keeping all other parameters as in our baseline case. Figures 7, shows that if q is sufficiently small ($q = 0.1$), welfare is maximized in a bank-only system. As q increases, as in Figure 2 ($q = 0.2$), the maximum welfare is reached with a mix of banks and market, where banks play a smaller role. For higher values of q ($q = 0.3$), as in Figure 8, a market-only system maximizes welfare. This result might be due to the fact that when q is small banks provide little risk-sharing but growth is faster. Constraining banks thus provides little additional benefit. When q is larger the benefit from constraining banks increases.

We also did some experiments changing β while keeping other parameters constant. Perhaps surprisingly, changes in β have very little effect on the value of χ that maximizes social welfare. One might have thought that there would be an important trade-off between early and late generations. Indeed, the benefits from additional growth should be felt disproportionately by late generations. A change in β, by modifying the relative weight put on early and late generations can give a sense of the importance of that trade-off. Our results suggests it is of second-order importance. We do not report graphs for this experiment.

In another exercise, we change the value of R (which in turns modifies X). Here we hope to capture the idea that developing countries, because they have a low stock of capital, might offer a higher return on capital than more developed countries. Figure 9, in the appendix, shows that if R is sufficiently large, corresponding to a developing country, banks should not be constrained by markets very much. For lower values of R, as in Figure 2, the role of markets increases. As R is decreased further, as in Figure 10, it becomes optimal for banks to provide no risk-sharing. The intuition is that as R decreases, the income effect dominates the substitution effect and households want less risk-sharing.

These results are consistent with the notion that developing countries (with low capital stocks and high return on capital) should have a more bank-oriented system than more developed countries in which capital is more abundant. In the development process, as capital accumulates and the return decreases, the financial system becomes more and more market-oriented. The usual arguments given to explain this evolution depend on informational asymmetries and the high fixed cost of setting up well-functioning markets.[22] Here we propose a different way to think about this evolution which depends on the endogenous trade-off between growth and risk-sharing.

3.2 The resource-cost case

We now consider the case of a resource cost. All relations up to (25) hold as before. Taking the deposit contract as given, the equation for determining i_t is now given by

$$qu(d_{1t}) + (1-q)u(d_{2t}) = qu(Cd_{1t}) + (1-q)u(Cd_{1t}R). \qquad (40)$$

Let $\underline{C}$ denote the cost which leads to $i = 1$. Then,

$$\underline{C} = \left[\frac{(1-q)R^{-\frac{(\alpha-1)^2}{\alpha}} + qR^{\frac{\alpha-1}{\alpha}}}{(1-q) + qR^{\frac{\alpha-1}{\alpha}}} \right]^{\frac{1}{\alpha-1}}. \qquad (41)$$

[22]See, for example, Greenwood and Jovanovic (1990) or Rajan and Zingales (1998, 2001).

We consider $C \in [\underline{C}, 1]$, which guarantees the endogenously determined $i_t \in [\underline{i}, 1]$. To see this, substitute (24) and (25) into (40) to obtain

$$i_t = \frac{R}{(1-q)R + qB}, \tag{42}$$

which is constant over time, where

$$B \equiv \left[\frac{q(C^{1-\alpha} - 1) + C^{1-\alpha}(1-q)R^{1-\alpha}}{1-q}\right]^{\frac{\alpha}{1-\alpha}}. \tag{43}$$

It can then be verified that as C varies from 1 to $\underline{C}$, i_t varies from $\underline{i}$ to 1. Note that since the corresponding $\Theta_t > 1$ and $\gamma R < 1$, the solution in (24) and (25) satisfies (IC_U). The solution also satisfies (IC_S) since $R \geq \Theta_t$. Note also that since $i_t \leq 1$, we have $\Theta_t \geq R^{1/\alpha}$. We again drop the indexes for i_t and Θ_t since they are time independent.

Since B is increasing in C, i is decreasing in the cost of becoming sophisticated. In words, the smaller C, the larger the fraction of households who choose to become sophisticated.

The analysis so far is homomorphic to the case with a utility cost, with the underlying linkage $C^{1-\alpha} = \chi$. The implication for capital accumulation is, however, slightly different here. We shall again focus on a symmetric equilibrium in which each bank holds the same portfolio. The law of motion for capital is now given by

$$\begin{aligned} K_{t+1} &= (1-q)(1-i)C\frac{d_{1t}}{p_t^+} + (1-q)i\frac{d_{2t}}{R}X \\ &= \frac{CR - (CR - \Theta)i}{R - (R-\Theta)(1-q)i}X(1-q)(1-\theta)K_t \\ &= \frac{\Theta - qCR + qCB}{(1-q)\Theta + qB}X(1-q)(1-\theta)K_t. \end{aligned} \tag{44}$$

Note, unlike in the case with a utility cost there are here two opposite effects of a resource cost on the growth rate. The smaller the cost of becoming sophisticated, the more households want to become sophisticated. This tends to help investment and growth on the one hand. On the other hand, as more households become sophisticated, they use resources to pay the cost. It can be shown that the positive effect always dominates the negative effect. In consequence, the growth rate, defined by

$$\rho = \frac{\Theta - qCR + qCB}{(1-q)\Theta + qB} X(1-q)(1-\theta), \tag{45}$$

is strictly increasing in C. It is then easy to show the growth rate is greater than or equal to $1-\delta$ for all $C \in [\underline{C}, 1]$ if and only if (32) holds, and it is greater than or equal to 1 for all $C \in [\underline{C}, 1]$ if and only if (33) holds.

Thus, regardless of how the cost is modeled, a general lesson is that a smaller cost leads to more sophisticated households and a more market-oriented economy. While this results in less risk-sharing and less liquidity insurance, it promotes more economic growth. What mix of banks and markets is optimal depends on what mix of growth and risk-sharing is optimal from a welfare point of view. We turn now to examining this issue.

The expression for welfare in this case is similar to the utility-cost case. It is easy to derive the following relations.

$$\rho'(C) > 0, \quad \Theta'(C) > 0, \quad G'(C) < 0, \quad i'(C) < 0. \tag{46}$$

We run a similar set of numerical experiments for the resource-cost case as we did for the utility-cost case. We keep the same parameters for our baseline experiments. Figures 4, 5, and 6, graph welfare, as well as the three effects that determine it, for different values of the risk-aversion coefficient (in these graphs, $\alpha = 2, 3$, and 5, respectively). The graphs confirm the general story told in the utility-cost case. When risk-aversion increases , there is a shift from a market-oriented to a bank-oriented system. Interestingly, with a resource cost we are unable to find cases where the optimal cost corresponds to $i \in (\underline{i}, 1)$. In words, welfare is maximized either when banks provide no risk-sharing or when they are unconstrained in how much risk-sharing they can provide.

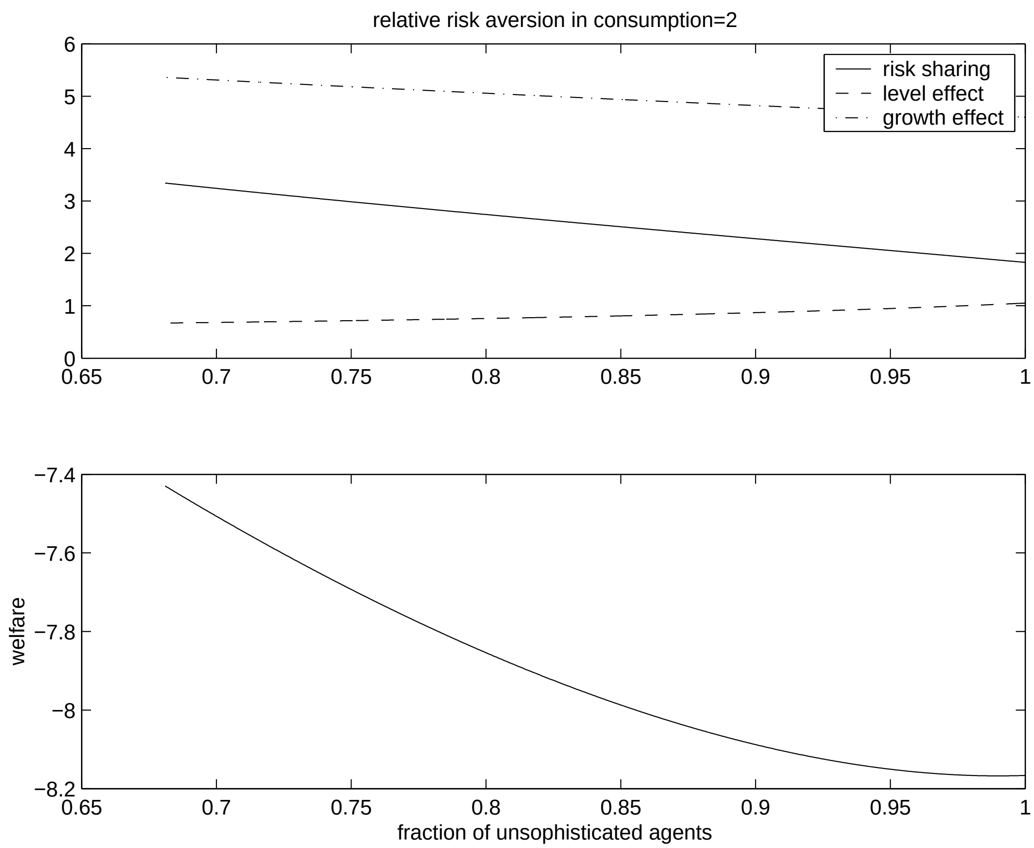

Figure 4. The case with a resource cost

As noted above, one important difference between the utility-cost and the resource-cost case is that in the latter the cost paid to become sophisticated reduces the capital stock and thus the growth rate of the economy. This effect helps explain why having a mix of banks and markets is never optimal in the resource-cost case.

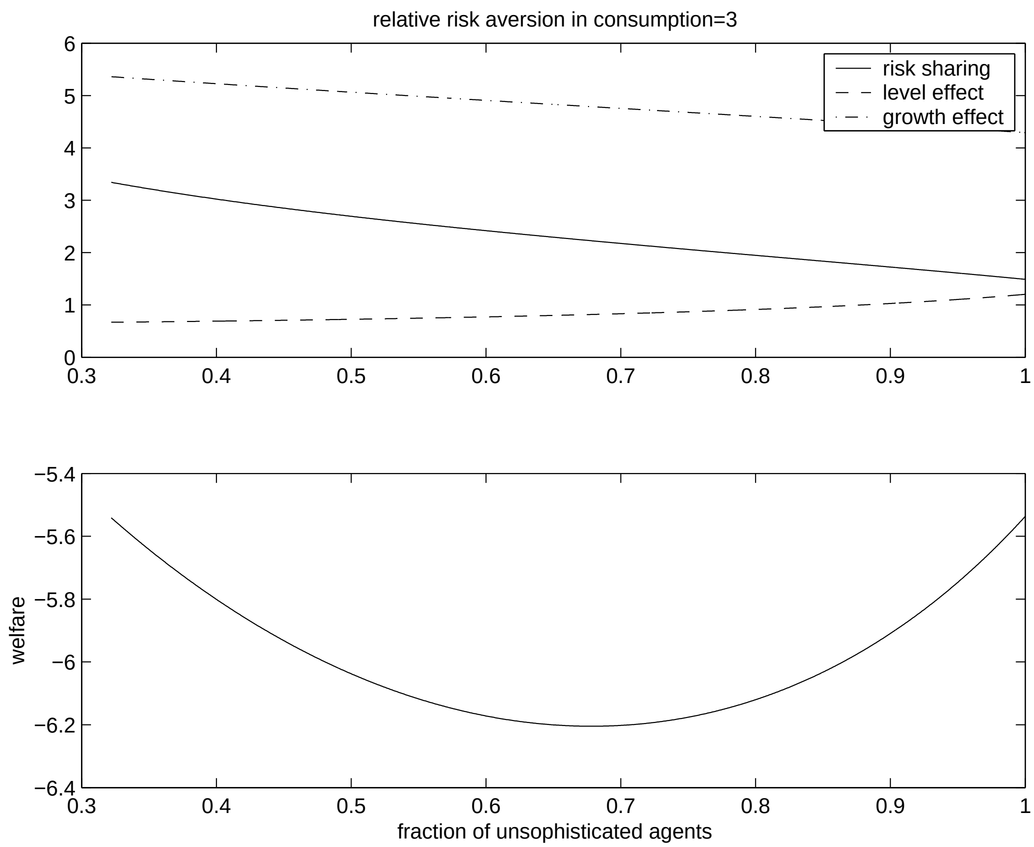

Figure 5. The case with a resource cost

Figures 11 and 12, in the appendix, show welfare for different values of q, the fraction of impatient depositors in the economy. As was the case for the utility cost, an increase in q leads to a shift from a market-dominated system to a bank-dominated system in the resource-cost case. The intuition for this result is the same for both type of costs. Finally, we considered different values of β. Again, changes in the value of β have very little impact on the value of C that maximizes social welfare. We do not report graphs for this case.

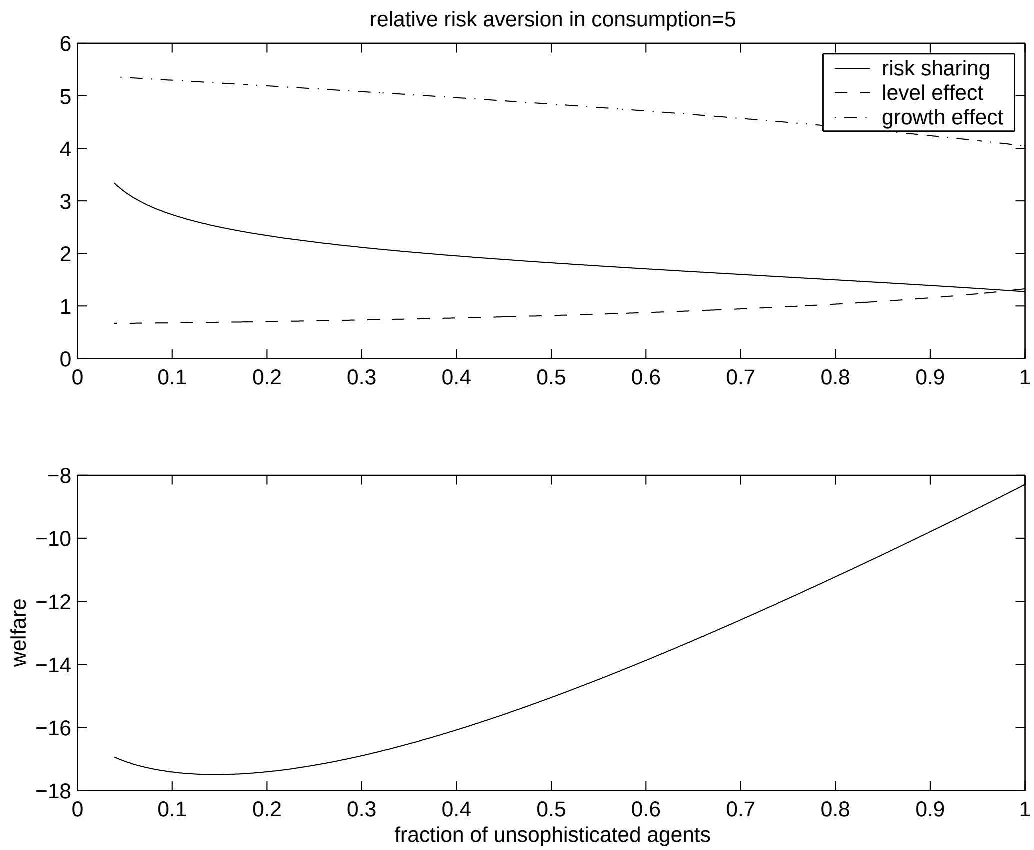

Figure 6. The case with a resource cost

Figures 13 and 14, also in the appendix, show welfare for different values of R (and thus, implicitly, X). As in the utility-cost case, an decrease in R increases the welfare associated with a market-dominated system and increases the welfare associated with a bank-oriented system. Consistent with our other results concerning the resource-cost case, the optimal mix switches from one extreme to the other rather than evolving gradually.

Figure 5 suggests that an exogenous decrease in C could hurt countries with bank-oriented systems more if the decrease is small than if it is large enough to lead to a complete change of system towards markets.

4 Conclusion

This paper contributes to the literature comparing the relative performance of financial intermediaries and markets by studying an environment in which a trade-off between risk-sharing and growth arises endogenously. Our model is consistent with recent evidence suggesting that, in countries with flexible legal systems, market-oriented financial systems promote growth compared to more bank-oriented systems. We consider a model in which financial intermediaries provide insurance to households against a liquidity shock, as in Diamond and Dybvig (1983). Households can also invest directly on a financial market, if they pay a cost. In equilibrium, the ability of intermediaries to provide risk-sharing is constrained by the market: The more households invest directly in the market, the less risk-sharing intermediaries can provide. On the other hand, overall investment in the productive technology is reduced when the available degree of risk-sharing in the economy is increasing. This creates a trade-off between risk-sharing and growth: While economies that are more market-oriented always enjoy higher growth, countries with more bank-dominated financial systems provide households with more efficient risk-sharing.

Regarding the welfare implications of this trade-off our numerical examples show that even though more market-oriented financial systems promote growth they do not necessarily increase social welfare. We derive the optimal balance between intermediaries and markets (or, equivalently, between risk-sharing and growth) in different economies. We find that, everything else being equal, economies in which households are more risk-averse should be more bank-oriented. The intuition is that if households care less about risk, they value the increase in the growth rate of the economy more than the loss in risk-sharing. These results are robust to changes in the values of parameters in our numerical simulations.

If a benevolent government can influence the cost of having access to market, then the policy implication of our model is clear. The government should influence the financial structure in order to have an optimal level of bank-dominance. The government could affect the financial system by modifying the costs of investing directly in the financial market. For example, the cost of investing in the market could be lowered by introducing more transparent accounting standards or implementing corporate governance codes that provide better investor protection. This way the government would reduce the effort required from investors to efficiently select and monitor their investments. Similarly, the costs of access to market could be increased by imposing restrictions on who is allowed to buy and trade financial claims. How bank-oriented a particular financial system should be depends on the economy's deep parameters. In some economies, particularly less developed countries with a high marginal return on capital, it might be beneficial to make direct financial market access rather costly. In such countries a bank-dominated financial system could increase overall welfare even though it might limit growth.

It is not clear, however, that governments can directly influence the general structure of the financial system very much. Given the various elements that constitute the different types of financial systems the governmental impact on the degree of the bank-dominance may be rather limited.[23] Other factors such as the international integration of financial markets could be important. In the case of bank-oriented countries, the international integration of financial markets has made access to financial markets for households easier. This evolution might have been welfare reducing if the initial degree

[23]See Allen Gale (2000).

of bank-dominance in these economies was optimal before the international integration of financial markets.

In Europe, for example, the integration of financial markets has changed the financial landscape entirely. Whereas in the early eighties financial systems were very different across European countries, national particularities are vanishing. They are being replaced by a more and more integrated continental European financial system, especially in the Euroarea. If these economies and their financial systems are not too different this might not affect overall welfare very much.[24]

However, in the case of the financial integration of the UK and continental Europe, the conclusion might be very different. Even though the economies are probably rather similar (in terms of the deep parameters) their financial systems are generally seen as the two opposite extremes. As Figure 5 suggests, this might be optimal for otherwise similar countries. But our model also suggests that financial integration between these economies could lead to an intermediate type of financial system making both countries worse off. An integrated financial system could accelerate growth in a country like Belgium beyond its optimal level while reducing growth in the UK. Hence, financial integration might reduce the overall welfare of households in both countries.

[24]This seems to be the case for most of the countries having introduced the Euro so far. See, for instance, ECB (2002) Report on financial structure.

5 Appendix

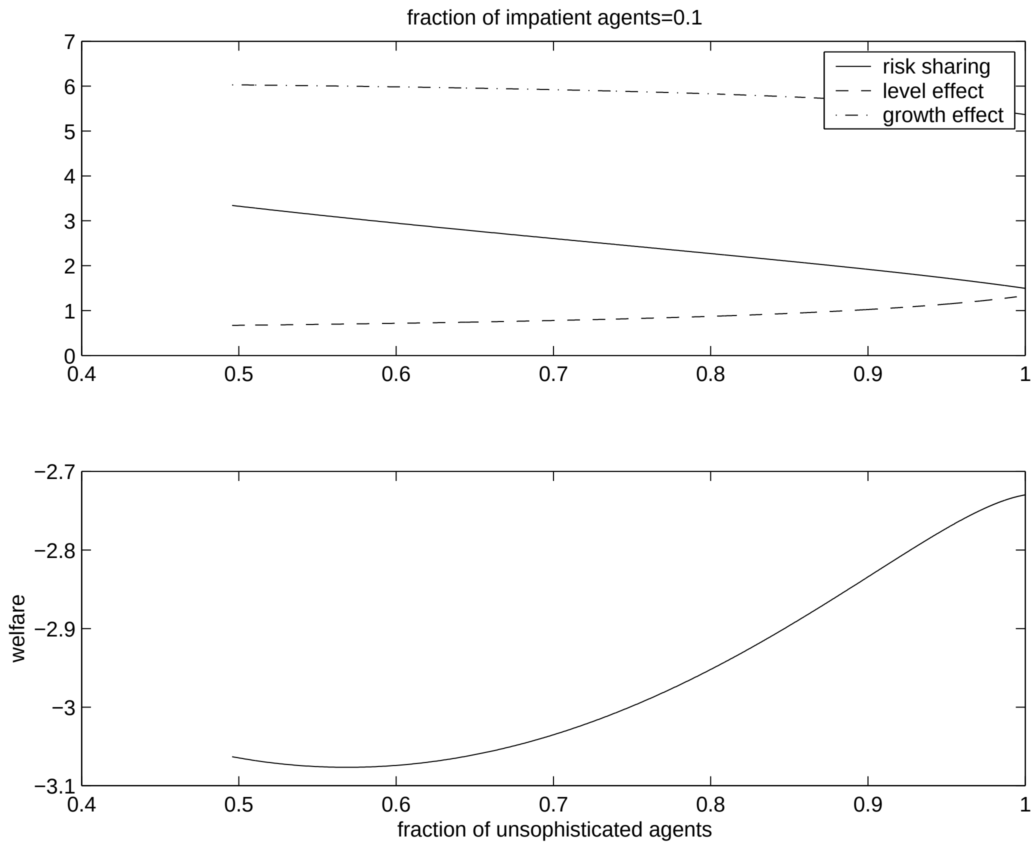

Figure 7. The case with a utility cost

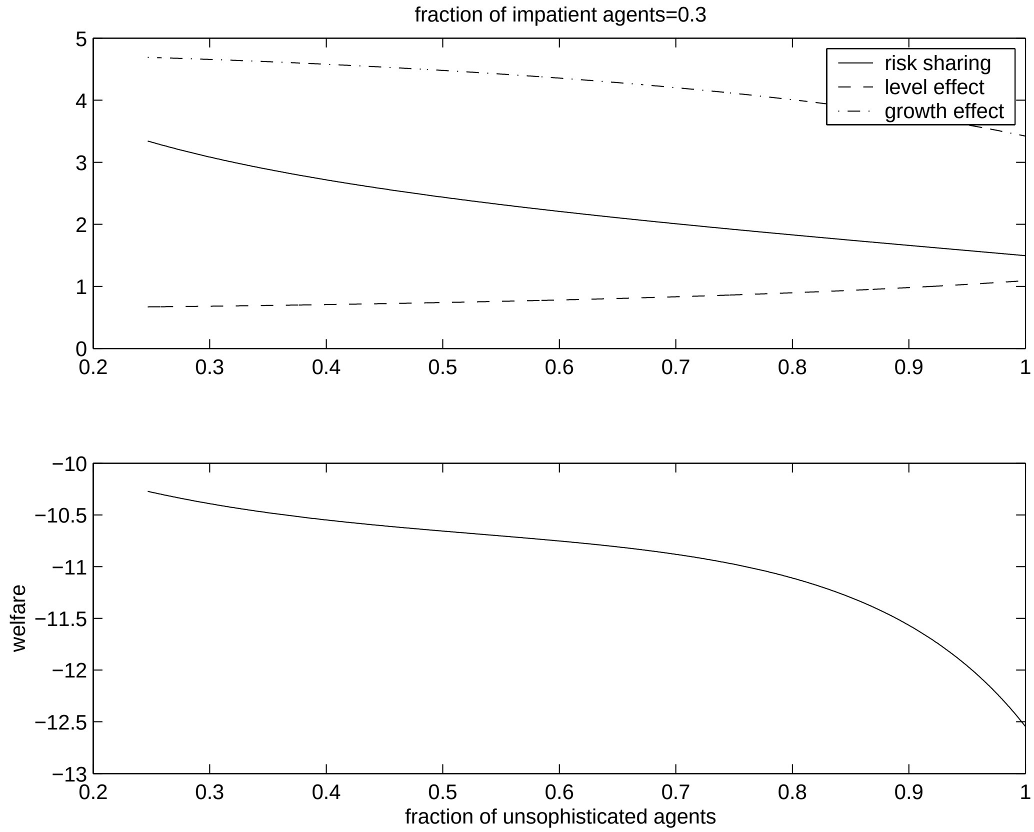

Figure 8. The case with a utility cost

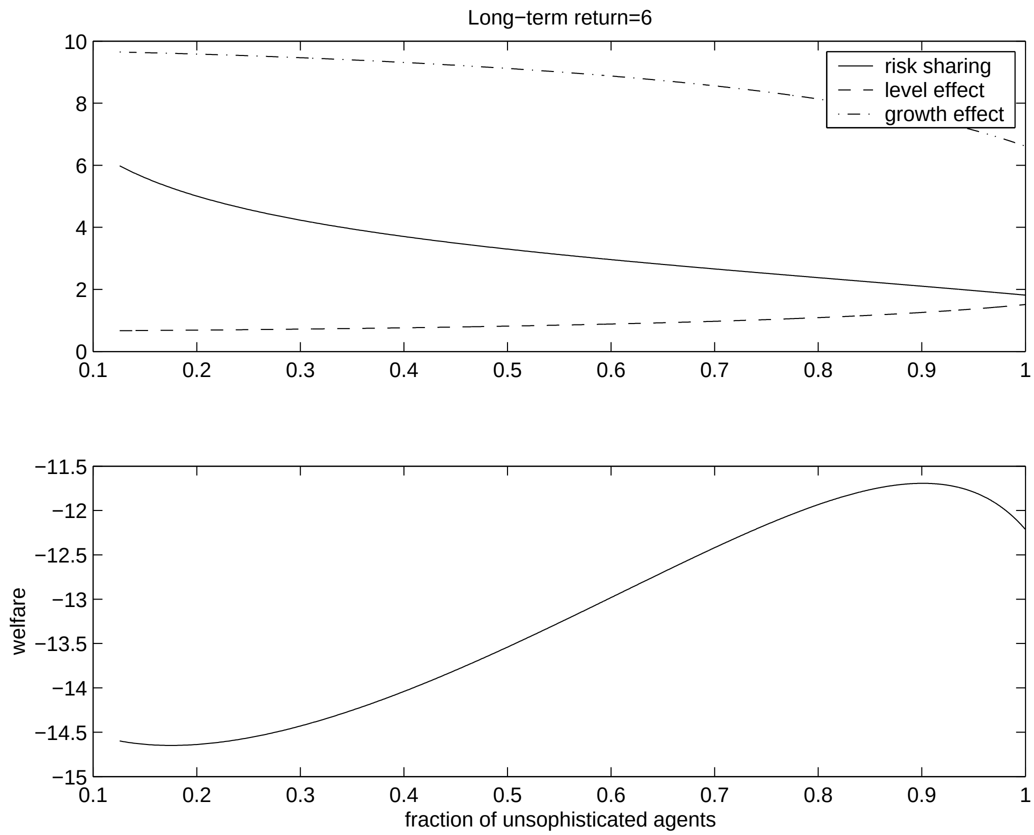

Figure 9. The case with a utility cost

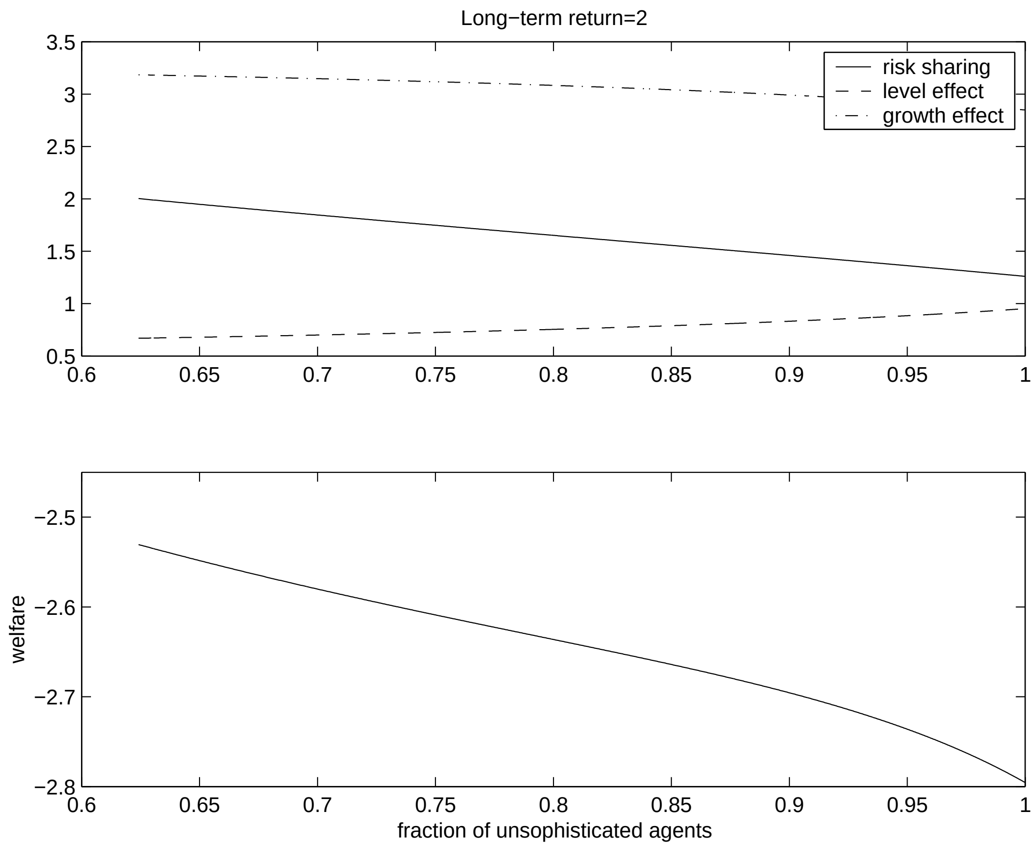

Figure 10. The case with a utility cost

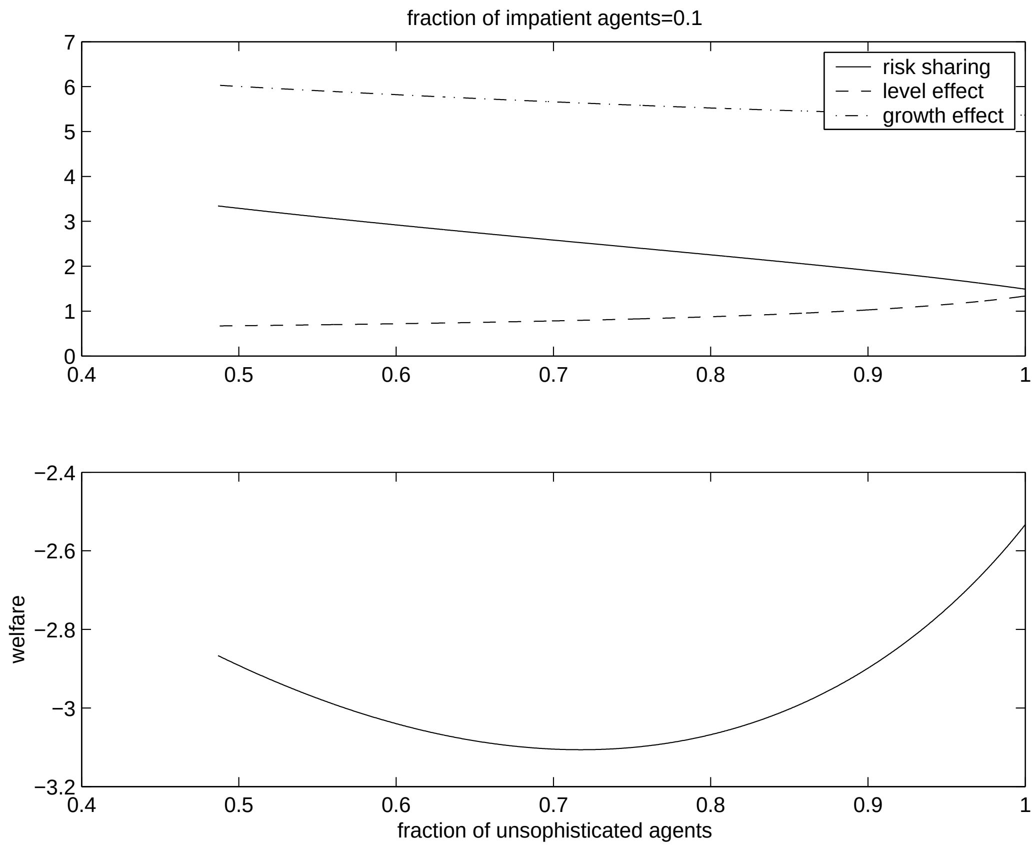

Figure 11. The case with a resource cost

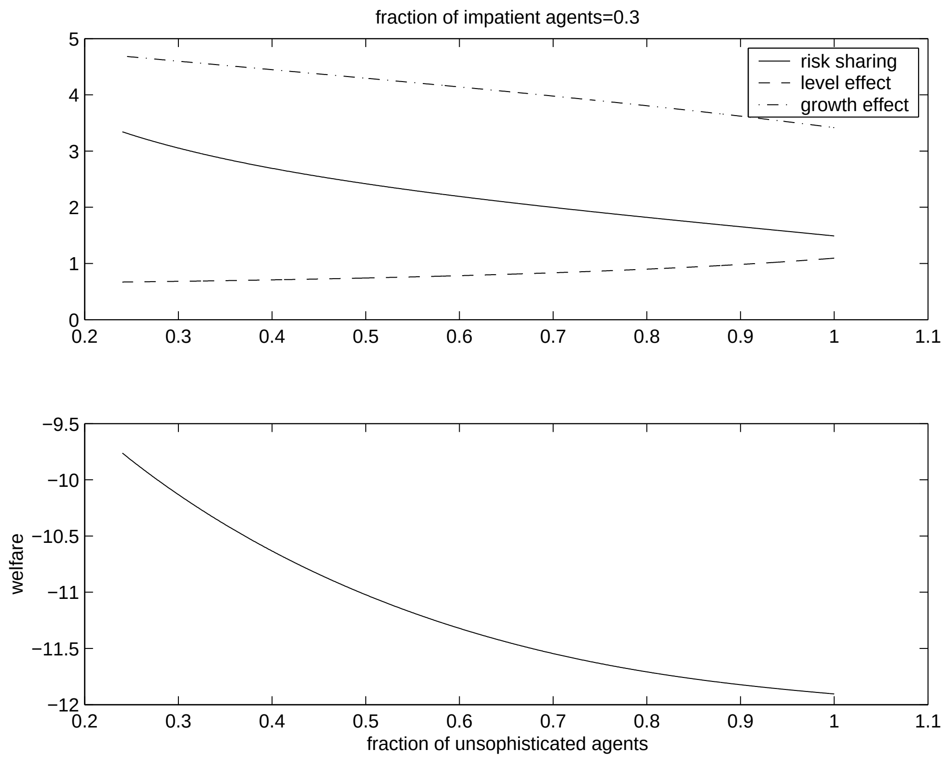

Figure 12. The case with a resource cost

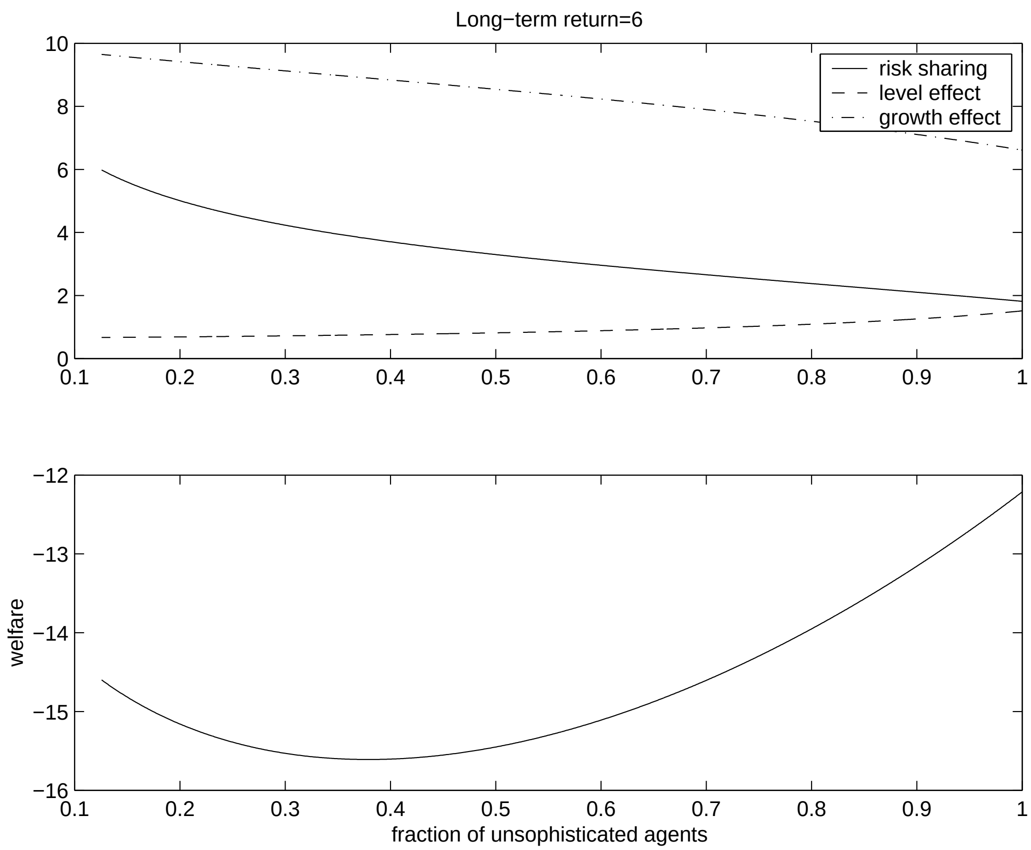

Figure 13. The case with a resource cost

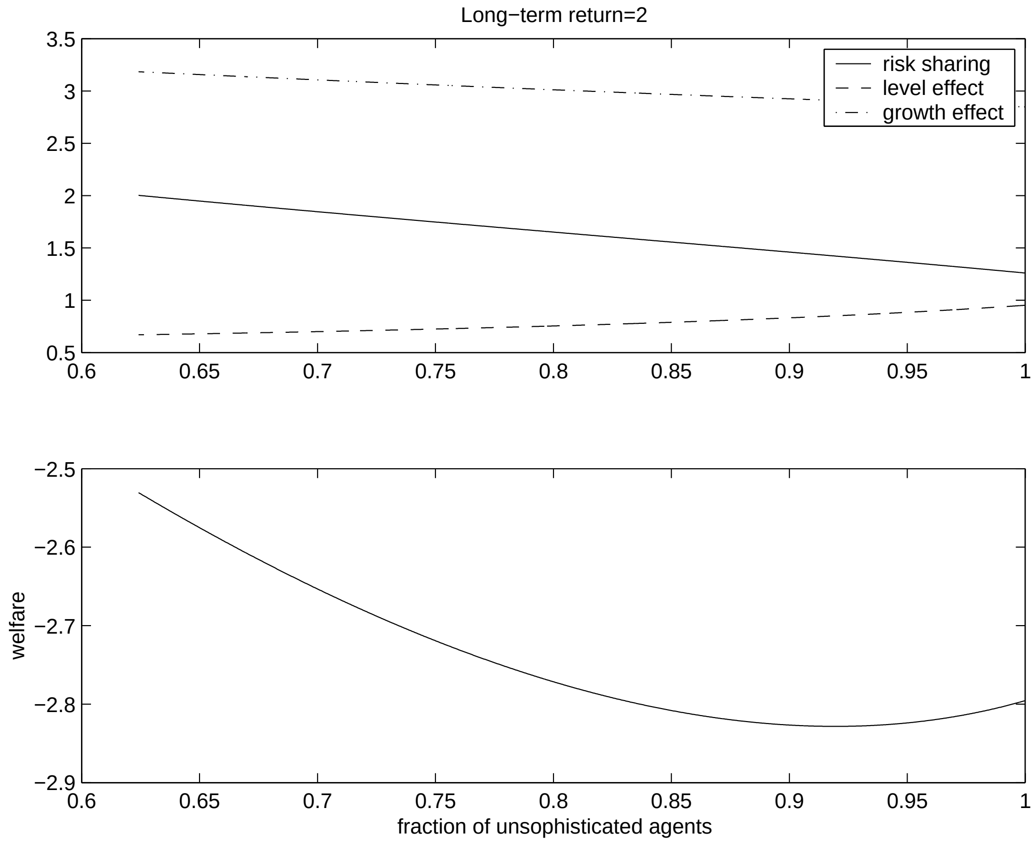

Figure 14. The case with a resource cost

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