Essays in asymmetric information: institutional response in financial markets with applications to the transition economies of Eastern Europe

BY

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Introduction

The purpose of this dissertation is to apply the concepts developed by the literature of asymmetric information and the principal-agent framework to three separate issues related to financial markets. The first issue relates to the prolonged negative real growth, financial disintermediation, inflation and low real interest rates observed in eight former Soviet Union countries after the political collapse of the Soviet Union. The second issue relates to the individual behaviour of members in group credit contracts. The third and final issue relates to the mutual development of pension funds and stock markets. Data relative to the development of pension funds and stock markets in the transition countries of Eastern Europe are reported although the issue is far from being country specific.

In the first chapter I develop a model of credit rationing with *ex ante* asymmetric information *à la* Stiglitz and Weiss (1981) with risk neutral borrowers and Bertrand competitor banks. The relationship between financial development and economic growth is assumed to belong to the Goldsmith (1969), McKinnon (1973) and Shaw (1973) hypothesis. According to these authors, there is a positive relationship between economic growth on one side and increasing investment volumes and efficiency in the allocation of funds on the other side. The model developed in this chapter provides a possible explanation for the sustained negative real growth, high inflation and financial disintermediation observed in eight former Soviet Union countries for several years after the collapse of the Soviet Union. Contrary to Stiglitz and Weiss (1981), who consider heterogeneous borrowers and where the focus is on adverse selection, the model developed in the first chapter focuses on the moral hazard problem with identical risk neutral borrowers with a unique stochastic project, whose probability of success can be increased by producing effort. Similarly to Stiglitz and Weiss

(1981), a pooling equilibrium with type II credit rationing is obtained where a less than socially desirable level of investments is produced. In Stiglitz and Weiss (1981) such a result derives from the fact that the marginal type in the pool of applicants chooses the safest project and any increase in the loan interest rate will cause the marginal type to drop out and hence, an increase in the average riskiness of the mix of applicants. In my model an increase in the loan interest rate reduces the borrowers' payoff in the good state and hence, it lowers the optimal effort produced by borrowers. Notice that the under-investment result is directly in contrast to De Meza and Webb (1987). The reason for such a contrasting difference between the Stiglitz and Weiss (1981) and the De Meza and Webb's (1987) frameworks relates to the fact that in the latter framework, the marginal type in the pool of applicants is instead, the riskiest type and any increase in the equilibrium loan interest rate increases the quality of the mix of applicants rather than reducing it; thus engendering a more than socially desirable level of investments. Clearly, my analysis falls in the former rather than in the latter framework.

In the second chapter I develop a model of credit rationing with *ex ante* asymmetric information which describes the behaviour of individual borrowers within credit group contracts. Rural households in marginal areas of developing countries are often said to be too poor to be profitable to formal lenders (Otero 1995, Hossain 1988, Von Pischke 1991). The principal reasons being that, due to the lack of seizeable collateral, formal lenders find the screening problem extremely costly relative to the small loan size that poor borrowers usually request. Group lending programmes have been introduced in various countries at an increasing rate thanks also to subsidised credit, but have moved beyond being profitable and often failed to properly target poor borrowers (Devereux and Fishe 1993, Khandker *et al.* 1995). The Grameen Bank experiment in Bangladesh has probably been the most successful of such programmes and due to its success, almost all group lending programmes in other

developing countries have been designed upon this model. The model developed focuses specifically on the issues of social sanctions and optimal group size. I introduce a social sanction function in the borrowers' utility function through which non-monetary disutility is imposed when borrowers deviate from the social norm. Peers engage in monitoring as individual actions affect the group payoff and an optimal group size can be found for any set of parameters.

In chapter three I analyse the issue of pension reform and pension funds development with particular reference to the transition economies of Eastern Europe. The model developed focuses on the mutual positive interactions between the development of pension funds and stock markets. It is claimed that the development of both these institutions is conditional to the production of publicly available information on the part of firms and therefore, that the development of pension funds is beneficial to stock market efficiency and to the creation of effective schemes of corporate governance.

The issue of pension reform is constantly debated in Eastern Europe because of the fiscal unsustainability of public pay as you go (PAYG) schemes and because the economic transition from the central plan has eroded the real value of pension benefits due to the almost total absence of indexation of contributions and benefits. A pension reform is likely to transform the structure of the financial sector by promoting the creation of new financial and non-financial agents, and by altering the relative importance of agents already active in the market. This is likely to have a profound impact on the existing patterns of allocation of funds, corporate governance and therefore, on the issue of firm restructuring. In this framework, pension funds are likely to play an important role. More than any other institutional investors, they are likely to influence the development of the stock market which in turn enables pension funds to develop even further as a more efficient stock market allows pension funds to allocate funds more efficiently.

The model developed in the third chapter is divided into two parts: in a first part I model the interaction between firms and stock market, and in a second part I model the interaction between pension funds and stock market. Firms in transition economies are affected by serious problems of corporate governance and this is one of the reasons for their exclusion from long term finance. In the model, a continuum of firms with different probability of survival seeks long term equity finance in order to increase the set of available projects and hence, increase future net revenues. The information about the different survival probability is private to firms and can be disclosed through signalling. The stock market is the natural means through which equity finance is provided and, for different sets of parameters, a fully or partially separating equilibria are obtained. Because of the monopolistic nature of the stock market in the activity of processing firms' information, a less than socially desirable number of firms is likely to be listed on the stock exchange. In the second part of the model, among the different types of institutional investors, pension funds are seen as the major provider of long term funding to the stock market. In a framework of bilateral monopoly with efficient bargaining, I show how increasing bargaining power of pension funds can yield to a larger number of firms being listed on the stock exchange and a larger volume of information being produced by firms; therefore, to an increased efficiency in the economy.

There is a unique framework that links together the three models presented in this dissertation. This is related to the presence of *ex ante* asymmetric information in a principal-agent type of models. The focus is always on possible institutional responses in the financial markets of developing/transitional economies, aimed at reducing or eliminating the market failure and hence increase efficiency. The overall importance of my analysis is related to the general institutional approach to financial development. Development is not just about getting the right economic and technical inputs through macroeconomic stabilisation policies

(The World Bank), it is also (among other things) about identifying which aspects of government actions need improving to overcome market failures. In this dissertation I address three specific issues related to market failures in financial markets whose identification and understanding definitely help the design of effective policies for financial development. Credit rationing alleviation in transition economies soon after the collapse of the Soviet Union is the topic of the first chapter. Credit rationing alleviation in rural credit markets is the topic of the second chapter. Pension reform, pension funds and stock market development in the transition economies is the topic of the third chapter.

CHAPTER 1

Credit Rationing, Inflation and Financial Collapse in the FSU Countries

1. INTRODUCTION

Within the literature on economic growth, two sets of models can be identified for their different approach to endogenous growth. In a first set, there are models[1] for which along the steady state per capita output is constant; in order to achieve this, a decreasing marginal productivity of capital is assumed. In a second set, there are those models[2] where the marginal productivity of capital does not decrease and per capita real output is therefore free to increase. I choose this latter approach as the main theoretical framework for the following analysis. The reason for this choice will become clear in the next sections but a first intuition can be anticipated: only if the level of capital and/or its marginal productivity are allowed to increase along the steady state, can one really think of a causality relationship between financial development and economic growth.

This chapter is structured in the following way. In section 2, I summarise the main results of the recent literature on financial development and economic growth. In section 2.1, I analyse different indicators of financial development that have been used in the literature.

In section 3, I relate the results of the literature to the findings in eight countries of the former Soviet Union: namely Armenia, Belarus, Estonia, Georgia, Latvia, Lithuania, Moldova, Ukraine. The main result of the section is that soon after the collapse of the Soviet Union, these countries experienced numerous years of both political and economic instability. What is specifically analysed in this section is the behaviour of macroeconomic variables such as GDP, inflation, interest rates and deposits with the attempt to relate this to the hypothesis of monetary overhang. The hypothesis of monetary overhang describes the

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[1] See Solow (1956) and Blanchard and Fisher (1989).

[2] See Lucas (1988) and Romer (1986).

passage from planned to market economies as a process involving a forced accumulation of monetary holdings that needs re-balancing through an increase in prices and interest rates. The process is of a monetary nature and it should be completed in the short run. Nevertheless, some countries had not managed to stabilise their economies before 1994. In the period 1991 - 1994, their economic instability was characterised, among other things, by negative real growth, high inflation, low real interest rates, financial disintermediation and rigidities on the labour market. Although the causes of the negative growth cannot be attributed to financial disintermediation only, the aim of this analysis is to investigate the contribution of the financial development in the FSU countries to their growth in the period 1991 - 1994 and therefore, only aspects relevant to the financial sector will be underlined.

In section 4 I develop a model of credit rationing focusing on the relationship between financial development and growth. The rational behind the model is that credit expansion can have a positive contribution to growth only if there are no losses of efficiency in the use of credit. The model gives a possible explanation to the delayed economic recovery of some FSU countries by assuming imperfect information on the part of the banks about borrowers. It also explains why some countries did not experienced a positive growth despite increased levels of financial deepening. The assumption, here, is that the legal and property rights systems of these countries were (and largely are still) not strong enough to guarantee a more efficient use of the new credit. As a matter of fact, I show that a credit expansion not accompanied by an improvement in the property right system yields to a less efficient use of credit and speculate that this is likely to have happened.

Conclusions follow in section 5.

2. FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH

Goldsmith (1969), McKinnon (1973) and Shaw (1973) can be seen as the original contributors to the literature on financial development and economic growth. In their work they all suggest a positive relationship between output and financial development but the channels through which this is achieved are different. On the one hand, Goldsmith (1969) suggests that financial development is responsible for higher rates of capital accumulation. According to this line of thought, the development of the financial sector would allow economic agents to increase their savings. Increasing loanable funds, in turn, would increase investments and, through the production function, output. On the other hand, McKinnon (1973) and Shaw (1973) concentrate on the role of the financial sector on capital allocation. The development of the financial sector would allow a more efficient allocation of resources by increasing the "quality" of investments. In this framework, output would increase again through the production function, but the focus is on increased efficiency in funds allocation rather than on increasing investment levels.

Since these first contributions, the debate in the theoretical literature has focused on the analysis of possible channels linking financial development to economic growth and their relative importance.

On a micro level Stiglitz and Weiss' (1981) paper focuses, among other things, on the relationship between financial development and volume of investment. Stiglitz and Weiss (1981) present a model where credit is rationed due to imperfect information on the part of the banks about borrowers' project types. Risk neutral borrowers can choose among projects with different riskiness and projects differ by a mean preserving spread.[3] In such a framework, banks cannot screen borrowers and the resulting equilibrium is a pooling

[3] See Rothschild and Stiglitz (1970).

equilibrium with the marginal borrower choosing the safest project. If interest rate is increased, the marginal borrower drops out from the mix of applicants and consequently, the average riskiness of the projects financed increases. Banks, therefore, ration borrowers more than what is socially desirable, engendering a lower than socially desirable level of investments.

De Meza and Webb (1987) present a model of credit rationing where instead, the marginal borrower in the pooling equilibrium is the one with the riskier project. If interest rate is increased, the marginal borrower drops out from the mix of applicants and the average riskiness of the projects financed decreases. In their model the level of investment generated because of the market failure is more than socially desirable. This proves that the relationship between credit expansion and level of investment is ambiguous when explained in a framework of asymmetric information.

On a macro level, Greenwood and Jovanovic (1990) show that the main role of financial institution is to process information and to channel loanable funds towards investment with higher return. Hence, on the one hand, the activity of financial institutions stimulates growth but at the same time it benefits from economies of scale. The process of growth allows a higher participation in the financial sector reducing costs per loan.

In Bencivenga and Smith's (1991) paper, agents face stochastic consumption needs. They have the choice between investing in a liquid asset with a low expected return or in an illiquid asset with a high expected return. The authors demonstrate that in the absence of financial institutions, investors tend to choose investments that can be readily liquidate while the presence of financial institutions decreases the costs associated with liquidity needs and it makes possible for savings to be channelled towards investment with higher expected

return. Because of this improvement in the "quality" of investments, growth is achieved even if the volume of savings decreases.

Roubini and Sala i Martin (1992) analyse the effect of tax evasion on financial development. They present an interesting model where financial development is avoided by the government in order to broaden the base of inflation tax. They suggest that financial development is avoided in those countries where revenues from tax on income are low because of tax evasion.

Jappelli and Pagano (1992), somehow in the line with Stiglitz and Weiss (1981) and De Meza and Webb (1987), analyse the effect on savings of the relaxation of credit constraints. They show that when credit is rationed because future income is uncertain, agents tend to increase savings to finance consumption. This implies an ambiguous relationship between a relaxation of the constraint on consumer credit and the level of savings.

In summary, financial development affects growth in a dual way. On the one hand, it may increases the marginal productivity of capital (but, at least on a theoretical ground, De Meza and Webb's 1987 results prove the possibility of the opposite outcome) by channelling loanable funds more efficiently. On the other hand it may increase the volume of savings (but the experience with the financial liberalisation in Latin America shows the contrary) that would result in a larger volume of investments.

The position adopted in the following analysis is that savings mobilisation and higher marginal productivity of capital alone are necessary but not sufficient conditions for economic growth. That is, savings mobilisation has to be accompanied by non decreasing productivity of investment (or *vice versa*) for this to have a positive effect on growth.

2.1 Alternative measures of financial development

After having identified what is most likely to be the relationship between financial deepening and economic growth, it is necessary to isolate an appropriate indicator suitable for measuring the level of financial development.[4]

A first best situation would be the analysis of two different and independent indicators: one for savings and/or investment mobilisation and one for capital productivity.

On the one hand, savings and/or investment can be easily measured by looking at the ratio of deposits and/or domestic credit over GDP. For a given size of the economy, such an indicator would measure the ability of the financial system to raise funds and channel them towards their logical use, i.e. investments.

On the other hand, capital productivity is more difficult a variable to measure, especially in developing countries. Intuitively it would be best measured by the rate of return on enterprise investment. Although this would represent the most appropriate indicator, it turns out not to be a feasible one with the data available for most of the FSU countries. The reason is that accounting systems used by the enterprises are too often inaccurate and biased. Since the direct observation of investment returns is made impossible by the inaccuracy of the data, it is necessary to rely on an indirect indicator of capital productivity.

The McKinnon-Shaw hypothesis suggests that real interest rates on loans act as a proxy for the productivity of investments. The higher the interest rate, the more efficient is assumed to be the investment.[5] Nevertheless, positive real interest rates may be high because

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[4] See King and Levine (1992) for a thorough analysis of various indicators, De Gregorio and Guidotti (1992) for a comparison between indicators based on monetary aggregates and interest rates.

[5] Agents would choose investments with a higher expected return to compensate the higher interest rate costs.

of risk premia rate caused by a weak financial sector, poor regulatory environment or legal framework. For this reason, a better indicator could be the opportunity cost of holding money measured by the interest rate differential between deposits and loans. But if this spread makes perfectly sense when real interest rates are positive, its interpretation is more ambiguous when interest rates are negative. With negative real interest rates on deposits, for instance, agents are better off shifting wealth into the future by trading goods instead of leaving their money into bank deposits. At the same time, if real lending rates are negative agents are always better off by borrowing instead of keeping their money. This means that when both real interest rates (deposits and loans) are negative, the relevant spread is not the one between deposit and loan real interest rates, but it is the spread between zero (which is what the activity of "investing" in goods would yield) and real rate on loans.[6] This is of course equal to the modulus of the real interest rate on loans.

In the FSU economies deposit and loan real interest rates were sometime positive and sometime negative in the period 1991-1994. Furthermore, it is known that for some countries, households preferred to use goods as a way of shifting wealth in time but very little data is available to measure such an activity. For these reasons I chose not to use an indicator (direct or indirect) for capital productivity separately from one for financial deepening, but to rely on a summary indicator for the two phenomena.

The value of domestic credit granted to the private sector as a percentage of GDP seems to be the best choice. Given the size of the economy, it tells us to what extent the financial sector contributes to growth by granting credit. It also gives an approximate measure of efficiency in the use of such credit if we assume that the private sector always uses credit in a more efficient way than the government.

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[6] In such a case, real interest rates on loans represent the benefit from borrowing with respect to the second best

3. FINDINGS IN THE FSU ECONOMIES

The following sections analyse the data collected in the eight countries surveyed. The behaviour of macroeconomic variables in the year after the dissolution of the Soviet Union is explained here in terms of the "monetary overhang" phenomenon, while I will present a theoretical model of credit rationing to explain the behaviour of the same variables in the subsequent years.

Table 1 M2 as % of GDP.

	Dec.-91	Dec.-92
Armenia	73.68	40.12
Belarus	-	35.10
Estonia	125.16	27.90
Georgia	62.01	43.60
Latvia	-	25.00
Lithuania	-	-
Moldova	74.95	40.38
Ukraine	59.06	31.40

Source: IMF

Before the political collapse, the financial sector of the Soviet Union was characterised by forced private saving and government dissaving. On the one hand, excess demand on the good market and fixed prices, meant that the private sector was forced to save the excess money balance. On the other hand the government did not cover all public expenditure from taxation and the financial sector intermediated to make private savings available to cover the excess. Table 1 reports a measure of this forced accumulation. It shows the high level of monetisation reached in the FSU economies by the end of 1991 expressed by the ratio of M2 over GDP.[7]

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action that agents can take. I.e. shifting wealth into future by storing it into goods.

[7] M2 was chosen as indicator for monetisation since M1 is not available for all countries. In particular, the continuous change of legal tender, resulted in inconsistent "money outside banks" series.

Hence, before the dissolution of the Soviet Union, there was a direct link between financial deepening and fiscal deficit. In 1989 household savings deposits were 36.2 percent of the GNP while a comparable figure in the US was 33.7 percent (Conway, 1995). Nevertheless, this measure of financial deepening does not suggest a desire for saving on the part of the private sector but it represents an inefficient government fiscal policy together with a forced accumulation of purchasing power that was to be redeemed for future production.

This excess growth did not lead to substantial inflation because of the extensive system of price controls and the inflationary pressure was simply postponed until later price liberalisation. The regime of repressed inflation, prior the dissolution of the Soviet Union, determined the accumulation of nominal money balances, and the consequent excess demand on the good market. This, could only be eliminated by setting the economy on a different path with higher nominal interest rates and prices. Higher nominal interest rates would clear the financial market while higher prices would clear the good market.

As a matter of fact, the adjustment took place only through prices because nominal interest rates remained artificially low. In particular, it is argued in section 4 that problems of imperfect information on the part of banks, due to a chaotic regulation system and an inefficient legal system, induced banks to ration credit by keeping interest rates low. When prices started to be liberalised in the new republics, monthly inflation in the eight countries surveyed reached on average the level of 80 percent in January 1992.

The situation in the new republics soon after the dissolution of the Soviet Union can be summarised in the following points:

1. Decreasing real GDP.

2. High inflation.

3. Low real interest rates on deposits and loans.

4. Drastically reduced levels of financial deepening with agents shifting to alternative means to transfer wealth into the future such as foreign currency and goods.

The theory of monetary overhang suggests that the adjustment should have taken place in the short run with prices and interest rates jumping to a higher level. What the data collected, is that such an adjustment did not take place at all, and if it took place, it took place in a much longer period than what suggested by the theory.

In particular, the different economies surveyed, can be separated into two different groups. In the first group there are the Baltic States that managed to stabilise their economies since 1993. In the last two years, these countries experienced low inflation, positive real interest rates, increasing levels of financial deepening and positive real growth in 1994. In the second group, all the other countries are far behind in the process of stabilisation and for most of them, the data seem not to suggest any sign of recovery.

3.1 Real GDP

A characteristic of former socialist economies is the strong decrease in real GDP that took place soon after the break down of the Soviet Union. Only few economies started recovering during 1994. Figure 1 shows how, in all the countries surveyed, real GDP decreased considerably between 1990 and 1993. Only in 1994, did real GDP increase in Armenia, Estonia, Latvia and Lithuania.[8]

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[8] The data on 1994 change in real GDP come from IMF and local authorities estimates for most of the non Baltic States. The reliability of the data is very low because of inconsistency of methodologies and coverage across

Latvia experienced an acute contraction in the period 1991-93, estimated at about 46 percent. The most important factors that affected the economy in those years include:

1. a terms of trade deterioration.
2. a continuing decline in trade with the FSU countries.
3. political disputes.
4. the collapse in payments mechanisms.

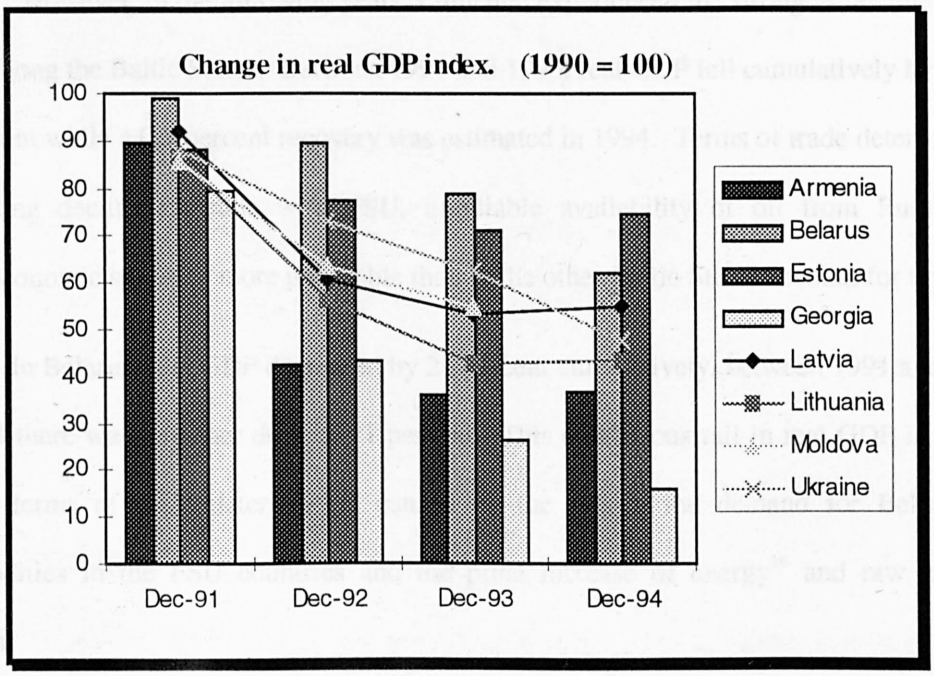

Figure 1 Change in real GDP

In particular, terms of trade deterioration occurred mainly in 1992. In addition to raw material shortages, terms of trade in Latvia sharply deteriorated as price liberalisation proceeded in other parts of the FSU. Meanwhile, a severe drought in mid 1992 caused

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countries. This is definitely true in Armenia more than elsewhere, hence, the national account figures should be treated with great caution. This may imply that the 0.6 percent growth in Armenia needs revising at a later date.

agricultural output to collapse. FSU demand for Latvian industrial goods also slowed due to the severe problems associated with adjustment and the breakdown of the trade and payments system within the region. As a result, in the first half of 1992 industrial output declined by 34 percent. Basically the same factors affected the other FSU economies but the Latvian fall in real GDP is somewhat more acute because the structural shocks listed before, occurred in Latvia at an earlier stage. This same reason is also expected to lead to a more rapid recovery.

In 1991, Lithuanian per capita GDP was estimated to be 46 percent higher than in Russia[9]. However, in the following years, Lithuania experienced the strongest decline in real GDP among the Baltic States. Between 1991 and 1993, real GDP fell cumulatively by nearly 57 percent while a 0.5 percent recovery was estimated in 1994. Terms of trade deterioration, continuing decline in trade with FSU, unreliable availability of oil from Russia and macroeconomic statistics more unreliable than in the other Baltic States account for this fall.

In Belarus, real GDP decreased by 21 percent cumulatively, between 1991 and 1993. In 1994 there was a further drop of 21 percent. This continuous fall in real GDP is mainly due to terms of trade deterioration caused by the fall in the demand for Belorussian commodities in the FSU countries and the price increase of energy[10] and raw material imports.

In Georgia, the fall in real GDP was even sharper. Between the same years, real GDP decreased by 74 percent. A further fall of 36 percent occurred in 1994. Georgia shows the worst pattern of all countries surveyed. Its economic performance was adversely affected by civil conflicts. Together with the disruption in trade and payments arrangements with

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[9] World Economic Outlook 1993.

[10] During 1990-93, imports of crude oil decreased by two third and imports of electricity decreased by one third.

FSU countries as well as the deterioration in the terms of trade associated with higher energy import costs, they account for the total collapse of the economy.

In Moldova, real GDP decreased by 45 percent between 1991 and 1993. In top of the trade disruption among FSU countries and terms of trade deterioration, local events such as the severe drought experienced in 1992 and the intense conflict over the status of the Transnistria region accounted for such a decline. Considering that agriculture represents a comparative advantage and that it accounted for about 42 percent of the NMP in 1993, the 1992 drought largely explains the more than average decrease in 1992 real GDP. The cessation of hostilities, and the subsequent resumption of economic relations between Transnistria and the rest of Moldova, contributed to a partial recovery, especially in the industrial sector, in 1993.

The last country surveyed was Ukraine. In this country, real GDP decreased by 37 percent between 1991 and 1993. A further decrease of 17 percent occurred in 1994. This decline resulted from severe weakening demand, cutbacks in energy imports in 1993, tightening of monetary policy and administrative controls over the economy.

3.2 Employment, wages and prices

Despite the fall in real output, unemployment remained relatively low in almost all countries.

Figure 2 shows how, at the end of 1993, unemployment never exceeded 10 percent of the labour force for any country except Armenia where it was 26.1 percent. Unemployment was calculated as residual in the labour force.[11] Official unemployment,

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[11] The method used is likely not to take into consideration the falling participation rates in the economy or the forced unpaid leaves that workers were "offered" as alternative to unemployment. For Ukraine, unemployment is given as a percentage of the working age population. The latter comprises labour force and students.

hardly exceeds 1 percent for many countries and such a calculation represent a proxy also for hidden unemployment, forced unpaid leave or underemployment. The low levels of unemployment are a clear sign of rigidity in the labour market. Even for Armenia, the decline in employment has been markedly smaller than the measured decline in output, reflecting in part a tacit policy of maintaining employment by state enterprises as part of social policy.

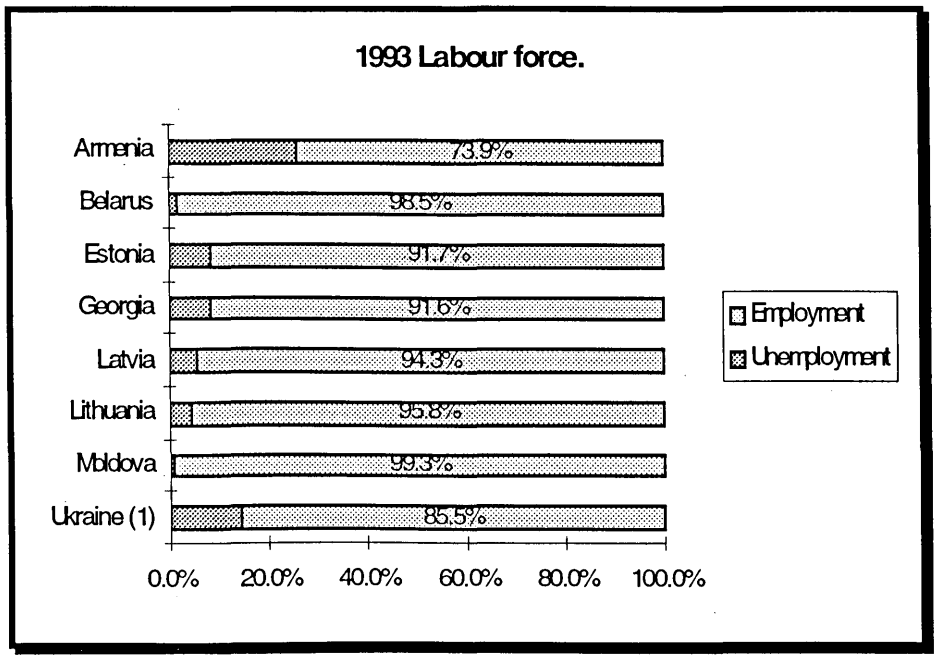

Figure 2 1993 Labour force. (1) *active population.*

3.3 Wages

Information on wages is very poor and it is often available only for the public sector. Given its relative big size, especially in the early years of transition, I used this information as a proxy for wages in the whole economy. Clearly, the quality of such an approximation, worsens with the progress of the privatisation process in each country and the following figures should be considered only as approximate.

Again, the Baltic States stand in a separate group showing relatively constant real wages at least in 1994. Between the first quarter of 1991 and the fourth quarter of 1993, real wages fell by 33 and 42 per cent in Estonia and Lithuania respectively. At the end of the same period, real wages in Latvia were back at 1991 levels. After the end of 1993, all three countries experienced relatively constant real wages. The reason for almost constant real wages in Latvia since 1991 is due to the fact that price liberalisation started in this country at the end of 1989 when real wages were already artificially low.

For the years 1992 and 1993, real wages in Armenia fell by 60 and 46 percent respectively, while in Ukraine by 23 and 61 percent. Belarus experienced an increase of 12 percent in 1993 after a decrease of 14 percent in 1992. Moldova and Georgia represent an exception in this framework because real wages remained relatively constant throughout 1992 and 1993, although there was a substantial variability within each year. Prior to 1993, wages in Moldova were determined on the basis of social policy and political objectives and were relatively stable. Afterwards, increases in nominal wages merely offset the increase in inflation.

Given the relative stability of nominal wages and employment, it is safe to assume that, nominal costs sustained by the enterprises for their working capital, remained relatively constant since the break down of the Soviet Union.

3.4 Prices

Also as far as prices are concerned, we can divide the eight countries into two groups. The Baltic States have substantially succeeded in stabilising their inflation, while for all other countries the inflation is still not under control. Figure 3, Figure 4 and Figure 5 allow an immediate comparison among the eight countries. It is worth noticing the similar inflation pattern in the Baltic States, almost identical for Estonia and Latvia. These last two

countries liberalised prices during more or less the same period and by the end of 1992, both governments had essentially completed the process of price liberalisation. Individual factors account for the success obtained in controlling inflation. A currency board was established in Estonia in June 1992, with a continued avoidance of net domestic financing of general government.

In Latvia, the progress in reducing inflation was due to the tightening of monetary policy that accompanied the introduction of the Latvian rouble in May 1992. Nevertheless, inflation accelerated by the end of 1993. Domestic absorption increased as a result of the increase in wages in budgetary organisations and average pensions increased by nearly 50 percent in November 1993.

Lithuania seems to have delayed inflation stabilisation due to a less tight monetary policy during the whole 1993. Nevertheless, inflation in this country has been very much comparable to that of the other two Baltic States afterwards. As a matter of fact, common sources of inflation exist in the Baltic States since the beginning of 1994. Namely, exchange rate, upturns in domestic absorption and supply rigidities in the non-tradable sector. For instance, the real appreciation of the Russian rouble in the second half of 1993 (120 percent against the kroon and 100 percent against the lat) drove up prices of goods imported goods from Russia which is still one of the Baltic States' largest trading partners. As Figure 4 shows, this had an immediate impact on the inflation of Latvia and Lithuania and with a gap for Estonia.

For the other countries, the situation is considerably different. Although the process of price liberalisation took place later than in the Baltic States, and prices of key product are still regulated, inflation has been considerably higher. In general the higher inflation of the

non Baltic States can be explained by the common inability of these countries to control the money supply. Nevertheless, some specific factors needs underlying.

In Armenia, monthly inflation reached the peak of 437.8 percent in November 1993 reflecting the uncertainty related to the introduction of the dram, the massive inflow of old roubles from other countries of the former Soviet Union and the population's rush to substitute goods for cash holdings.

Georgia faced similar problems during 1993 as a result of indiscriminate price liberalisation, highly accommodative financial policies and inflation expectations due to a lack of confidence in the economic policies.

Expectations played also an important role in explaining inflation in Moldova. The reduction of subsidies on key food products at the end of 1993, resulted in a sharp increase in price pressures. Together with the following expectations of widespread confiscations related to the introduction of the leu, this induced the population to convert their cash balances and bank deposits into goods or foreign currency. The much lower inflation in 1994 is attributable to the tight monetary policy that accompanied the introduction of the leu in November 1993.

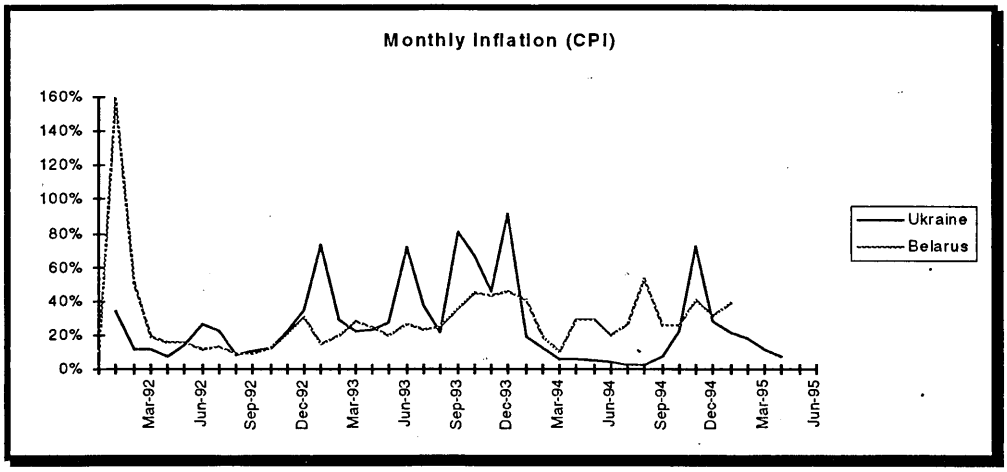

Figure 3 Monthly inflation in Ukraine and Belarus

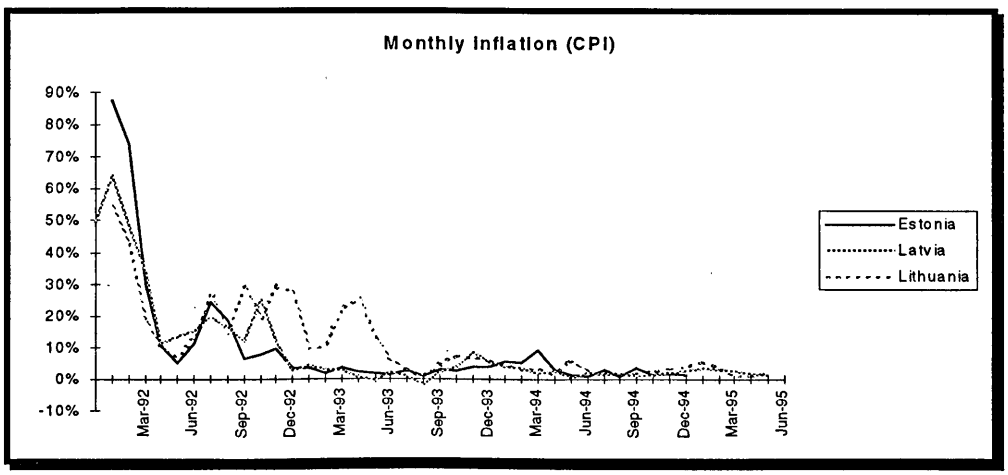

Figure 4 Monthly inflation in the Baltic States

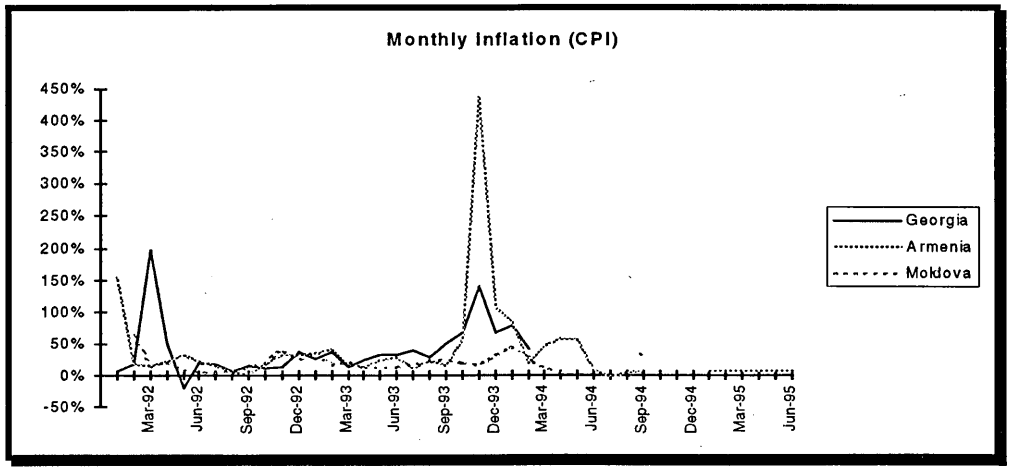

Figure 5 Monthly inflation in Georgia, Armenia and Moldova

Ukraine is probably the country that still possess a considerable system of administered prices. Until December 1993, administered prices added up to more than 30 percent of the CPI. Such prices were periodically increased producing sharp spikes in the recorded monthly inflation in January, June, September and December 1993. Inflation was considerably reduced during the first three quarters of 1994 due to the strong monetary tightening of late 1993 and to the fact that administered prices were not allowed to adjusted until the end of 1994.

3.5 Interest rates

The following figures report the monthly weighted real interest rate on time deposits and the monthly weighted real interest rate on short term loans for those countries with available comparable data.

Given the fact that nominal interest stayed low because of informational problems, the behaviour of real interest rates is mainly determined by the behaviour of inflation. As it was anticipated by the data on inflation, the Baltic States seem to be the only countries to have succeeded in stabilising their economies. The negative interest rates in the early 1993

in Lithuania is easily explained by considering that inflation was then as high as four times more than in the other two Baltic States. Furthermore, the Central Bank of Lithuania adopted a highly restrictive credit policy in 1993 and early 1994. In the absence of a well functioning money market, banks had no uses for lent funds. As a result, real interest rates were strongly negative through the first four months of 1993.[12]

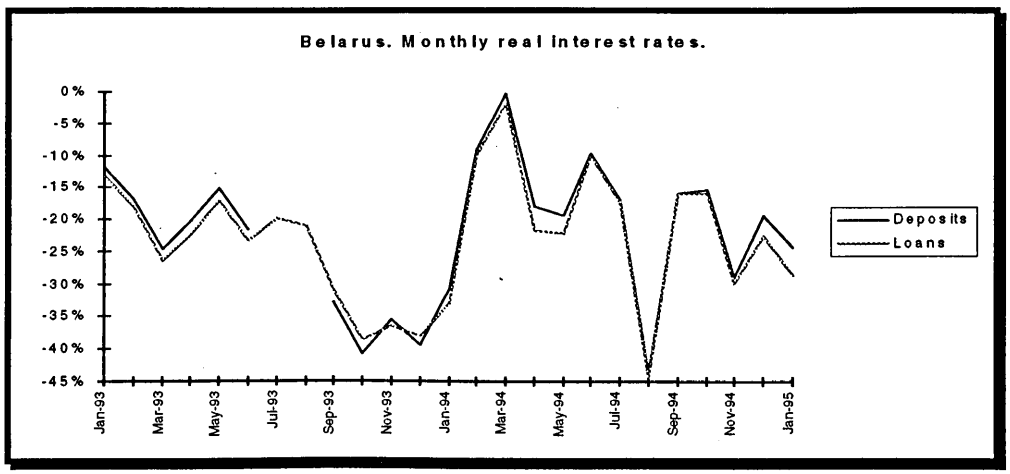

Figure 6 Loan and deposit interest rates in Belarus

[12] The credit ceilings imposed by the BOL may undermine the assumption of credit rationing as a result of asymmetric information for Lithuania. Although this should be generally true, in the Lithuanian case it does not look like being the case. Figure 9 shows that the abolition of the credit ceilings had no effect on real interest rates. This suggest the hypothesis that such ceilings were not binding after all.

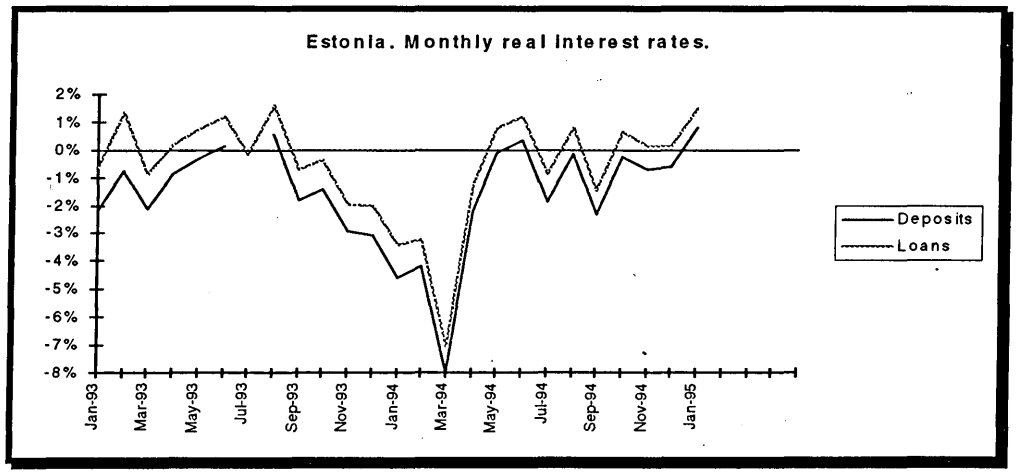

Figure 7 Loan and deposit interest rates in Estonia

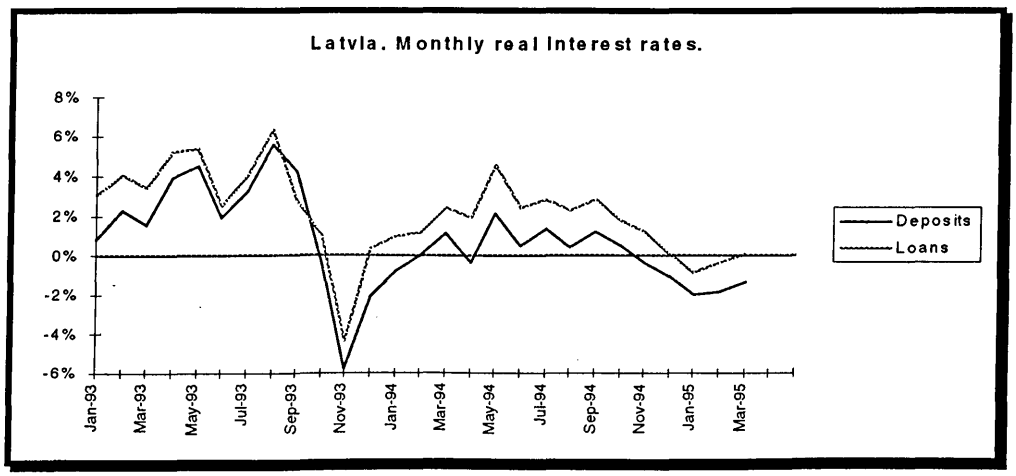

Figure 8 Loan and deposit interest rates in Latvia

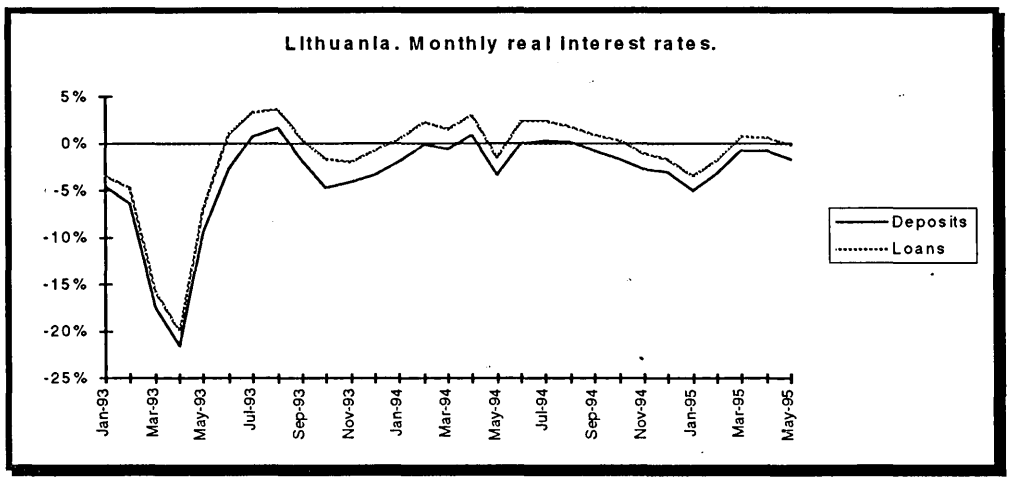

Figure 9 Loan and deposit interest rates in Lithuania

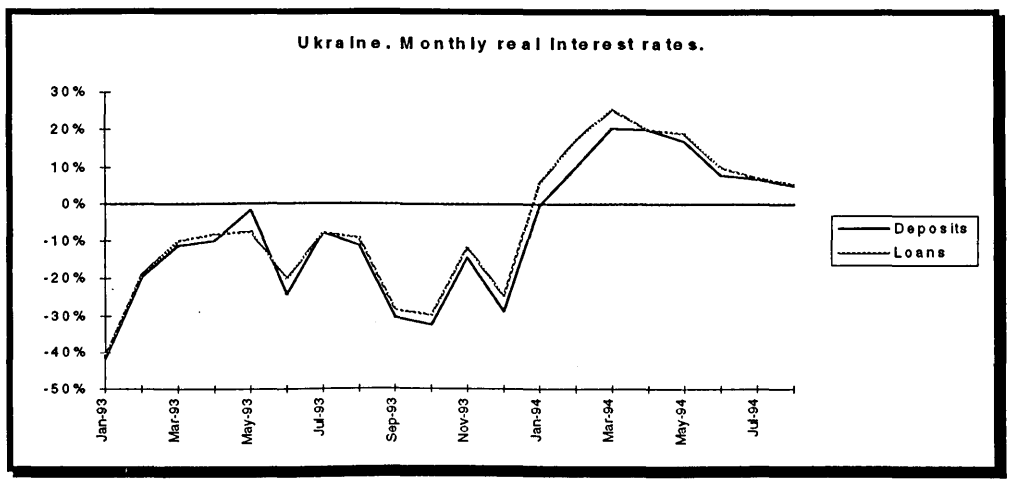

Figure 10 Loan and deposit interest rates in Ukraine

A feature which is in common to the three Baltic States (but of different magnitude) is the negative rates during the third quarter of 1993 and the first quarter of 1994. Again the inflation acceleration, caused in large part by the appreciation of the Russian rouble at the end of 1993, is mostly responsible for such a drop.

Belarus and Ukraine are clearly far from stabilising their economies. In Belarus, monthly real interest rates are highly negative and what is worse, they show a decreasing linear trend. In Ukraine, monthly real interest rates were negative throughout 1993 and then

positive during 1994. This behaviour mirrors the adjustments in the administered prices in 1993 and the tightening of the monetary policy late in the same year that managed to curb inflation until the end of 1994.

3.6 Savings

The high level of financial deepening achieved in the Soviet Union was eliminated soon after the political collapse. With the dissolution of the Soviet Union, fiscal deficits rose and private income dropped. This, together with the initial high inflation that resulted in negative real interest rates, discouraged private savings in the banking system. Table 2 shows the considerable decrease of deposits as a percentage of GDP that occurred in all surveyed countries during the first years of independence.

If before the independence, savings were redirected to finance the fiscal deficit, this was not possible anymore after the independence because of savings shortage and uncontrolled prices. With decreasing income, the only source of income left to the governments to finance fiscal expenditure was an inflation tax. Since the source of tax inflation is given by the monetary holdings denominated in local currency, the natural reaction to the government policy was a prompt switch into assets denominated in foreign convertible currency. Table 3 shows the marked increase in the share of deposits denominated in foreign currency in some countries.

In Estonia, despite the progressive liberalisation of foreign currency transactions, the share of foreign currency deposits held with commercial banks, fell from 31 percent at the end of 1992 to nearly 8 percent at the end of 1993, suggesting the growing confidence in the kroon. During the same period, time and savings deposits increased by almost 130 percent indicating improving confidence in the banking system. Nevertheless, this is not evident

when looking at the ratio of deposits over GDP. The ratio decreased by 2 percent in 1994, probably as a consequence of the 4 percent increase of real GDP during the same year.

Table 2 Deposits as % of GDP.

	Dec.-91	Dec.-92	Dec.-93	Dec.-94
Armenia	97.04	45.75	57.16	20.60
Belarus	-	30.92	22.22	34.60
Estonia	62.63	20.60	16.20	14.70
Georgia	32.69	27.75	18.85	
Latvia	-	17.70	21.10	27.63
Lithuania	-	33.94	17.36	28.31
Moldova	67.70	66.29	11.22	
Ukraine	51.31	22.69	6.44	5.83

Source: IMF

Table 3 Foreign Currency Deposits.

	Dec.-91	Dec.-92	Dec.-93	Dec.-94
Armenia	0.21	19.23	70.08	71.94
Belarus	-	5.44	44.38	
Estonia	-	31.0	7.39	16.88
Georgia	-	2.80	57.98	
Latvia	-	49.52	40.54	40.55
Lithuania	-	54.06	36.90	42.11
Moldova	-	-	-	-
Ukraine	-	11.91	36.10	86.04

Source: IMF

In Latvia, deposits increased in 1993 and 1993 as a ratio of GDP. Despite the appreciation of the lat and the high rates on the lat-denominated deposits in the first three quarters of 1993, foreign currency deposits, dropped from nearly 50 percent in the end of 1992 to 40 percent at the end of 1993 and they remained at that level throughout 1994.

In Lithuania, deposits increased only in 1994 as a ratio of GDP. Among the Baltic States Lithuania is the only state that experienced a decrease of deposits over GDP in until 1993. The reason for this delay is attributable to the restrictive credit policy of the Central Bank. As mentioned in section 3.5, credit ceilings discouraged the banks from attracting deposits.

With the exception of Belarus in 1994, all the other countries experienced a continuous decrease of the ratio deposits over GDP in all the years surveyed.

3.7 Domestic credit

The substantial financial disintermediation of the period 1991 - 1993 is also evident in the credit market. During those years, the ratio of domestic credit granted to the economy over GDP constantly decreased. In order to have an idea of the magnitude of the phenomenon in real terms, it is worth recalling the magnitude of real GDP decrease reported in section 3.1.

Table 4 Domestic Credit, GDP %.

	Dec.-91	Dec.-92	Dec.-93	Dec.-94
Armenia	67.45	66.50	41.99	24.02
Belarus	-	49.48	27.23	
Estonia	60.59	10.09	10.16	
Georgia	85.09	94.61	29.72	
Latvia	19.54	14.34	17.08	26.21
Lithuania	-	23.16	14.66	24.58
Moldova	64.32	49.95	21.73	
Ukraine	36.64	54.81	13.75	18.22

Source: IMF

Table 5 Private Sector DC , GDP %.

	Dec.-91	Dec.-92	Dec.-93	Dec.-94
Armenia	66.60	45.26	9.68	17.46
Belarus	-	44.43	18.25	
Estonia	55.73	11.44	12.71	
Georgia	78.36	72.52	20.54	
Latvia	-	12.80	13.72	19.21
Lithuania	-	11.42	13.87	24.03
Moldova	6.00	5.22	4.27	
Ukraine	24.42	36.09	12.48	13.47

Source: IMF

As it can be seen in Table 4 and Table 5,[13] during 1994, and for some countries already in 1993, the decreasing trend of financial disintermediation was reverted. This is

[13] A close look of the two tables reveals that percentages in Table 5 for Estonia (1992 and 1993) are higher than the respective percentages in Table 4. This is due to the fact that in the Estonian monetary survey the Credit to

particularly true for the domestic credit granted to the private sector. In Estonia, nominal credit to the private sector increased by 139 percent in 1993 while credit to state enterprises remained constant. This reflected the rapid expansion of the private sector and the reluctance of banks to lend to state enterprises, the future of which was uncertain in the privatisation process that was boosted in 1993.[14] In 1992, banks granted almost essentially short term credits but by the end of 1993 the maturity of such loans started increasing reflecting the increasing needs of the larger number of enterprises in the private sector to finance working capital.

In Latvia, domestic credit more than doubled in 1993. In that year, domestic credit to private sector increased from 11 to more than 18 percent over GDP. This increasing trend was reinforced in 1994. Although Latvia shows the strongest credit expansion among the FSU countries in the last two years, the maturity of the loan portfolios remained short throughout 1993 and it started increasing only last year.

In Lithuania, the Central Bank adopted a highly restrictive credit policy in 1993 and early 1994. Under such a policy, each commercial bank was given a limit on domestic credit expansion each quarter. This is probably the reason for the decrease of domestic credit over GDP in 1993. Nevertheless, as Table 5 shows, the ratio of credit to private sector over GDP

Government is net and negative. The data for Latvia 1992 and 1993 in both tables refer to January of the following year. Furthermore, the Latvian Domestic Credit to the private sector of the same two years includes credit to State enterprises.

[14] The total proceeds from privatisation sales amounted to EEK 37 million in 1991-92. In 1993, the value of sales reached more than EEK 300 million, of which EEK 125 million were due to small enterprise privatisation. Privatisation of public enterprises has proceeded with varying success, depending on the size of the enterprise and the type of business in which they were involved. (IMF, 1994 Estonia survey.)

increased from 12.5 to 13.5 percent that year. After the abolition of these ceilings in 1994, domestic credit over GDP expanded by 10 percent.[15]

With the exception of Ukraine, for which domestic credit over GDP increased in 1994 both in the private and government sector, the data collected show a continuous credit contraction for all the other countries. In Armenia although domestic credit to the whole economy contracted when measured over GDP, the same ratio relative to the private sector shows an increase of nearly 100 percent.

In the following section I develop a model of credit rationing that explains the factual evidence just presented. In particular I will relate the slow recovery of some country to wrong government intervention in their financial markets. No claim is made of a unique explanation of the patterns observed but only of mere possibility. Unfortunately, the lack of data for the period soon after the political collapse of the Soviet Union makes it impossible to test the veridicity of the assumptions made here.

4. THE MODEL

What follows is a one period model of credit rationing with *ex ante* asymmetric information and with three agents: borrowers, banks and government. Borrowers' type is not known to banks and therefore, credit rationing may arise. Such market failure justifies government intervention, which tries to expand credit by providing banks with "cheap" money. Because of the low levels of income funds cannot be raised through taxes or borrowing and seignorage is used instead. Inflation has a negative effect on the quality of the mix of applicants since it lowers the real return on borrowers' projects and this may

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[15] Notice that the relationship between credit ceilings abolition and credit expansion in 1994 is ambiguous. As already stated in footnote 12 it is dubious whether the credit ceilings were actually binding, since their abolition did not affect interest rates.

offset the increase in the supply of loans, which would derive from the government money expansion. Even if credit does not decrease, inflation may reduce borrowers' incentive to produce effort below the minimum level for their participation constraint not to bind and the financial system collapses because the demand for credit drops to zero. Alternatively, when the government tries to expand credit by increasing the value of the collateral that banks can seize in case of project failure,[16] inflation is not created, the quality of the mix of applicants improves and therefore, the credit rationing is relaxed.

4.1 Borrowers

A set of identical risk neutral firms (borrowers) each have wealth w insufficient to finance the activity of production (project) which costs $l > w$ in nominal wages.[17] In order to run the project, each borrower obtains a fixed size loan l through a credit contract with the banks in order to pay wages at the beginning of the period. The credit contract defines the nominal size of the loan l, the nominal interest rate r to be paid at the end of the period in case of success and the collateral c to be paid in case of failure. The project is stochastic, with a binary realisation of $X = 0$ in the bad state with probability $(1-p)$ or $X = M$ in the good state with probability p. The probability of success p is a function of the effort e that borrowers produce in running the project and it is logical to assume that $p'(e) > 0$. Effort is a cost for the borrower and it enters his maximisation problem through a cost function $g(e)$ with $g' > 0$ and $g'' > 0$. Because of a weak legal framework and private property right

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[16] The government can, for instance, strengthen legal framework for seizing collateral in bankruptcy states, enhance property rights *et cetera*.

[17] I assume that labour is the only input in the firm's production function. Alternatively, the model can be re-interpreted in terms of material inputs where short term lending is directed at funding inventories rather than wages. Under this interpretation, firms have identical up-front purchases of material inputs. The reference to wages is merely indicative.

system, in the bad state banks can seize a fraction $\beta \in [0,1]$ of the collateral agreed in the credit contract.

In the economy there is inflation π and although credit contracts are written in nominal terms, the parties are interested in the real value of the contract. Nevertheless, agents are not perfectly rational and can only anticipate a fraction $\gamma \in [0,1)$ of future inflation. In other words, agents, at the beginning of the transition, have not learned yet that they will be living in a high inflationary environment. Hence, borrower's real payoffs at the end of the period are $(-\beta c)$ in case of failure and $(m - lR)$ in case of success. Here $m = M\frac{1+\gamma\pi}{1+\pi}$ is the real value of the project in the good state and $R = (1+r)\frac{1+\gamma\pi}{1+\pi}$ is the real loan interest rate.

The assumptions made so far need some justification.

1. Borrowers are risk neutral and there is no reason why the market failure presented in this model would disappear if some agents were risk averse. The literature on credit rationing demonstrates that indirect screening mechanisms such as collateral and interest rate may not be sufficient to avoid credit rationing even when agents are risk averse (Bester 1985, Stglitz and Weiss 1992). Furthermore, risk neutrality allows us to show how credit rationing is not attributable to the underprovision of insurance schemes to risk averse agents (Mankiw 1986).

2. The size of the loan is fixed in nominal terms. This fits the information collected on the FSU countries. The rigidities in the labour market reported in section 3.2 allow us to assume that the nominal cost of labour was basically constant in the period 1992 - 1994.

3. Collateral is here constant in real terms and it seems unreasonable to assume the opposite. When inflation reduces the real value of money, borrowers can always hedge themselves by buying goods or any other asset whose nominal value increases with inflation.

4. The realisation of the project is negatively affected by inflation. The non-neutrality of money derives from the fact that inflation is only partially endogenised. Hence, unexpected inflation negatively affects projects as firms are likely to have sale contracts to meet stipulated at the beginning of the period. Also, changes in relative prices are unmistakably seen as the effect of real shocks only in a world with no inflation. But when inflation is positive, agents cannot distinguish between monetary and real components in the relative price change. As a result, unexpected inflation decreases the average profitability of a project since the information conveyed in the relative prices is reduced.

Hence, the borrower's real expected return on the project is given by:

(1) $$\phi(e) = -\beta c(1 - p(e)) + (m - lR)p(e) - g(e)$$

with $m > R > l > w = c > 0$.

By normalising $l = 1$ and assuming that $p(e) = e$ and $g(e) = \frac{ke^2}{2}$ with $k > 0$, borrowers' real expected return from the project can be re-written as:

(2) $$\phi(e) = -\beta c + (m - R + \beta c)e - \frac{ke^2}{2}$$

Borrowers maximise their real expected return given by (2) with respect to the effort e and subject to $e \in [0,1]$. Assuming an internal solution, this yields an optimal level of effort given by:

$$(3) \qquad \hat{e} = \frac{m - R + \beta c}{k}$$

In order for $\hat{e}$ to be not larger than one, it must be the case that $(m - R + \beta c) \leq k$. Furthermore, nobody would borrow if (2) were negative. Therefore, a participation constraint on the real expected return must be taken into consideration, which implies that the optimal level of effort be $0 < \sqrt{\frac{2\beta c}{k}} \leq \hat{e} \leq 1$. It is worth noticing that the optimal level of effort cannot be zero. In such a case, borrowers would lose βc with probability one and consequently, they would not borrow. In the presence of collateral, a lower bound for effort exists, which is increasing in the level of collateral that banks can seize in the bad state.

By totally differentiating the first order condition it is possible to determine the sign and magnitude of the change in the optimal level of effort for changes in the parameters. Thus:

$$(4) \qquad \frac{d\hat{e}}{d\beta} = \frac{c}{k} > 0; \quad \frac{d\hat{e}}{dr} = -\frac{1}{k(1+\pi)} < 0; \quad \frac{d\hat{e}}{d\pi} = \frac{R-m}{k(1+\pi)}(\gamma - 1) < 0.$$

The optimal level of effort is increasing with the seizeable collateral and decreasing with nominal loan interest rate and inflation. The reason for this is that, other things being equal, any increase in the seizeable collateral (nominal interest rate) will make that bad (good) state more costly and borrowers will try to compensate for this by modifying the optimal level of effort produced. Whenever effective inflation is higher than expected inflation the real value of repayment in the good state decreases. At the same time, the

profitability of the project for any level of effort decreases. Since the second effect offsets the first effect, borrowers are better off by reducing effort when effective inflation is higher than expected inflation.[18]

4.2 Banks

Banks are risk neutral and Bertrand competitors on the loan and deposit markets.[19] On each loan they grant, banks obtain βc when the project fails and lR when it succeeds. This means that banks' real expected return is given by:

$$\rho(r,c) = \beta c(1 - p(e)) + lRp(e) \tag{5}$$

Given the previous normalisation of $l = 1$ and the fact that $p(e) = e$, banks' real expected return, when the optimal response from borrowers is taken into consideration, can be re-written as:

$$\hat{\rho}(r,c) = \beta c + (R - \beta c)\hat{e} \tag{6}$$

Banks know that for any contract offered, borrowers' optimal effort is given by (3). Therefore, banks solve the maximisation problem recursively by taking into account borrowers' behaviour when maximising their real expected return. Banks' maximisation problem yields the following first order conditions:

$$\frac{\partial \hat{\rho}}{\partial c} = \beta\left[(1 - \hat{e}) + \frac{R - \beta c}{k}\right] > 0 \tag{7}$$

---

[18] Notice that when $y = 1$, $\frac{d\hat{e}}{d\pi} = 0$.

[19] Assume that banks are already re-capitalised and that re-capitalisation is perceived as a once and for all solution.

(8) $$\frac{\partial \hat{\rho}}{\partial r} = \frac{1+\gamma\pi}{1+\pi}\left(\hat{e} - \frac{R-\beta c}{k}\right)$$

Since (7) is monotonically increasing in c there will be no internal solution and banks will invariably ask for the maximum level of collateral from borrowers.[20] Since (8) is concave in r, it is possible to find an internal solution for the nominal interest rare: i.e. $1+r^* = (\frac{m}{2}+\beta c)\frac{1+\pi}{1+\gamma\pi}$. This corresponds to an equilibrium real interest rate $R^* = \frac{m}{2}+\beta c$ which is decreasing with inflation and increasing with seizeable collateral.

At the equilibrium values, borrower's and banks' real expected return are given by:

(9) $$\hat{\phi}\big|_{r^*} = -\beta c + \frac{m^2}{8k}; \qquad \hat{\rho}\big|_{r^*} = \beta c + \frac{m^2}{4k}$$

Notice that banks are Bertrand competitors, hence the equilibrium real expected return on each loan must be equal to the real interest rate on deposits. Thus:

(10) $$\hat{\rho}\big|_{r^*} = \beta c + \frac{m^2}{4k} = (1+i^*)\frac{1+\gamma\pi}{1+\pi} = I^*$$

This equation allows us to determine the change in the equilibrium real rate of deposit I^*.

(11) $$\frac{dI^*}{d\beta} = c > 0; \quad \frac{dI^*}{d\pi} = \frac{m^2(\gamma-1)}{2k(1+\pi)} < 0$$

---

[20] Notice that this justifies the assumption initially made that $w = c$.

(11) says that the real interest rate on deposits increases with the seizeable collateral and decreases with unexpected inflation.[21]

From totally differentiating the first order condition of this second problem, it is also possible to determine the sign and the magnitude of the change in the optimal loan rate R^* for a change in the other parameters. Hence:

(12)
$$\frac{dR^*}{d\beta} = c > 0; \quad \frac{dR^*}{d\pi} = \frac{m(\gamma - 1)}{2(1+\pi)} < 0.$$

(12) says that the equilibrium real interest rate R^* increases with the seizeable collateral and decreases with unexpected inflation.

4.2.1 The supply of funds and loans

Banks face a real supply of funds which is increasing in the deposit real interest rate given by:

(13)
$$L(I) = H(I) + FD$$

where $H(I)$ is the real supply of funds from households with $H' > 0$, FD is the (exogenous) real supply of funds from the government financed through a budget deficit and $I = (1+i)\frac{1+\gamma\pi}{1+\pi}$ is the real interest rate on deposits. Funds are used by banks as reserves RE or in order to supply credit S in proportions α and $(1-\alpha)$ respectively; i.e. $L = RE + S$. Therefore, if the reserve requirement is binding, the real supply of loans is given by:

---

[21] Notice the role played by unexpected inflation. Banks know that there will be inflation like all other agents and like all other agents know that their forecast will be always and systematically lower than effective inflation. Hence, nominal interest rate is higher than what be required if agents were perfectly rational.

(14) $$S(\rho) = (1-\alpha)L(\rho)$$

At the equilibrium real rate of interest R^*, demand for credit can be in excess of supply as shown in Figure 11 and credit rationing arises.

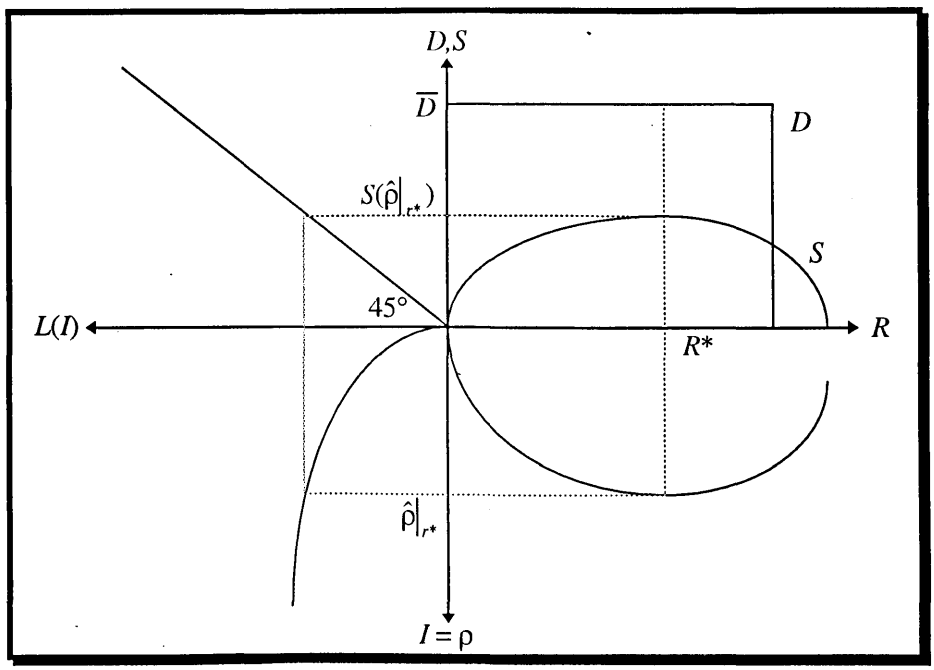

Figure 11: Credit rationing pooling equilibrium.

In the first orthant of Figure 11 we have the demand and supply of credit. The demand D is infinitely elastic with respect to the real loan rate of interest since borrowers are all the same and the total demand in the economy is given by $\overline{D}$. . The supply S is concave in R because of (8). Demand equals supply at the Walrasian real interest rate R_w (not shown in the figure). In the second orthant we have bank's real expected return on each loan ρ. In the third orthant we have the supply of funds to the banking sector $L(I)$. The level of credit rationing is given by $[\overline{D} - S(\hat{\rho}|_{r^*})]$. This is a type II credit rationing in the sense that, for the same loan, borrowers are willing to pay a higher real interest rate than the one set by the banks.

4.3 Government

The government is assumed not to have an objective function to maximise but it has a budget constraint to respect. The real government expenditure g, which is not financed by income taxes τ, gives rise to a real budget deficit FD that needs financing by printing high powered money. That is:

(15) $$FD = g - \tau = \Delta RE$$

(15) can only be fully justified if we assume that there is no currency outside banks. In such a case, the real supply of funds to the banks $L(I)$ can be interpreted as the real money supply and the real value of reserves RE as the real high powered money.

It is possible to interpret (15) in a even more interesting way. In fact, the change in real high powered money can be re-written as:

(16) $$\Delta RE = \frac{RE^{n}_{t+1} - RE^{n}_{t}}{P_t}$$

where $RE^{n} = \alpha PL(I)$ is the nominal value of reserves. By substituting the expression for the nominal value of reserves into (16), (15) can be re-written as:

(17) $$FD = \pi RE$$

(17) says that the government fiscal deficit has to be financed by a tax inflation and the base for this tax is the real money balances $RE = \alpha L(I)$.

4.4 Credit expansion or contraction?

Given the market failure stemming from asymmetric information, it is safe to assume that the government may intervene in various ways in order to increase efficiency in the

credit market. The theoretical literature actually justifies public intervention in the presence of imperfect information because of its ambiguous effects on investment (Stiglitz and Weiss 1981, 1992, De Meza and Webb 1987) and externality-like effects (Greenwald and Stiglitz 1986). The model just developed allows us to analyse two alternative intervention policies.

4.4.1 Exogenous increase in the supply of funds

The government can exogenously expand the supply of funds to the banking sector by printing money and letting banks allocate the extra funds to borrowers. By doing so inflation is produced by (17) $\frac{d\pi}{dFD} = \frac{1}{RE}$. When inflation is produced, both borrowers and banks experience real costs as there is always part of this inflation that is not forecasted. From (9) we obtain:

(18) $$\frac{d\hat{\phi}\big|_{r^*}}{dFD} = \frac{m^2(\gamma-1)}{4k(1+\pi)}\frac{1}{RE} < 0; \quad \frac{d\hat{\rho}\big|_{r^*}}{dFD} = \frac{m^2(\gamma-1)}{2k(1+\pi)}\frac{1}{RE} < 0$$

where $\frac{d\hat{\phi}\big|_{r^*}}{dFD}$ is the change in the equilibrium real return for the borrower and $\frac{d\hat{\rho}\big|_{r^*}}{dFD}$ is the change in the equilibrium real expected return to banks when the government exogenously increases the supply of funds. Notice again that there is no change in the equilibrium if all inflation produced is endogenised by agents; i.e. $\gamma = 1$. In this case money is neutral. Since both borrowers and banks lose from unexpected inflation, with the latter losing more than the former, it is ambiguous whether the ration on credit is going to be relaxed or tightened after government intervention. To see this, it is necessary to evaluate the supply of loans at its maximum by substituting (10) into (13) and the result into (14). By doing so, the equilibrium supply of credit can be re-written as:

$$(19) \qquad \hat{S}\Big|_{r^*} = (1-\alpha)\left[H(\beta c + \frac{m^2}{4k}) + FD\right]$$

It is straightforward to calculate the change in the equilibrium supply of credit when *FD* increases:

$$(20) \qquad \frac{d\hat{S}\Big|_{r^*}}{dFD} = \frac{\partial S}{\partial FD} + \frac{\partial S}{\partial I^*}\frac{\partial I^*}{\partial \pi}\frac{d\pi}{dFD} = (1-\alpha)\left[1 - \frac{\partial H}{\partial I^*}\frac{m^2(\gamma-1)}{2k(1+\pi)}\frac{1}{RE}\right]$$

The sign of (20) depends on the elasticity of the households' supply of funds with respect to the deposit real rate of interest and by how much inflation is anticipated by agents. For a given γ, if the supply of funds is sufficiently elastic, credit rationing is likely to increase. The increased inflation will lower the real interest rate on deposits by (11), therefore reducing the households' supply of funds to the banks.

This possibility is shown in Figure 12 where the gap between demand and supply increases. The increase in government funds will shift the supply of funds to the left in the third orthant. At the same time the higher inflation will reduce the profitability of borrowers and hence, the real expected return to banks. Banks cannot increase the nominal interest rate on loans in order to fully compensate the increase in inflation because this would further decrease the level of effort that borrowers produce. Therefore, real interest rates decrease on both loans and deposits. In Figure 12 the supply of funds is highly elastic to real interest rate changes and the decrease of the deposit rate from I^* to I'^* more than offsets the exogenous increase in *FD*. Consequently, the equilibrium supply of credit diminishes in the first orthant and the level of credit rationing increases. Of course, if the elasticity of household's supply

of funds with respect to the deposit real rate of interest is sufficiently low, the outcome of this policy may be reversed and credit rationing may actually decrease.[22]

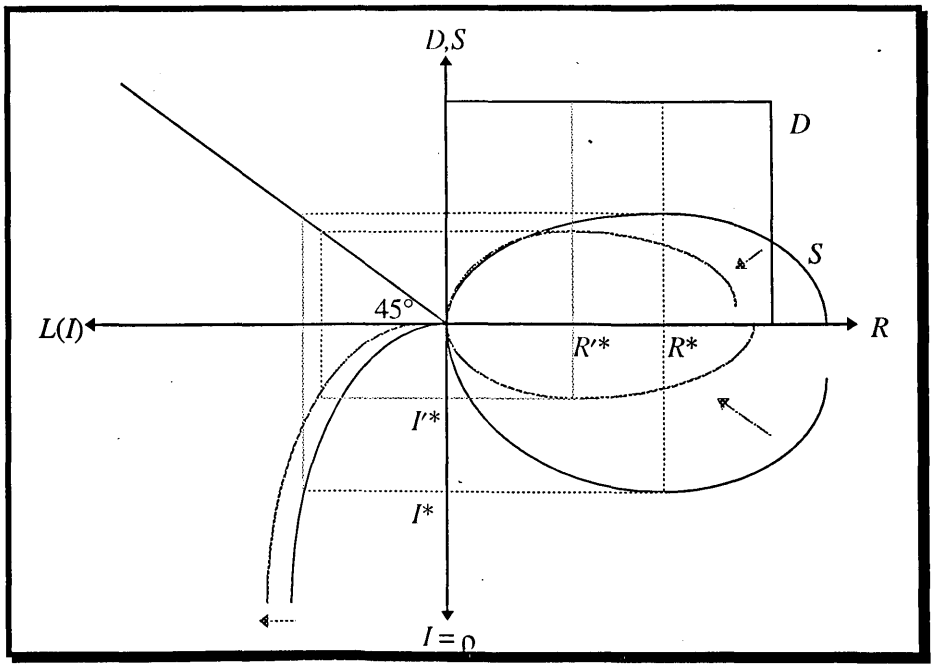

Figure 12: Government providing "cheap" money to banks.

A second important result deriving from this analysis should be also taken into consideration. This result answers the question whether the policy of "cheap" money is in the end sustainable. In order to do this it is necessary to further consider borrowers' participation constraint. When effective inflation is higher than unexpected inflation, we know by (4) that the optimal level of effort $\hat{e}|_{r^*} = \frac{m}{2k}$ is lower than what necessary to maximise borrwers' utility. This means that the condition $\sqrt{\frac{2\beta c}{k}} \leq \hat{e}|_{r^*}$ for the participation constraint to hold, may fail when inflation is not correctly anticipated. Therefore, it must be

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[22] The likelihood of such outcome can be increased if governments announce well in advance their policies and the inflationary nature of money expansion. In this case, inflation would be almost fully anticipated and the adverse effect on rationing , that derives from the households' supply, would be limited.

the case that for high levels of inflation π such that $\tilde{\pi} < \pi$, real expected return from the project becomes negative for every borrower and the whole credit market collapses.[23]

A first conclusion can be drawn from the previous analysis. A policy aimed at expanding credit by providing money to the banking system and relying on the inflation tax, may not increase the supply of credit if households' supply of funds is sufficiently elastic to the real interest rate on deposits and if agents do not anticipate such policy. Furthermore, even if expansion is achieved, this may not be sustainable and it could risk the collapse of the whole financial system.

4.4.2 Increasing seizeable collateral

The model suggests a second alternative for the government to expand credit. This is strictly related to the idea of making borrowers more profitable to banks and it is suggested by the role of collateral in the model. The government could for instance spend its limited resources in improving the legal framework governing bankruptcy procedures or in strengthening the private property rights system. This would increase the value of collateral that banks can seize in case of project failure. The strategy seems to be less inflationary than the previous one and it possesses a further strength: by (4), when banks can seize a higher fraction of the collateral agreed in the contract, the level of effort produced by borrowers increases. Because of (7), this yields positive profits to banks, which start competing for borrowers by raising nominal interest rates. Credit expansion will therefore be achieved without lowering the productivity of investments. By recalling that $\hat{S}\big|_{r^*} = (1-\alpha)\left[H(\beta c + \frac{m^2}{4k}) + G\right]$ from (19), the change in the supply of credit for a change in β is given by:

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[23] For a similar result, see Mankiw (1986).

(21) $$\frac{d\hat{S}\Big|_{I^*}}{d\beta} = (1-\alpha)\frac{\partial H}{\partial I^*}c > 0$$

which still depends on the elasticity of the households' supply of funds with respect to the deposit real rate of interest $I^* = \beta c + \frac{m^2}{4k}$, but it is nevertheless unambiguously positive.

5. CONCLUSIONS

The data collected on eight countries of the former Soviet Union (Armenia, Belarus, Estonia, Georgia, Latvia, Lithuania, Moldova and Ukraine) over the period 1991 - 1994 suggest that these countries experienced a considerable economic instability from which only the Baltic States seem to have recovered at the end of 1994. The economic instability of the countries investigated was characterised, among other things, by a sharp decrease in real GDP, high inflation, low real interest rates and financial disintermediation. Furthermore, rigidities in the labour market implied that nominal wage and employment remained relatively constant over the period.

The initial instability is well explained by the hypothesis of monetary overhang. Before the political collapse, the financial sector of the Soviet Union was characterised by forced private saving and government dissaving. On the one hand, excess demand on the good market and fixed prices, meant that the private sector was forced to save the excess money balances. On the other hand the government did not cover all public expenditure from taxation and the financial sector intermediated to make private savings available to cover the excess.

This excess growth did not lead to substantial inflation because of the extensive system of price controls and the inflationary pressure was simply postponed until later price

liberalisation. The regime of repressed inflation, prior the dissolution of the Soviet Union, determined the accumulation of nominal money balances, and the consequent excess demand on the good market. This, could only be eliminated by setting the economy on a different path with higher nominal interest rates and prices. Higher nominal interest rates would clear the financial market while higher prices would clear the good market.

Two issues have been analysed in this chapter:

1. Interest rates remained very low despite what is suggested by the monetary overhang hypothesis. It seems that the adjustment (partially achieved only in the Baltic States) took place only through prices. It has been claimed here that in all countries, interest rates stayed low because of the imperfect information that banks have on borrowers. When banks cannot perfectly screen borrowers, they offer contracts with collateral and interest rate that maximise their expected profits with no consideration about the demand level. If this is the case, the equilibrium interest rate need not to be the Walrasian interest rate and borrowers are rationed.

2. The economic recovery seems to have taken place only in the Baltic States but in a period of time well beyond what the monetary overhang hypothesis suggests. In these countries, the level of financial deepening, measured as the ratio of domestic credit to the private sector over GDP, started increasing already in 1993, suggesting a relationship between financial deepening and growth. The Baltic States are not the only states showing this pattern. In 1994 financial deepening increased also in Belarus and Ukraine. Nevertheless these two countries are far from showing positive growth.

It is claimed in this paper that one possible explanation for the different pattern followed in the transition between the Baltic States and the rest of the FSU countries lies in

the presence of imperfect information in the credit market, coupled with a weak institutional and legal framework, especially as far as the system of property rights is concerned.

In such a set up, governments have tried to increase the efficiency of the credit market by providing the banking sector with "cheap" money. Because of the low revenues from income, the only source for this extra funds has been the inflation tax. Nevertheless, by producing inflation which is not perfectly anticipated, governments reduced the profitability of projects for borrowers and as a consequence, the real expected return to banks on each loan. As a result, banks kept nominal interest rates on loans low in order to offset the negative impact of inflation on borrowers' quality. This meant that lower profits were available to pay depositors and nominal interest rates on deposits also remained low.

Credit rationing has been relaxed in those countries with low inflation, with a stronger legal framework and better defined institutions. In countries with high inflation, the quality of borrowers has been too low to create any substantial demand for credit. The situation of the financial market in countries such as Belarus, Ukraine, Georgia and Armenia is a situation of virtual collapse with extremely low demand for credit despite the negative real interest rates on loans.

The role of unexpected inflation and collateral in this model suggests a second option available to governments to expand credit. By increasing the value of the collateral that banks can seize in the event of project failure, governments improve the quality of applicants served by banks. This policy is unlikely to be as inflationary as the previous one and it would result in higher real interest rates and increasing supply of credit from the banking sector. More specifically, governments should first stabilise their economies and through this, reduce inflation and create the conditions for a positive credit demand. Once

the demand for credit exists, it can be improved by strengthening the legal framework with particular reference to the bankruptcy law and private property right systems.

CHAPTER 2

Credit Rationing, Group Lending and Optimal Group Size

6. INTRODUCTION

Credit is an important constraint on production in developing countries. Formal credit is almost unavailable to the rural poor because their lack of collateral, and the extreme unpredictability of the weather, make them "unprofitable" to formal lenders. Informal credit, although widely present, is granted by moneylenders at extremely high interest rates which limit the set of feasible productive projects available to borrowers. In this context the availability of credit at lower costs is considered essential to alleviate poverty and promote economic development in developing countries, especially in rural areas.

Rural households in marginal areas of developing countries are often said to be too poor to be profitable to formal lenders (Otero 1995, Hossain 1988, Von Pischke 1991). The principal reasons being that, due to the lack of seizeable collateral, formal lenders find the screening problem extremely costly relative to the small size of the loan that poor borrowers usually request. Group lending programmes have been introduced in various countries at an increasing rate thanks also to subsidised credit, but have moved beyond being profitable and often failed to properly target poor borrowers (Devereux and Fishe 1993, Khandker *et al.* 1995). The Grameen Bank experiment in Bangladesh has probably been the most successful of such programmes[24] and due to its success, almost all group lending programmes in other developing countries have been designed upon this model.[25]

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[24] Important studies of the Grameen Bank and other successful rural credit programmes are: Hoff *et al.* 1993, Hossain 1988, Huppi and Feder 1990, Khandker *et al.* 1995, Von Pischke *et al.* 1983, Wahid 1994, Wenner 1995, Yaron 1992.

[25] Among the developing countries that have introduced group lending programmes modelled upon the Grameen Bank system are: Bolivia, China, Kenya, India, Indonesia, Lesotho, Nepal, Nigeria, Malaysia, The Philippines and Tanzania. In the United States, the Grameen Bank system has been replicated in the city of Chicago and rural Arkansas (Armendáriz and Gollier 1996).

This chapter is structured in the following way. In section 7, drawing on the existing literature on group lending, I analyse the group characteristics that are likely to make a group credit contract more efficient that an individual credit contract. The literature has so far concentrated on various issues such as the risk sharing properties of the group contracts, their informational content, efficiency, welfare properties, monitoring structures and joint responsibility of project outcome. Little work has been done on why credit groups tend to be small and little weight has been put on the social interactions that seem to me crucial in explaining group formation and behaviour. In section 8 I present a model of group lending which focuses specifically on the issues of social sanctions and optimal group size. The contribution to the existing literature consists in the attempt to formally study the determinants of group size in group lending contracts. Conclusions follow in section 9.

7. GROUP CHARACTERISTICS

In the principal agent framework of credit contracts, specific characteristics of group credit have been identified, likely to make group credit contracts more efficient than individual credit contracts. At the stage of group formation agents are likely to make use of superior private information in choosing their peers: self selection is likely to take place then, excluding bad types from the contract. Peers are usually jointly responsible for the group outcome and this incentive scheme triggers a monitoring activity among group members. Mutual monitoring structures can be efficient in small groups but hierarchical monitoring structures with specialised monitors tend to be preferred in larger groups. Non-monetary disutility in the form of social sanctions, shame, guilt and stigma play a crucial role in imposing discipline on individual behaviour. The nature of the group implies that problems such as co-ordination and/or free riding can be extremely detrimental to the success of group credit schemes. However, an appropriate incentive scheme based on the characteristics just

mentioned, and that has the basic property of transferring risk from the principal to one or more (eventually all) agents, is thought to be able to offset the lack of collateral and increasing efficiency in rural credit markets.

7.1 Self selection

Credit groups work as self selection mechanisms and can improve the informational content of credit contracts. Co-borrowers are likely to make use of latent information not available to formal lenders in their screening process (Wenner 1995), therefore excluding high risk type from the group. Wenner (1995) uses data collected from the FINCA (Fundación Integral Campesina) group credit programme in Costa Rica to study the viability and cost effectiveness of group credit as a means to transmit information about borrower creditworthiness. FINCA is a non-profit development agency whose objective is to assist poor rural communities through the establishment of self-sustaining, locally managed and controlled loan funds used to finance either consumption or productive projects. Small groups of farmers and rural women without collateral receive up to US$ 384.00 for a period of one year at an interest rate that varies between 15 - 33%. The group distributes the loan in equal shares among co-borrowers who are jointly responsible for the loan repayment at the end of the period. Wenner argues that credit groups improve information transfer as co-borrowers make use of latent information not available to formal lenders in their screening processes. His empirical results are based on an individual credit assessment model of the following kind:

$$y_t = \alpha + \beta_1 x_{1t} + \beta_2 x_{2t} + u_t$$

where:

y_t is a binary variable with value one if individual repayment was delayed or did not occur, zero otherwise.

x_{1t} is a binary variable with value one if the individual belonged to a group that had a written code of regulations, zero otherwise.

x_{2t} is a binary variable with value one if the individual belonged to a group that screened according to reputation, zero otherwise.

By using the above logit model for 118 individuals Wenner (1995) finds that x_{2t} is statistically significant and with the right sign (negative) while x_{1t}, although with the right sign (negative), is statistically non-significant. The fact that x_{1t} is non significant suggests that self-selection may have occurred at the stage of group formation and that the fact that groups have a written code of behaviour is irrelevant once individuals have agreed to it. The fact that x_{2t} is significant suggests that groups make use of extra information ("reputation" in Wenner's (1995) paper) which is unlikely to be available to formal lenders.

7.2 Joint liability

Joint liability is used in almost all group lending programmes. With joint liability assigned to all group members, each member of the group is responsible for all individual loan repayments and can be asked to make up for the missing repayment of defaulting members.

Devereux and Fishe (1993) develop a principal-agent model with risk neutral lenders operating in a perfectly competitive credit market and risk neutral borrowers organised in groups of $(N+1)$ members. Each borrower has wealth W which is put up as collateral C in the group. Investors request a loan of size 1 to finance a project with payoffs X in the good state and zero in the bad state. There are γ high-risk borrowers in the economy and $(1-\gamma)$

low-risk borrowers. There are two kind of projects available to borrowers: a risky project (1) and a safe project (2). The two projects succeed with probability δ_1 and δ_2 respectively with $\delta_2 > \delta_1$. Borrowers are jointly liable for each others' repayments and the collateral of defaulting members is redistributed among the non-defaulting members of the group.

The lender's problem is to design two loan contracts which maximise profits and provide borrowers with an incentive to self-select by level of risk. The lender decides the interest rates $R_i = (1 + r_i)$ and the amount of collateral required C_i for each contract, where $i = 1,2$. Furthermore, the lender borrows funds disbursed as loans at an interest $I = (1 + i)$.

Since lenders are perfect competitors on the deposit market, the lender's profit maximisation problem can be re-written as the maximisation problem of borrowers' utility subject to (among other constraints) a zero profit constraint for the lender. Thus:

$$\max_{\{R_i,C_i\}} \quad \gamma g(\delta_1,R_1,C_1)+(1-\gamma)g(\delta_2,R_2,C_2)$$

s.t.

$g(\delta_1,R_1,C_1) \geq g(\delta_1,R_2,C_2)$

$g(\delta_2,R_2,C_2) \geq g(\delta_2,R_1,C_1)$

$\delta_i R_i, = I$

$0 \leq C_i \leq W$

where $g(\delta_i,R_i,C_i) = \delta_i(X-R_i)-(1-\delta_i)C_i + \sum_{a=0}^{N}\binom{N}{a}\delta_i^{N-a}(1-\delta_i)^a\left[\frac{a}{(N+1-a)}\right](C_i-R_i)$ is the payoff function.

The first two incentive compatibility constraints guarantee self-selection, the third constraint is the participation constraint for the lender and the fourth constraint guarantees that borrowers are not asked to put up more collateral than their wealth. Notice that in the participation constraint of the lender there is no collateral as the joint liability clause implies that loan repayment does not take place only when all members fail. Whenever there are $a \leq N$ members defaulting the other $(N+1-a)$ members will share among them the defaulting members' collateral and indemnify the lender against these defaults.

The solution to this problem is markedly different from the solution (using the same set-up) of the problem with only one borrower. In the problem with only one borrower the low-risk type receives a contract with high interest rate and zero collateral while the high-risk type receives a contract with lower interest rate and positive collateral. In the group lending case, the group formed by high-risk types will be offered a contract with both higher interest rate and collateral. The justification for this is that a high-risk group will share the burden of re-paying another member's debt more often than members of a low-risk group. Therefore, they will require more collateral to offset this burden.

7.3 Small group size

When group membership increases, the value of joint liability in encouraging members to assist each other is reduced. This is because the share of collateral from the marginal defaulting members assigned to non defaulting members is reduced. Furthermore, the costs of monitoring increase with group size and it is unlikely that members would increase proportionally the effort in monitoring; hence, reducing the overall control on members' actions. In order to encourage monitoring, some lending programmes have assigned joint liability only to a few group leaders. These individuals are likely to be seriously affected by

even one default and therefore, will specialise in monitoring in order to prevent such occurrence.

7.4 Monitoring

Joint responsibility of loan re-payment implies that co-borrowers have the incentive to monitor each other (Varian 1990). As is most likely to be the case, it is particularly feasible when monitoring costs are lower for peers than for formal lenders'. In general, in a principal-agent problem, when the output of one agent is correlated with the actions of other agents, the optimal incentive scheme typically involves making the payments to one agent depend on the output of the other agents. This is clearly shown in Stiglitz (1990). In his model, risk averse borrowers borrow a loan L to finance a stochastic project that yields $Y_t(L)$ if successful and zero if unsuccessful. The subscript $t = r,s$ indicates that borrowers can choose between a safe or a risky technique with the probability of success of the safe technique always higher than the probability of success of the risky technique: i.e. $p_s > p_r$. Furthermore, the safe project stochastically dominates the risky project: i.e. $p_s Y_s > p_r Y_r$. Borrowers have zero collateral and produce effort when running the project. Their expected utility from the project is given by:

$$V_t(L,r) = U[Y_t(L) - (1 + r)L]p_t - v(e(L))$$

where r is the interest rate to be paid on the loan when the project is successful and the term $v(e(L))$ is the disutility of effort e with $v' > 0$ and $v'' > 0$. Effort is not assumed to affect the probability of success of the project but it is function of the loan size and $e'(L) > 0$.

Perfect competitive banks receive the loan repayment $(1 + r)L$ in the good state, zero in the bad state and their cost of capital is constant and equal to ρ because of the assumption of perfect competition. Therefore, their zero profit condition is given by:

$$\Pi_r(L,r) = (1 + r)Lp_t - L\rho = 0$$

Since the probability of success of the safe technique is higher than the probability of success of the risky technique there is a moral hazard problem in the sense that banks prefer borrowers to use always the safe technique while this may not be incentive compatible for borrowers. In order to make the choice of the safe technique incentive compatible for borrowers, banks ration borrowers along their own zero profit locus and so that borrowers are indifferent between choosing the safe or the risky technique. This occurs along the locus of L and r such that $V_s(L,r) = V_r(L,r)$.

Stiglitz (1990) shows that if borrowers were allowed to form groups in which members monitor each other and report agents using the risky technique, the credit rationing that arises in an individual contract can be relaxed. The idea is that monitoring improves the informational content while transferring risk from the principal to the agent and therefore, allows banks to offer a larger loan with at least the same (if not lower) interest rate.

The way monitoring is triggered is by offering a contract to a group of, say, two borrowers where one borrower agrees to cosign the loan and pay qL (with $q > 0$) to the lender in the event that the loan he has cosigned goes into default. Making one of the borrowers cosign the loan imposes an additional risk that will trigger the activity of monitoring, costless by assumption. Furthermore, since borrowers are identical,[26] they jointly decide whether to undertake the safe or the risky technique. In this set-up the locus of points L and r for which the two borrowers are indifferent between the safe and the risky technique is given by:

$$U[Y_s(L) - (1 + r)L]p^2_s + U[Y_s(L) - (1 + r - q)L]p_s(1 - p_s) =$$

[26] Stiglitz (1990) assumes perfect self selection at during the stage of group formation.

$$U[Y_r(L) - (1 + r)L]p^2_r + U[Y_r(L) - (1 + r - q)L]p_r(1 - p_r)$$

Under plausible conditions, Stiglitz (1990) shows that there is a positive relationship between the size of the loan L needed to attain a certain level of utility and the magnitude of the cosignee's payment rate q. In other words in order to compensate the cosignee for taking additional risk, the lender has to provide a larger loan: i.e. credit rationing is relaxed.

In the next section I will draw on the results just shown in order to construct a model of group lending.

8. A MODEL OF GROUP LENDING: OPTIMAL GROUP SIZE

The model in this section is divided into two parts. In the first part I consider an individual loan contract and prove that rich borrowers with collateral are more profitable to formal lenders than poor borrowers with less or no collateral. This means that in the competition for loans, poor borrowers will only be served after all rich borrowers and in a world with limited credit, it is likely that poor borrowers are credit constrained. This provides a justification for the institutional response of group lending and the analysis in the second part of the model.

Among the various issues that characterise credit groups, I want to analyse the determinants of the group size. Little formal analysis has been done on the determinants of group size and the usual explanation put forward for the instability of large groups is related to the free riding problem (Armendáriz 1995), or to the reduced control over peers in large groups (Devereux and Fishe 1993). These may account for much of the reasons why groups tend to be small but it does not seem to be the only reasons. Social factors, such as social norms, imitation, conformism *et cetera*, related to the particular nature of the group should be also taken into consideration. This paper is an attempt to formally model the effects of

social factors on the size of borrowing groups and such analysis incidentally provides an indirect answer to the question of why it has been difficult to replicate the Grameen experiment outside Bangladesh (Thomas 1995).

The only paper surveyed which considers a group with more than two borrowers is the paper by Devereux and Fishe (1993). The authors analyse the effects of the joint liability clause in a group lending contract using a group of $(N+1)$ borrowers. The group size is taken as given and the problem for the lender is to offer two contracts which enable to separate high-risk groups from low-risk groups. Because of self-selection during the stage of group formation (or "assortative matching" in Armendáriz 1995, Armendáriz and Gollier 1996) the probability of success of each group member are identical. Exactly this allows Devereux and Fishe to use the binomial distribution to determine the probability of default of $a \leq N$ members in the group.

It would have been interesting to use the same framework and introduce social customs to endogenise the group size but this appears not to be possible. The main reason for rejecting the Devereux and Fishe's (1993) framework is that group size is likely to be related to the behavioural characteristics of individual borrowers within the group. This suggests that individual borrowers cannot be *ex ante* homogeneous since a group of perfectly identical members does not create the possibility of any sort of social interaction. The fact that group members can be heterogeneous does not necessary imply that the self selection process that takes place during the stage of group formation is of no value. It only points out that the use of private information to select low-risk borrowers cannot possible achieve the selection of perfectly identical individuals.[27] In my model there are several differences from Devereux and Fishe (1993):

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[27] See Armendáriz and Gollier 1996 for a model with heterogeneous borrowers.

1. the group size is assumed to be a continuous variable and it is endogenously determined. This implies that I cannot use the binomial distribution to keep on board joint liability.[28] As a matter of fact this assumption is dropped and the lender will be partially insured against individual defaults in the group by the fact that now the lender can seize the collateral of defaulting members.

2. Members produce effort in running their own project and therefore, they affect the project probability of success. This means that the members of a group can have different probabilities of success. In other words, self-selection during the stage of group formation matches similar but not necessarily identical individuals. This hypothesis allows me to analyse the possibility of individual deviations from a group norm in terms of effort.

3. In Devereux and Fishe (1993) the lender receives a constant full repayment in all states of the world except when it receives zero because all members default. In my model the lender receives full repayment only when all members succeed and members' collateral when everybody in the group defaults. In all intermediate states of the world the lender receives decreasing repayments constituted by a combination of loan repayments from successful borrowers and collateral from unsuccessful borrowers. This apparent lack of insurance is offset by the fact that borrowers now produce effort which affects the probability of success of each individual project; thus, the expected profit to lender will be constant in all states of the world.

4. This introduces another difference which is the presence of monitoring. Members can deviate from a social norm and this produces a disutility to all participants.

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[28] Notice that the binomial distribution can be approximated by a continuous distribution. The reason why joint liability is ignored in my model is that the members of a group can have different probabilities of success. See further.

Costly monitoring ensures that deviations can be observed and properly punished. Non-monetary disutility in terms of social sanctions is inflicted on deviating members by all non deviating members. Since the imposition of social sanctions is assumed to be costless, the threat of punishment is credible.

8.1 Borrowers

In this section I will consider the outcome of individual credit contracts. Borrowers are risk neutral[29] with wealth w and each (individually) obtains a loan L in order to finance an investment project represented by a random variable X_t that yields x_t with probability p_t or zero with probability $(1-p_t)$. In running the project borrowers can choose between a safe and a risky technique; this is again indicated by the subscript $t = s,r$. If the project is successful borrowers will pay back the loan plus an interest on the loan $LR = L(1+r)$ where r is the loan nominal interest rate. If the project is unsuccessful borrowers will lose collateral in the amount of $c \leq w$.

When using the safe technique the payoff of the project in the good state is x_s while it is x_r when the risky technique is used. The payoff of the project in the good state is a concave function of the loan size, i.e. $x_t'(L) > 0$ and $x_t''(L) < 0$. The fixed costs associated with the risky project are larger than for the safe project: i.e. $\overline{L}_r > \overline{L}_s$. At the same time, for any loan size the return to scale to the risky project are larger than for the safe project: i.e. $x_r'(L) > x_s'(L)$. With the aid of Figure 13 it is possible to explain the implications of this assumption. For any loan size $L > \overline{L}_r$, the return to the safe project is larger than the return to the risky project. Nevertheless, since returns to scale are larger for the risky project, there

[29] Similar results can be obtained with risk averse borrowers.

will be a loan size L^* such that for $L > L^*$ the return to the risky project is larger than the return to the safe project.

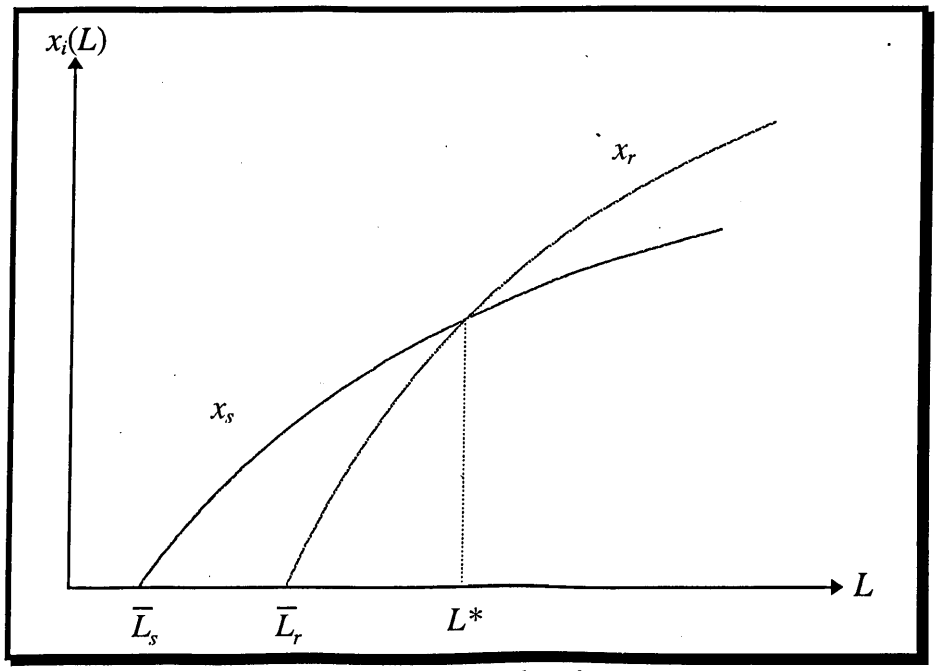

Figure 13 Project returns to scale when safe and risky techniques are used.

Finally, the probability of success of the risky technique is lower than the probability of success of the safe technique for any given other parameter and the safe project stochastically dominates the risky project for all L.

In running the project borrowers produce an effort e at a cost given by a convex function $h(e)$ and the probability of success of the project is positively correlated with effort, i.e. $p_i'(e) > 0$. Thus, borrowers' expected utility from the project is given by:

$$(22) \qquad EU_t(e,R,c,L) = p_t(w + x_t - LR) + (1 - p_t)(w - c) - h(e_t)$$

I will simplify this general form by assuming that: $p_t = e_t$, $h(e_t) = \frac{k_t}{2}e_t^2$ with $k_t > 0$[30] and by renaming $(w + x_t - LR)$ as W_t. Furthermore, I will assume for the moment[31] that banks require borrowers to put up all their wealth as collateral: $c = w$. Thus, (22) can be re-written as:

(23) $$EU_t(e,r,L) = e_t W_t - \frac{k_t}{2}e_t^2$$

where $e_t W_t$ is the borrowers' expected payoff from the project.

For any given L and R borrowers maximise (23) with respect to e_t. Assuming an interior solution, the optimal effort function is given by:

(24) $$\hat{e}_t = \frac{W_t}{k_t}$$

Notice that other things equal an increase in wealth (and therefore, collateral) increases the optimal effort produced in equilibrium $\frac{\partial \hat{e}_t}{\partial w} = \frac{1}{k_t} > 0$; an increase in the loan size has an ambiguous[32] effect on effort $\frac{\partial \hat{e}_t}{\partial L} = \frac{x_t' - R}{k_t}$; an increase in interest rate has a negative effect on effort $\frac{\partial \hat{e}_t}{\partial R} = -\frac{L}{k_t} < 0$.

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[30] Notice that since $p_t = e_t$, it must follow that $k_t < (w + x_t - LR)$ so that $e_t \in (0,1)$. Furthermore, it has been said that $p_s > p_r$; hence, $e_s > e_r$ and therefore, it must be the case that $k_r > k_s \frac{w + x_r - LR}{w + x_s - LR}$ for any set of parameters.

[31] This will be proved in section 8.2 where banks' technology is described.

[32] Notice that the effect of loans size on effort is positive for sufficiently small a loan size: i.e. when the marginal return to scale of the project is larger than the interest rate charged by lenders.

By substituting (24) into (23) and by totally differentiating, it is possible to plot borrowers' indifference curves in the space (L x R). Their slope is given by:

(25)
$$\left.\frac{dR}{dL}\right|_{\overline{EU}_r} = \frac{x_r' - R}{L}$$

Consider now all L such that (25) is positive. Since $x_r' > x_s'$ the indifference curves when the risky technique is used are steeper than the indifference curves when the safe technique is used. More formally:

(26)
$$\left.\frac{dR}{dL}\right|_{\overline{EU}_s} < \left.\frac{dR}{dL}\right|_{\overline{EU}_r}$$

It must be the case, then, that indifference curves relative to the safe and risky techniques intersect in the space (L x R) as depicted in Figure 14.

The intersection takes place along the *aa'* switch line the slope of which is given by:

(27)
$$\left.\frac{dR}{dL}\right|_{\overline{EU}_s = \overline{EU}_r} = \frac{\hat{e}_s(x_s' - R) - \hat{e}_r(x_r' - R)}{L(\hat{e}_s - \hat{e}_r)} < 0$$

Below the switch line $EU_r < EU_s$ and borrowers will use the safe technique. *Vice versa*, above the switch line $EU_s < EU_r$ and borrowers will use the risky technique. Along *aa'* borrowers are indifferent between the safe and risky project and by assumption they will use the safe technique. The combined indifference curve for a borrower who can choose between a safe and risky project is given by the safe indifference curve to the left hand side of *aa'* and by the risky indifference curve to the right hand side of *aa'*.

The switch line is negatively sloped under the plausible assumption that, because returns to scale are more important for the risky project than for the safe, an increase in the

loan size increases the expected utility of the risky project more than for the safe project. Thus:

$$(28) \qquad \frac{\partial EU_s}{\partial L} = \hat{e}_s(x_s' - R) < \hat{e}_r(x_r' - R) = \frac{\partial EU_r}{\partial L}$$

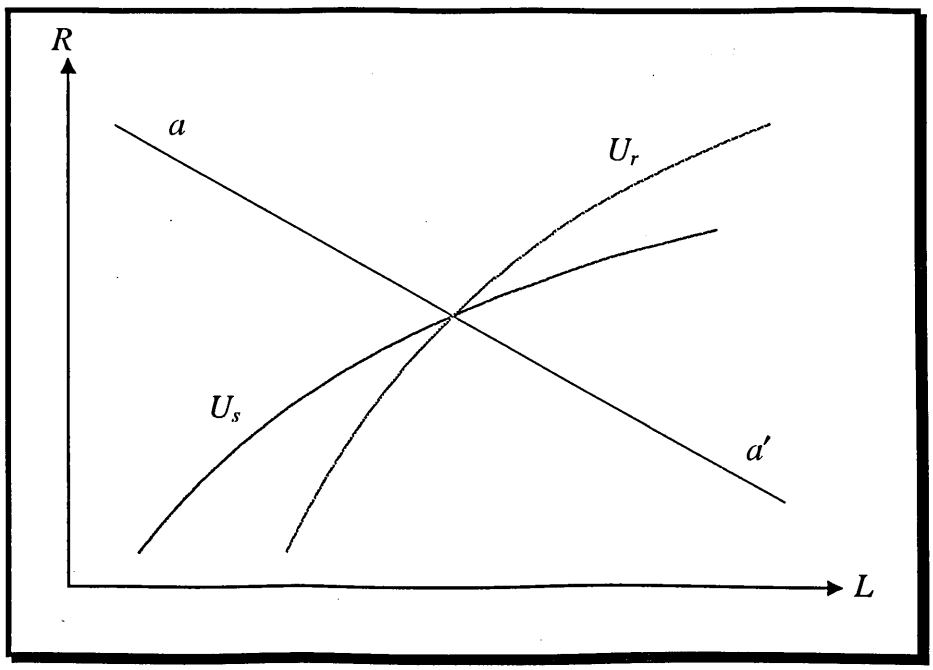

Figure 14 Risky and safe technique indifference curves.

This can be seen also by taking any point along *aa'* in Figure 14 and increase the loan size for a given loan interest rate. When *L* increases utility increases and the risky project dominates the safe project because returns to scale are more important for the risky than for the safe project. A decrease in *R* would increase the optimal effort produced and make borrowers again indifferent between the two techniques.

8.2 Banks

Banks are risk neutral. In case of a successful project they obtain at the end of the period the loan plus the interest on the loan $LR = L(1 + r)$. In case of failure of the project they obtain the collateral c. Thus, banks' expected return on each project is given by:

(29) $$EP_t(e,R,c,L) = e_t LR + (1 - e_t)c$$

Banks are perfect competitors on the deposit market and in equilibrium they have to respect the zero profit condition:

(30) $$e_t(LR - c) + c = LI$$

where $I = (1 + i)$ is the nominal interest rate on deposits exogenously given because of the assumption of perfect competition.

Throughout the previous section I assumed that $c = w$. This assumption can now be proved by noticing that from the assumption of risk neutrality of borrowers, banks' expected return is monotonically increasing in the collateral c. Thus, after substituting (24) into (29):

(31) $$\frac{\partial EP_t}{\partial c} = \frac{LR - c}{k_t} + (1 - \hat{e}_t) > 0$$

Hence, banks will always ask borrowers to put up all their wealth as collateral. If this is true, it is possible to re-write (29) as:

(32) $$EP_t(e,R,L) = e_t(LR - w) + w$$

When offering a contract, the bank solves the following maximisation problem:

$$\max_{\{e_t,L,R\}} \quad EU_t(e,L,R) = e_t W_t - \frac{k_t}{2} e_t^2$$

s.t.

(33) $$e_t = \frac{W_t}{k_t} \qquad \textbf{IC}$$

(34) $$e_t(LR - w) + w = LI \qquad \textbf{PC}$$

(35) $$EU_s \geq EU_r \qquad \textbf{IC}$$

with $W_t = (w + x_t - LR)$. (33) is the incentive compatibility constraint that guarantees that borrowers produce the optimal effort in equilibrium. (34) is the participation constraint for the bank that guarantees that banks will respect the zero profit condition in equilibrium. (35) is the incentive compatibility constraint for the borrower that guarantees his or her choice of the safe project in equilibrium: i.e. $t = s$.

Instead of solving formally the maximisation problem I will develop the intuition that lies behind the resulting equilibrium.

By substituting (33) into (34) and by totally differentiating, it is possible to plot the zero profit loci (ZPL_t) in the space (L x R) relative to the safe and risky techniques. The ZPL_t are negatively sloped[33] and their slope is given by:

(36) $$\left.\frac{dR}{dL}\right|_{ZPL_t} = -\frac{\frac{x_t' - R}{k_t}(LR - w) + (\hat{e}_t R - I)}{\frac{L}{k_t}[x_t - 2(LR - w)]} < 0$$

[33] Provided $x_t > 2(LR - w)$ and $\frac{x_t' - R}{k_t}(LR - w) > (\hat{e}_t R - I)$.

For a given loan size, an increase in R has a positive effect on banks' expected return for a sufficiently high project payoff, i.e. whenever $x_t > 2(LR - w)$. A decrease in the loan size is then necessary to decrease banks' expected return such that (34) is met again. This explains why the ZPL_t are negatively sloped.

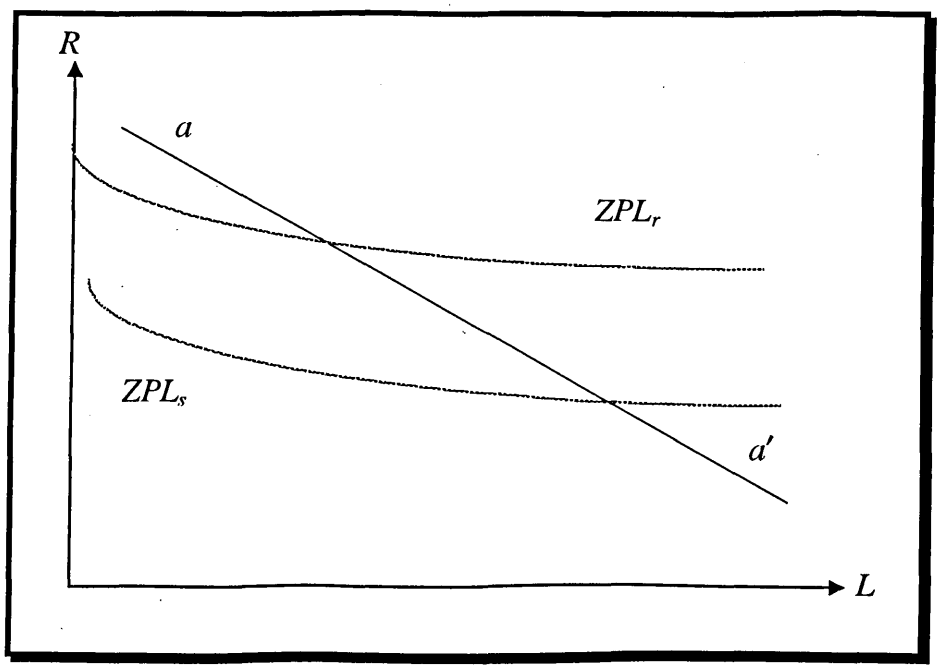

Figure 15 The combined zero profit locus when borrowers can choose between risky and safe technique.

Banks have two zero profit loci according to which technique borrowers choose. Since the probability of success of the risky technique is lower than the probability of success of the safe technique for any given L and R, banks' expected return is higher when borrowers use the safe technique. In other words the safe zero profit locus ZPL_s lies always below the risky zero profit locus ZPL_r. This means that the combined ZPL when borrowers can choose between the two projects is given by ZPL_s and by ZPL_r to the left hand side and to the right hand side of aa' respectively, as depicted in Figure 15.

8.3 The equilibrium contract

Banks cannot specify in the loan contract which technique borrowers should be using when running the project and even if this were possible, it would not be enforceable. Banks would like borrowers to use the safe technique because this makes borrowers produce a higher effort in equilibrium. The only way to force borrowers to choose the safe project is to offer a contract below the switch line *aa'*.

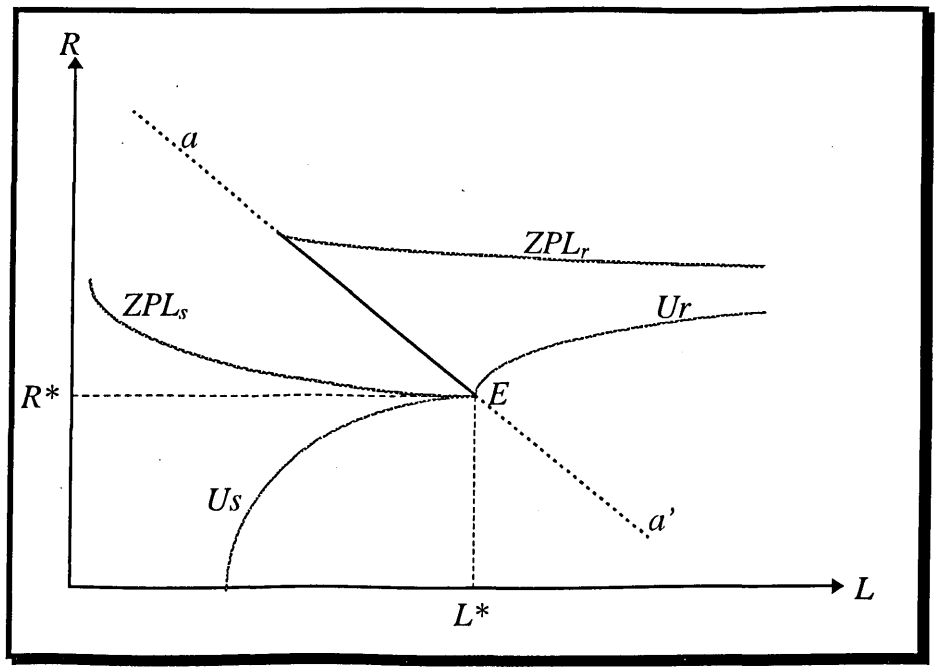

Figure 16 The equilibrium contract.

Contract E in Figure 16 lies on the switch line, where by assumption borrowers use the safe technique, on the combined *ZPL*, where banks make zero profits, and it maximises borrowers' expected utility. Hence, it is an equilibrium contract. Clearly, borrowers are rationed at E as, at the equilibrium interest rate R^*, they can move to a higher indifference curve if they were allowed to borrow a loan size $\tilde{L} > L^*$ such that $x_t'(\tilde{L}) = R$. Nevertheless, if this happens, banks would make expected losses on each loan as at $\tilde{L}$, $EU_r(\tilde{L}) > EU_s(\tilde{L})$

and borrowers would choose the risky project. Therefore, banks maximise their expected return by rationing borrowers along *aa'*.

In the preceding sections I showed how rationing arises in equilibrium when the credit market is characterised by imperfect information on the part of the lenders. In the next section I will show how rich borrowers are always offered a better contract than the one offered to poor borrowers. In other words rich borrowers are less rationed than poor borrowers in equilibrium.

8.4 Rich and poor borrowers

In what follows, a rich borrower differs from a poor borrower only for its initial wealth w. In order to prove that rich borrowers are less rationed than poor borrowers it is necessary to consider the effect of wealth on the equilibrium contract.

Wealth affects the equilibrium contract in two ways. The first effect is on the switch line. From (25) we know that wealth does not affect the slope of the indifference curves. Nevertheless, the switch line of a rich borrower lies always to the right hand side of the switch line of a poor borrower. To see this, let's start at E in Figure 16 and increase wealth. At E, $EU_s = EU_r$ but when wealth increases and it is all put up as collateral both expected utilities increase by $\frac{\partial EU_s}{\partial w} = \hat{e}_s > \hat{e}_r = \frac{\partial EU_r}{\partial w}$. This means that at E, the safe project dominates the risky project for the rich borrower. In other words, E lies to the left hand side of the rich borrower's switch line *bb'*. Figure 17 shows both the poor borrower switch line *aa'* and the rich borrower switch line *bb'*.

Another way of proving this is to notice that for given L, R and technique used, a rich borrower produces a higher effort than a poor borrower since $\frac{\partial \hat{e}_t}{\partial w} = \frac{1}{k_t} > 0$. This means

that for a given R, a rich borrower can be offered a larger loan size before he switches technique.

The second effect of wealth is on the combined ZPL of the bank. Again, a rich borrower produces a higher effort than a poor borrower for any given L, R and technique used. This means that banks make always a higher expected return by lending to a rich borrower than by lending to a poor borrower for any given L, R and technique used. Therefore, the combined ZPL^r for a rich borrower must lie below the combined ZPL^p for the poor borrower, as depicted in Figure 17.

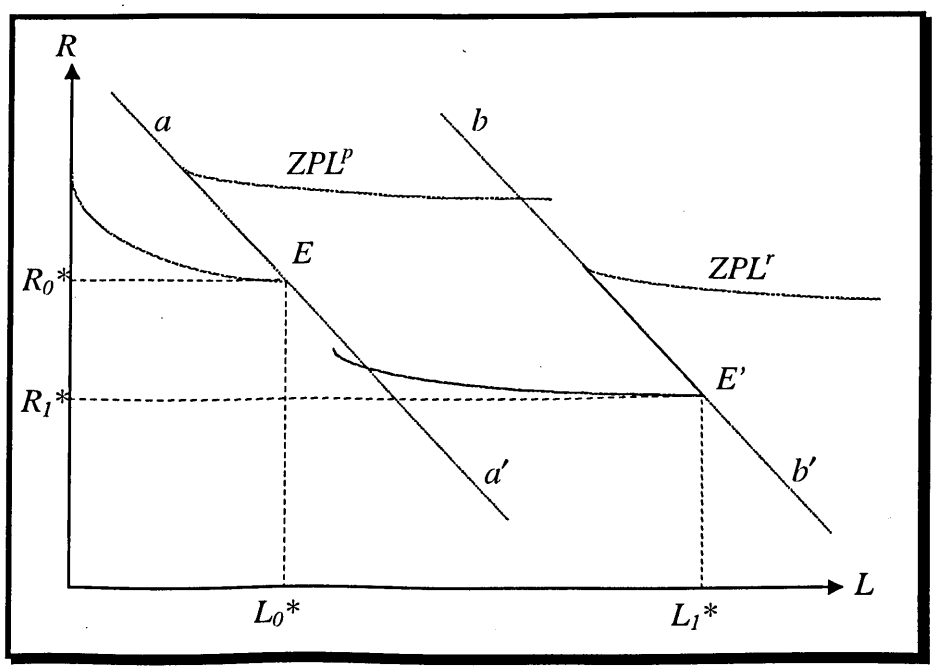

Figure 17 Poor and rich borrowers' equilibrium contracts.

It follows that a rich borrower will always be offered a contract with a lower loan interest rate and a larger loan size as in E': i.e. a rich borrower is less rationed than a poor borrower. In the next sections I will show how group borrowing modifies individual's

behaviour and how poor borrowers can compensate for their lack of physical wealth by borrowing within a group.

8.5 Group lending

The literature on peer monitoring has so far concentrated mainly on issues such as efficiency and welfare gains (Stiglitz 1990, Arnott and Stiglitz 1991, Armendáriz 1995, Besley and Coate 1995, Varian 1990) or on risk sharing issues (Udry 1991, 1992). Very little attention has been given to the issue of optimal group size. I believe that an indirect attempt has been made by those authors (Thomas 1995, Otero 1995, Devereux Fishe 1993, Hossain 1988, Wahid 1994) investigating the successes of the Grameen bank and the difficulties in reproducing such experiments outside Bangladesh. The general conclusion on this issue is that groups have to be small for them to be stable. Nevertheless, few papers have addressed the social issue formally.[34]

Group borrowing differs substantially from individual borrowing in the sense that individual behaviour in the group will not be necessarily dictated by intrinsic preferences only (Bernheim 1994, Kandel and Lazear 1992). The causes of such a modification in behaviour may be better understood by looking at a few important characteristics of groups:

1. It is costly to form a group because its management is inevitably more complex than the management of an individual in isolation. Difficulties arise from the early stages when an investment project has to be chosen up to the very end when payoffs have to be shared among co-borrowers.

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[34] Armendáriz (1995) excludes the possibility of large groups because of increasing negative effects of the free riding problem while Deveruex and Fishe (1993) conclude that large groups are unstable because of the decreased effort dedicated to monitoring peers. This is part of the reason but it completely ignores the social aspect of the problem. I.e. whether *ex ante* agents are likely to form a group or not.

2. If the group expected payoff has to be shared among co-borrowers, this yields the possibility of free riding.

3. Groups with common goals give rise to social norms which do not affect agents behaviour in isolation. Social norms should be endogenously determined within the group.

4. Individual deviations from the norm affect group utility. When spillovers are negative, individuals are punished with non-monetary disutility. When spillovers are positive, individuals are rewarded with non-monetary utility. Non-monetary disutility is identified with social sanctions or "shame".[35]

5. The magnitude of the punishment or reward depends on:

   a) The magnitude of the deviation from the social norm. As group disutility is directly proportional to the magnitude of agent's deviation from the social norm, it is safely to assume that the punishment be directly proportional to the magnitude of such a deviation.

   b) The level of monitoring within the group: A plausible assumption is that monitoring costs increase with the group size as people in rural economies are fairly dispersed geographically.

   c) The ability of the group to impose the punishment. The ability to impose a sanction is directly related to the ability to monitor the behaviour of peer borrowers. As the cost of monitoring increase with the group size, the ability to sanction is likely to decrease with the group size.

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[35] Shame is felt only in a group because the deviating agent is actually observed. I here ignore the possibility of "guilt" which would affect individual behaviour inside and outside the group. See Kandel and Lazear (1992).

d) The costs for the group involved in imposing the punishment. A plausible assumption is that the larger the group the lower the cost that each individual borrower in the group will have to bear when he/she imposes the sanction.[36]

I will be analysing the individual behaviour of credit group members who pool their initial individual wealth w and each obtain a loan L which will be used to finance n independent stochastic projects X_t. In the group there is no joint liability clause and the lender is partially insured from individual failures by the fact that the physical collateral of unsuccessful members can be seized. Although projects are run separately, the payoff is shared among group members.[37] In such a set-up, points 1) to 5) above, can be formalised in the following expected utility function for borrower i within the group:

$$(37)\ EU_{i,t}(e_{i,t}, L, m_{i,t}, n, R) = \alpha_i \sum_{i=1}^{n} e_{i,t} W_t - \frac{k_t}{2}(e_{i,t} + m_{i,t})^2 - g(e_i; e_j, \cdots, e_n, m_j, \cdots, m_n, n, L)$$

with $e_{i,t} \in [0,1]$; $m_{i,t} \geq 0 \ \forall\ i$; $n \geq 1$.

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[36] This depends of course on the structure of monitoring of the group and it is easy to find structures where both punishment and monitoring increase with group size. See Armendáriz (1995) for an analysis of alternative monitoring structures.

[37] Notice that this particular incentive scheme is not one necessarily empirically observed. A joint responsibility clause is almost invariably present in group contracts as it plays a crucial role in triggering monitoring within the group. In my framework, joint responsibility is absent and monitoring is triggered by the clause of profit sharing. As a matter of fact, both joint responsibility and profit sharing make the utility of each peer depend on the action of other peers. This interdependence makes peer monitoring necessary so that deviating agents, whose actions would negatively affect utility, can be observed and punished. Therefore, because of the identical role played by the two clauses of joint responsibility and profit sharing, only profit sharing is here considered. Furthermore, the particular choice of the incentive scheme makes it easier to model the choice of the optimal group size without loss of generality.

(37) is basically equal to (23) with few modifications necessary to take into consideration the individual behaviour in a group.

On the right hand side of (37) α_i represents borrower i's share of the group expected payoff $\sum_{i=1}^{n} e_{i,t} W_t$ from all projects. There are many ways in which the outcome of the project can be shared among co-borrowers but the most plausible one in our context is that co-borrowers agree on a Nash bargaining solution proportional to the amount of wealth deposited by each individual before jointly applying for a loan.[38] Since all co-borrowers have identical wealth and technology, the Nash bargaining solution is given by $\alpha_i = \frac{1}{n}$.

The function $g(\bullet)$ is the punishment function that gives the utility loss in the case of deviation from the social norm. It is plausible to assume the following behaviour of such a function:

$\frac{\partial g}{\partial e_i} < 0$ Other things equal, the higher borrower i's own effort, the lower the punishment or in other words: any lack of effort is punished. The "lack of effort" is measured in terms of social norm: if borrower i's effort falls short of the social norm he/she receives a punishment which is proportional to the deviation.

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[38] Devereux and Fishe (1993) suggest that rather than the average expected payoff, each member is usually rewarded according to its productivity. This may of course be the case in a world where co-borrowers have different abilities and all participate to the realisation of a single project. Here, co-borrowers are identical and they all work on separate and independent projects; furthermore, they have no outside option. Hence, a more plausible way to share the expected payoff of the projects is proportionally to initial wealth.

$\frac{\partial g}{\partial e_j} > 0 \ \forall j \neq i$ Other things equal, the higher other borrowers' effort the higher the punishment. In other words, an increase in effort on the part of other borrowers can be seen as a relative lack of effort produced by the *i*th borrower. This assumption can also be interpreted in terms of social norm: the higher other's effort, the more demanding is the social norm each borrower has to comply with if he/she does not want to be punished.

$\frac{\partial g}{\partial m_j} > 0 \ \forall j \neq i$ Punishment occurs if there is monitoring. Deviants cannot be punished if they are not observed when they deviate from the social norm. Hence when there is no monitoring (i.e. $m_j = 0 \ \forall j \neq i$), there is no punishment (i.e. $g(\bullet) = 0$). The monitoring activity is costly and this is captured by the fact that m_i enters the cost function in (37). Therefore, it is plausible to assume that the higher the level of monitoring, the higher the punishment in case of deviation from the social norm.

$\frac{\partial^2 g}{\partial e_j \partial m_i} < 0$ Since the level of monitoring increases the disutility of being caught deviating from the social norm, it is plausible to assume that group members will offset an increase in monitoring levels by increasing the effort produced and therefore, by decreasing the probability of success of the projects. Notice that the monitoring activity does not contribute directly to the probability of success of the project. Nevertheless, it does indirectly by modifying the effort produced by

each individual. In other words: if additional monitoring is to increase the level of effort, there must be a gain to increasing effort when monitoring increases.

$\frac{\partial g}{\partial L} > 0$ Punishment is proportional to the disutility inflicted on other members in the group. The larger the loan size, the larger the scale of the project (remember that $x'(L) > 0$) and therefore, the larger the disutility imposed to all participants in case of individual project failure. Therefore, it is safe to assume that the punishment in case of deviation be proportional to the loan size.

$g(\cdots, n=1, \cdots) = 0$ No guilt is assumed in this framework. As previously mentioned, punishment occurs only if deviation from the social norm is observed (i.e. there is a positive level of monitoring). Clearly, if the group is constituted by a single individual, there is no monitoring and shame is not imposed.[39]

By taking all this into consideration we can give a specific form to the punishment function $g(\bullet)$ and borrower i's expected utility from the project can be re-written as:

$$(38) \qquad EU_{i,t} = \frac{1}{n}\sum_{i=1}^{n} e_{i,t} W_t - \frac{k_t}{2}(e_{i,t} + m_{i,t})^2 - (s(L) - n)(\tilde{e} - e_{i,t}) \sum_{j \neq i} m_{j,t} G$$

[39] The issue of social norm does not arise when the group collapses to an individual size. For an individual in isolation the social norm coincides with individual norm and therefore, no deviation is possible.

where $\frac{1}{n}$ is the individual share of the group expected payoff $\sum_{i=1}^{n} e_{i,t} W_t$; $\frac{k_t}{2}(e_{i,t} + m_{i,t})^2$ is the individual cost function for producing effort and monitoring; $s(L)$ is the sanction, increasing in the loan size (i.e. $s'(L) > 0$), inflicted in case of deviation; $(\tilde{e} - e_{i,t})$ is the deviation (positive or negative) from the social norm $\tilde{e}$; $\sum_{j \neq i} m_{j,t}$ is the level of monitoring that borrower i faces;[40] G > 0 is a scale factor.

When agent i's effort is lower than the social norm $\tilde{e}$, he/she is punished proportionally to such deviation and to the loan size. The punishment takes place only when more than one borrower is in the group (n > 1) and when the deviation is observed ($m_{j,t} > 0$). Alternatively, when agent i's effort is higher than the social norm, he/she is rewarded with social status.

The perception of such punishment or reward is a decreasing function of the group size and this is captured by the factor $(s(L) - n)$. When groups have a high degree of social cohesion, social sanctions can be a powerful incentive device since the costs of upsetting other members in the group may be high (Besley and Coate, 1991). A plausible assumption is that social cohesion is a decreasing function of the size of the group. Therefore, it must be the case that the larger the group size the lower is the perception of, or equivalently the ability to impose, a given sanction s.

Notice that the social norm $\tilde{e}$ is here arbitrarily chosen. This is unlikely of course to be the case and we need a way of endogenising it. The easiest way to do this is to assume that each borrower i decides what level of effort he or she produces by looking at the average

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[40] Notice that the level of monitoring faced by a group member can be easily standardised in form of probability of being observed.

effort that the other co-borrowers produce in equilibrium. This means that $\tilde{e} = \frac{1}{n-1}\sum_{j \neq i} e_{j,t}$ and $(\tilde{e} - e_{i,t}) = \frac{1}{n-1}\left(\sum_{j=1}^{n} e_{j,t} - n e_{i,t}\right)$. Notice that if the term $(\tilde{e} - e_{i,t})$ can be interpreted as agent i's deviation from the social norm, the term $\left(\sum_{j=1}^{n} e_{j,t} - n e_{i,t}\right)$ is the shortfall on overall effort given by borrower i's deviation.

In this new set-up each borrower in the group has to choose how much effort to produce and how much monitoring to undertake. This can be done in two steps: in the first step, we can maximise (38) with respect to $e_{i,t}$ $\forall$ $i = 1, \ldots, n$ keeping all $m_{i,t}$ fixed. This yields n first order conditions of the type:

$$(39) \qquad \frac{\partial EU_{i,t}}{\partial e_{i,t}} = \frac{W_t}{n} - k_t(e_{i,t} + m_{i,t}) + (s-n)\sum_{j \neq i} m_{j,t} G = 0$$

and therefore:

$$(40) \qquad e_{i,t} = \frac{W_t}{n k_t} - m_{i,t} + \frac{(s-n)}{k_t}\sum_{j \neq i} m_{j,t} G \qquad \forall\ i = 1, \cdots, n$$

Notice that from an individual point of view, there is a negative relationship between own effort and own level of monitoring.

In the second step, each individual effort level can be then substituted into the objective function which now becomes a function of the monitoring variables only. The optimal level of monitoring produced by each co-borrower is then given by:[41]

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[41] Notice that since all co-borrowers are identical, it must be the case that in equilibrium $m_{i,t} = m_t$ $\forall$ $i = 1, \ldots, n$.

$$\hat{m}_t(L,n,R) = \frac{W_t}{n}\left(1 - \frac{k_t}{(s-n)(n-1)G}\right) \quad (41)$$

When the group size is neither too large nor too small $(s-n)(n-1)G > k_t$. When this condition holds true, both the loan size and wealth affect positively the level of monitoring in the group (i.e. $\frac{\partial \hat{m}_t}{\partial L} > 0$ and $\frac{\partial \hat{m}_t}{\partial w} > 0$), while the interest rate affects negatively the level of monitoring in the group (i.e. $\frac{\partial \hat{m}_t}{\partial R} < 0$). When the group size is either too large or too small $(s-n)(n-1)G < k_t$ and the level of monitoring becomes negative and the sign of the above derivatives is reversed. Since a negative level of monitoring makes little sense in this framework, it will be assumed that when the group size is either too large or too small no monitoring takes place. When monitoring is positive, it first increases and then decreases with group size.

Monitoring is a costly activity for members and it does not contribute directly to the success of a project. The effect of a marginal increase in monitoring by one member in the group has a double effect. It increases the probability of observing deviation among other peers, therefore it imposes discipline on others' effort and by this means, it increases the group expected payoff. At the same time, because of the inverse relationship between own effort an monitoring given in (40), a marginal increase in monitoring by one member in the group lowers the social norm that the other peers take into consideration when assessing the level of effort they produce. By this means, group expected payoff is lowered. The magnitude of these two contrasting effects is larger in small groups. This is simply because in smaller groups, both social norm and probability of observing deviation are calculated by averaging the effort and the level of monitoring of fewer individuals. Therefore, in small groups, although the probability of observing deviation is likely to increase considerably, very little monitoring occurs because high monitoring would decrease the social norm in

such a way that group expected payoff is lowered. In large groups, very little monitoring occurs as well but for a different reason. When groups are large, the effective social sanction that deviating agents perceive $(s-n)$ is small and it has no impact on individual behaviours. In this situation it is not worth monitoring as effective punishment would be minimal. This last point can be explained also by looking at the incentive of producing increasing effort when monitoring increases. This is given by the elements off the diagonal in the Hessian of the punishment function g which can be related to the "accuracy of detection". When group size increases, $\lim_{n\to s} \frac{\partial^2 g}{\partial e_j \partial m_i} = -(s(L)-n)G = 0$. This means that when the size of the group increases, the marginal benefit from increasing monitoring tends to zero as it has to be shared among too many members.

Let's substitute (41) into (40) to obtain the optimal level of effort produced by each group member. Thus:[42]

(42) $$\hat{e}_t(L,n,R) = \frac{W}{nk_t} + \left(\frac{(s-n)(n-1)G}{k_t} - 1\right)\hat{m}_t$$

Monitoring has a positive effect on individual effort only when $(s-n)(n-1)G > k_t$: i.e. when groups are neither too small nor too large. Incidentally this condition is the same for the level of monitoring to be strictly positive and in this situation, exactly like for the individual lending contract analysed in the previous section, the loan size and wealth have a positive effect on effort (i.e. $\frac{\partial \hat{e}_t}{\partial L} > 0$ and $\frac{\partial \hat{e}_t}{\partial w} > 0$) while interest rate has a negative effect on effort (i.e. $\frac{\partial \hat{e}_t}{\partial R} < 0$).

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[42] Notice that since all co-borrowers are identical, it must be the case that in equilibrium $e_{i,t} = e_t \; \forall \; i = 1,\ldots,n$.

Banks maximise their profits by solving the problem recursively. They know that for any given contract each individual will produce a level of effort and monitoring given by (41) and (42). Therefore, they offer a contract and choose the optimal group size such that borrowers choose the safe technique and such that banks earn zero profits in equilibrium. Assuming an internal solution (i.e. $n \in (1,s)$), banks' problem for each co-borrower can be formally written as:

$$(43) \qquad \max_{\{e_i, L, m_i, n, R\}} EU_{i,t} = \frac{1}{n}\sum_{j=1}^{n} e_{j,t} W_t - \frac{k_t}{2}(e_{i,t} + m_{i,t})^2 - (s(L) - n)(\tilde{e} - e_{i,t})\sum_{j \neq i} m_{j,t} G$$

s.t.

$$(44) \qquad e_{i,t}(L,n,R) = \frac{W_t}{nk_t} + \left(\frac{(s-n)(n-1)G}{k_t} - 1\right) m_{i,t} \qquad \textbf{IC}$$

$$(45) \qquad m_{i,t}(L,n,R) = \frac{W_t}{n}\left(1 - \frac{1}{(s-n)(n-1)G}\right) \qquad \textbf{IC}$$

$$(46) \qquad EU_{i,s} \geq EU_{i,r} \qquad \textbf{IC}$$

$$(47) \qquad \frac{1}{n}\sum_{j=1}^{n} e_{j,t}(LR - w) + w = LI \qquad \textbf{PC}$$

where (44) and (45) are the incentive compatibility constraints that guarantee that borrowers produce the optimal effort and monitoring in equilibrium; (46) is the incentive compatibility constraint for the borrower that guarantees his or her choice of the safe project in equilibrium; (47) is the participation constraint for the bank that guarantees that banks earn zero profits in equilibrium. Again: $W_t = (w + x_t - LR)$ is the payoff in the good state when the safe ($t = s$) or risky ($t = r$) technique is chosen.

After the usual substitution of $c = w$, the maximisation problem here outlined is equivalent to the maximisation problem analysed in section 8.2 where the group size was not taken into consideration. By substituting (44) and (45) into the other equations it is possible to "simplify" the problem and reduce the choice variables to L, n and R. Nevertheless, the problem is still too complex to be easily solved and not much would be added to the intuition about the effect of group size on the equilibrium contract. Therefore, in the next section I will develop such intuition without formally solving the problem.

8.6 Optimal group size

In section 8.4 I showed how wealth affects the equilibrium contract. The main result was that rich borrowers are offered a better contract. This resulted from the fact that rich borrowers have a switch line that lies always to the right hand side of the poor borrowers' switch line and from the fact that the ZPL^r of the bank relative to a rich borrower lies always below the ZPL^p relative to a poor borrower, as depicted in Figure 17. In turn, the different position of the rich borrowers' switch line and ZPL^r in the (L x R) space was determined by the fact that rich borrowers produce a higher level of effort for any given set of parameters. This must be the case simply because rich borrowers have a higher level of collateral at risk.

Poor borrowers do not have wealth and can only obtain better contract terms if they can commit themselves to produce a higher effort in equilibrium. Such a commitment is not credible in an individual contract since in such a contract there is no incentive mechanism that would enforce the commitment and therefore, banks ration borrowers. A group with its peer pressure can make such commitment credible because monitoring and shame modify individual behaviour. Therefore, in order to determine whether borrowers in a group enjoy a relaxation of their credit constraint, as a rich borrower enjoys a relaxation of his credit

constraint compared to the poor borrower, it is sufficient to determine whether the group size has the same effect that wealth has on effort.

It is possible to prove that if the level of shame s is sufficiently high, the individual equilibrium effort in a group can be higher than what it would be outside the group. Thus:

$$\hat{e}_t(L,n,R) = \frac{W}{nk_t} + \left(\frac{(s-n)(n-1)G}{k_t} - 1 \right) \hat{m}_t > \frac{W}{k_t}$$

This is shown in Figure 18 where individual effort in a group is shown together with the effort that a member in a group would produce if he/she were not monitored. For a given set of parameters, individual effort reaches a maximum at n^*. This means that banks are better off by lending to a group of n^* poor borrowers than by lending to the same poor borrowers individually. Social pressure is such that in equilibrium, individual effort is higher than what it would be if members borrow individually. It must be the case, then, that in equilibrium borrowers in a group will be compensated for the higher level of effort with more favourable contract terms. In other words they will be jointly offered a contract with a lower loan interest rate and a larger loan size.

For a given set of parameters, effort is first decreasing, then increasing and eventually decreasing again with n. The reason for this behaviour is related to the negative and positive effects of group size on effort. The negative effect on effort derives from the profit sharing clause in the contract and to the resulting free riding problem. This is captured by the first term in (42) which says that individual co-borrowers receive in equilibrium only a share $\frac{1}{n}$ of the group expected payoff $\sum_{i=1}^{n} \hat{e}_{i,t} W_t$. When the group size increases a smaller share of the expected payoff is distributed to each member and consequently, this has the

effect of reducing the optimal level of effort produced.[43] The positive effect on effort derives from the social sanction imposed by the group when individuals deviate from the social norm.

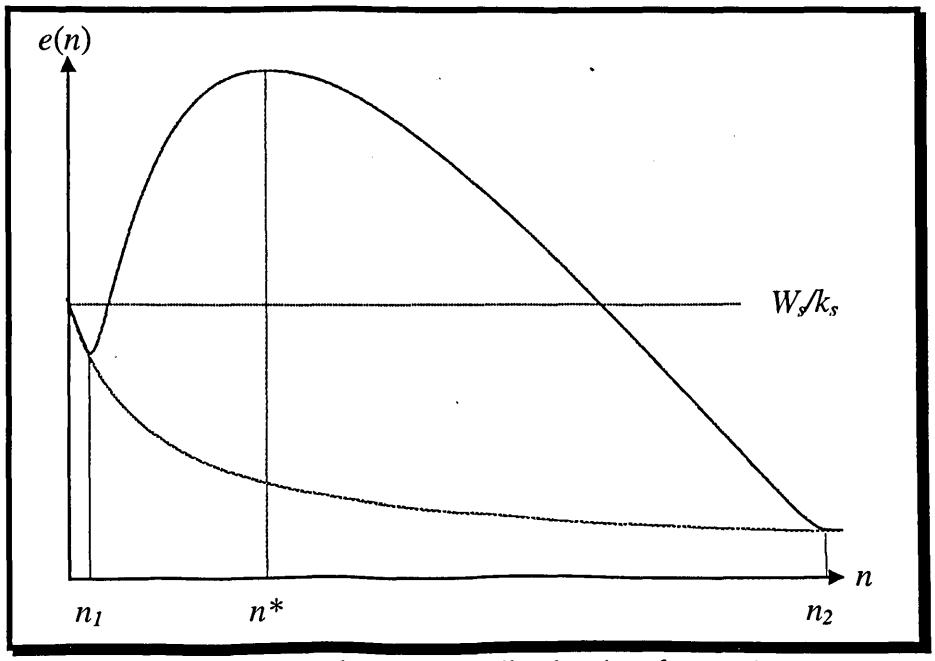

Figure 18 Optimal individual's effort function of group size.

This is captured by the second term in (42). For extremely small groups (groups of size $n \in (1,n_1]$, for instance), no monitoring occurs and the effort produced in equilibrium is simply dictated by the profit sharing characteristics of the contract. When the group size increases (groups of size $n \in [n_1,n^*]$), group members find optimal to produce increasing levels of monitoring, as explained before, but at a decreasing rate. Further increases in group size (groups of size $n \in (n^*,n_2]$) reduce the level of shame that can be imposed to such levels that can only be compensated with extremely high levels of monitoring. When this occurs,

[43] Effort represents a cost and it is higher the larger the expected payoff.

the costs outweigh the benefits of monitoring and members reduce their control on other peers until eventually, monitor levels drop to zero (groups of size $n \geq n_2$, for instance).

Because of this effect of monitoring on individual behaviour, it follows that borrowing groups cannot be either too small or too large. They cannot be too small because then, the discipline imposed by monitoring cannot offset the negative impact on the social norm and therefore, group expected payoff would decrease. At the same time, groups cannot be too large because too many individuals have problems in co-ordinating their monitoring activity and in imposing punishment.

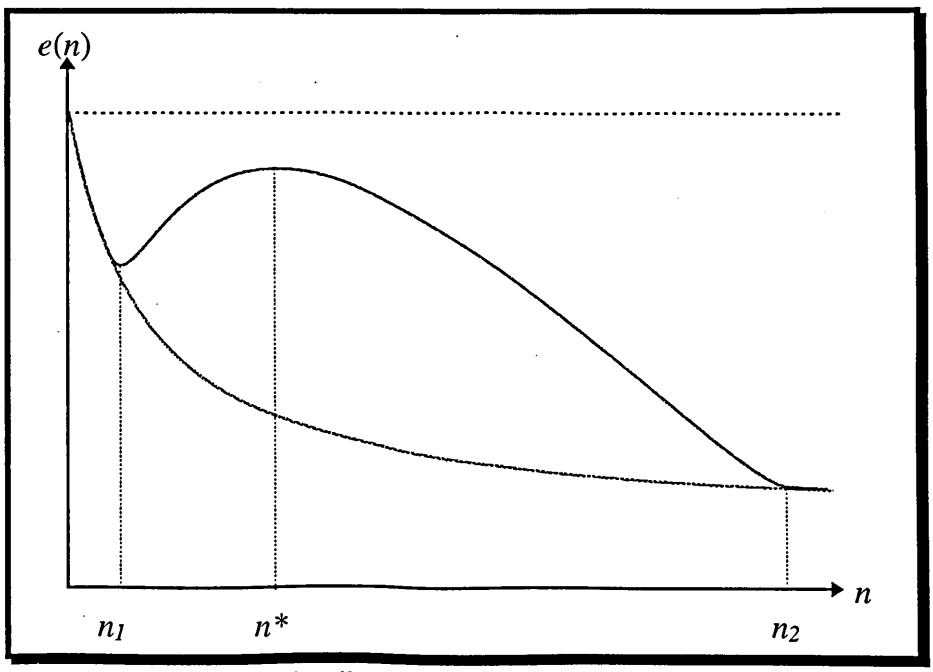

Figure 19 The effect of shame on the optimal group size.

Finally it is worth analysing the role of shame in group formation. As stated above, the individual effort in a group can be higher than what it would be outside the group only if the level of shame is sufficiently high. In this case a maximum in the effort function can be

found at n^* and we can prove that $\frac{\partial n^*}{\partial s} > 0$: i.e. the larger the shame that can be impose on deviating agents, the larger the group size that can be achieved in equilibrium.

If the level of shame is too low, groups cannot be formed either because a maximum in the individual effort function does not exist or because, even if such maximum exists, it is lower than the effort produced by an individual borrowing in isolation. Figure 19 shows the case when a maximum exists but it is too low for the lender to allow group borrowing.

The level of shame s depends here on the scale of the loan L. It can also be interpreted as the *ex ante* characteristics of individuals that determine whether groups will be formed or not. Groups will be formed only when individuals are sufficiently able to "behave" in a group. If individuals are particularly insensitive to social sanctions (notice that s can be easily seen as the individual's perception of shame), groups tend to be unstable and unprofitable to lenders; therefore, they will not be allowed.

9. CONCLUSIONS

In a credit market where poor borrowers are more rationed than rich borrowers there exists some scope for institutional innovation. Formal lenders can offer a group contract that relies on the formation of "social collateral" to improve the risk sharing properties of the equilibrium. "Social collateral" is not some physical element that lenders can seize in the bad state but it is a product of group interactions. It represents the discipline that monitoring has on co-borrowers' effort and such discipline may increase the individual equilibrium level of effort so that poor borrowers can obtain more favourable contractual terms from formal lenders.

Group interactions produce contrasting effects on individual optimal effort. Effort tends to be lowered because of free riding and profit sharing; furthermore, other things equal,

the monitoring activity reduces the amount of effort that each individual can dedicate to the project, thus reducing the social norm. Positive effects are related to the social norm that groups endogenously develop and to the discipline that derives from monitoring. Deviation from the norm are punished with social sanctions by peers when they can be observed and this tends to increase the equilibrium level of effort. This form of behaviour discipline is the "social collateral" that may increase banks' expected return on each loan.

Banks' expected return on each loan will decrease or increase according to whether the negative effect of group lending on effort dominates or not. The negative effect is likely to dominate when groups are either too small or too large. When groups are too small the discipline imposed by monitoring cannot offset the negative impact on the social norm and therefore, the group expected payoff would decrease. When groups are too large the ability to impose sanction is too low; this lowers the discipline and therefore, the expected payoff of the group. In any case, the reason why borrowers tend not to form either too small or too large groups cannot be explained only by the magnitude of the free riding problem as much of the literature on group lending and peer monitoring seems to underline. There are factors of exclusively social nature that affect group formation. These factors can be identified with the ability of co-borrowers to monitor each other; with the ability of groups to impose social sanctions on deviating partners and with the individual perception of social sanctions.

The individual perception of social sanctions ("*s*" in the model) seems to play a crucial role. It was easy to show that the optimal group size is positively correlated with the individual sensitivity to social sanctions and this observation may provide an indirect answer to why difficulties have been encountered in replicating the Grameen Bank success outside Bangladesh. Very simply, it is necessary that a minimal strictly positive value of "*s*" exists *ex ante* for a group to be formed. In other words, the higher the individual sensitivity to social sanctions, the higher the likelihood that a group will be formed and the larger will be

the optimal group size. If this is true, it must also be the case that group lending programmes will be more successful simply among individuals which simply have a high *ex ante* predisposition to form groups.

CHAPTER 3

Pension Reform, Pension Funds and Stock Market Development in Eastern Europe

10. INTRODUCTION

The issue of pension reform is constantly being debated in Eastern Europe due to the fiscal unsustainability of public pay as you go (PAYG) schemes and because the economic transition from the central plan has eroded the real value of pension benefits due to the almost total absence of indexation of contributions and benefits. But a pension reform involves issues that go further than the "simple" problem of guaranteeing adequate retirement income to pensioners. A pension reform is likely to transform the structure of the financial sector by promoting the creation of new financial and non-financial agents, and by altering the relative importance of agents already active in the market. This is likely to have a profound impact on the existing patterns of allocation of funds, corporate governance and therefore, on the issue of firm restructuring.

In this framework, pension funds are likely to play an important role. More than any other institutional investors, they are likely to influence the development of the stock market which in turn enables pension funds to develop even further as a more efficient stock market allows pension funds to allocate funds more efficiently.

This chapter will focus on these propositions: Sections 11 and 12 analyse the role played by public PAYG pension schemes, their fiscal unsustainability, the issues that are likely to be addressed by the reforms and the consequences of a pension reforms. Section 13 analyses how pension funds influence and are influenced by the development of the stock markets. Section 14 presents a stylised model of pension funds and stock market interaction, focusing on its impact on firms' information disclosure. Section 15 presents factual evidence of pension funds and stock market development in the transition economies of Eastern Europe and the former Soviet Union (FSU). Conclusions follow in section 16.

11. PENSION REFORM IN EASTERN EUROPE

Public pension schemes play an important role in the social security system of many countries and pension reform is a major issue that governments throughout the world are now facing due to the fiscal unsustainability of existing old age security systems. Reforms are occurring at a growing speed in Latin America (Chile 1981, Mexico 1991, 1997, Peru 1993, Argentina 1994, Colombia 1994, Uruguay 1995, Bolivia 1997) and in OECD countries (Switzerland 1985, Australia 1992). Current discussion are taking place to reform pension systems in most Latin American countries together with other developing countries and the transition economies of Eastern Europe. In this section I briefly summarise the major characteristics of public pension schemes, the reasons for their long-run unsustainability and finally, the major issues addressed in the reform.

11.1 The role of public pension plans

Public pension plans are generally mandatory, publicly managed, defined benefit based and mostly unfunded Pay-As-You-Go (PAYG). Their main economic goals are to provide forced savings for retirement; to provide insurance against various types of risk; to provide intergenerational and intragenerational redistribution of income (The World Bank 1994).

The reason why people should be forced to save for their retirement is somewhat paternalistic and it is based on the assumption that workers do not fully anticipate their retirement needs. By making the scheme mandatory governments' aim is mainly to limit old age poverty but a further reason for compulsion may also be dictated by the fact that public pension schemes have an important income redistributive aspect that governments may want to enhance.

Public pensions schemes provide insurance for participants against different types of risk such as long-term investment risk, inflation risk and longevity risk. Insurance against long-term investment risk is achieved by the provision of defined benefits for retirees; insurance against inflation and the erosion of the real value of benefits is achieved when contributions and benefits are fully indexed; finally, retirees are insured against longevity risk since pension annuities are paid for an indefinite number of years after retirement. Nevertheless, the insurance provided by public pension schemes is incomplete even when systems are actuarially fair since there is always a political risk, linked to the public management of the scheme, that participants cannot avoid (Davis 1995).

Another characteristic of public pension schemes relates to their redistributive power. Apart from the redistribution that occurs along the life cycle of participants, PAYG schemes may allow for both inter and intragenerational income redistribution. Intergenerational redistribution takes place across cohorts and it occurs when the schemes are in a period of over or under accumulation. When the rate of growth of the labour force is higher than the rate of growth of capital, cohorts live in a period of overaccumulation and benefit from the PAYG system. If the economic system is in a period of underaccumulation and the rate of growth of the labour force is lower than the capital rate and existing cohorts are worse off (Blanchard and Fisher 1989). Intragenerational redistribution takes place within cohorts and more specifically, between agents with low survival probability and agents with high survival probability. The possibility of redistribution arises because public pension plans pool together types with different risk and pooling equilibria are stable; because of compulsory participation low risk types cannot drop out and problems of adverse selection are avoided.

A final major characteristic of public pension schemes relates to progressivity. In general, the redistribution impact is higher the higher the progressivity of the social security

system. Increasing levels of progressivity can be achieved for both contributions and benefits, depending on how these are designed. Contributions can be a) regressive, b) proportional and c) progressive while benefits can be a) earnings related (with higher benefits to those who earned or contributed more); b) flat rate (with same benefits for everyone per year of covered employment); c) means-tested (with higher benefits for pensioners with lower income and assets). For both contributions and benefits, the redistributive power of the system increases with the level of progressivity.

11.2 The need for reform

PAYG schemes can be very cheap to run when they are implemented in countries with a high proportion of young people since in this case few pensioners need to be sustained by a relatively young labour force. Nevertheless, they tend to become unsustainable when the ratio of pensioners to the labour force increases; although workers contributions can be raised to sustain the demand for pension, contribution rates cannot be raised indefinitely with the ageing of the population.

PAYG schemes tend to follow a life cycle characterised by increasing coverage rates among workers, increasing demographic dependency ratio[44] and system dependency ratio.[45] When schemes are immature (low system dependency ratio) less than 1 per cent of GDP is generally spent on pensions. Although contributions rates are low, the schemes run surpluses and high replacement rates[46] can be afforded. In an intermediate stage the system dependency ratio increases and a larger coverage and/or increased contribution rates are

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[44] Ratio of people aged more than 60 to people between 20 and 59.

[45] Ratio of pension recipients, including widows, orphans and disability pensioners to contributors.

[46] Ratio between pensions and average wages

needed to finance current pensions. Eventually schemes reach their maturity[47] and they run deficits that cannot be matched by increasing contribution rates or by decreasing the average replacement rate. The ageing of the population puts further pressure on the system that eventually needs reforming. Pension expenditure in this final stage is generally 8 per cent or more of GDP (The World Bank 1994). As it will shown later, OECD countries with PAYG schemes have in average reached this stage and the transition economies in Eastern Europe closely follow behind. For the two areas, average public pension expenditure reached at the beginning of the nineties 9.2 and 8.4 per cent of GDP respectively.

The problem of unsustainability of unfunded schemes can be addressed through a pension reform which could potentially address several other undesirable features. For instance, PAYG pension contributions are typically proportional to wage income and therefore, they distort labour market decisions. Employers are motivated either to reduce their hiring of labour and workers are motivated to reduce their effort or to escape to the informal sector where payroll taxes can be avoided. Distortions in the labour market stems from the missing link between contributions and benefits in a defined benefit PAYG system and they are reinforced when there are no tax advantages linked to employers contributions.

Other undesirable features of PAYG schemes relate to their redistributive power. Compulsory PAYG schemes have been praised for their intragenerational redistribution power. Nevertheless, Nelissen (1987) argues that there is little evidence of redistribution from the lifetime rich to the lifetime poor while Panis and Lillard (1995) argue that there is empirical positive correlation between lifetime earnings and life expectancy; workers with higher wages, who should contribute more, tend to stay more in education, therefore contributing in average less to the system than those who are supposed to benefit from it.

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[47] A scheme is mature when increases in benefits cannot be matched by an increase in coverage of the labour force.

Furthermore, even if benefit formula appear to be progressive they are often earning related and therefore far less progressive than means-tested schemes. Finally, PAYG schemes are intended to insure participant from investment and inflation risks but, as said before, the political risk more than offsets such a positive characteristic especially in countries with unstable regimes. A well designed pension reform may represent an effective means to address the vast majority of the issues just mentioned.

Table 6 State pensions in transition economies, selected countries.

Country	Male retirement age 1991	Demographic dependency ratio 1990	System dependency ratio 1990	Social security expenditure		Pension expenditure		Year
		(per cent)	*(per cent)*	*(per cent of budget)*	*(per cent of GDP)*	*(per cent of budget)*	*(per cent of GDP)*	
Poland	60	28	49	48.00	22.80	30.80	14.63	1995
FYR Macedonia	–	–	–	37.46	21.20	24.61	13.93	1994
Slovenia	–	29	54	–	–	28.99	13.70	1994
Georgia	60	30	45	–	–	31.00	11.00	1992
Belarus	60	33	49	23.71	12.40	19.69	10.30	1995
Hungary	60	36	59	28.39	17.60	16.61	10.30	1994
Slovak Republic[2]	60	32	–	31.24	16.90	18.30	9.90	1995
Latvia	60	33	51	41.88	16.00	25.65	9.80	1995
Czech Republic[2]	60	32	–	27.79	13.42	18.80	9.08	1995
Bulgaria	60	37	87	24.39	10.58	18.52	8.03	1995
Ukraine	60	36	–	40.09	18.00	17.82	8.00	1995
Armenia	65[1]	22	34	35.83	15.80	15.19	6.70	1994
Estonia	60	32	52	31.14	10.60	19.56	6.66	1995
Romania	60	29	62	32.41	10.50	–	6.50	1993
Albania	–	17	37	29.76	12.20	14.40	5.90	1994
Russian Federation	60	31	46	23.65	8.30	–	5.50	1993
Lithuania	60[1]	30	53	30.90	8.20	18.11	4.81	1994
Azerbaijan	60	19	–	22.59	5.53	19.00	4.65	1995
Moldova	60	26	–	22.80	5.32	17.60	4.11	1994
Uzbekistan	60	15	34	–	–	–	2.60	1993
Kyrgyzstan	60	20	34	42.35	11.90	–	2.40	1993
Tajikistan	60	16	–	41.13	10.90	–	–	1994
Average[3]	60	30	48.30	31.39	12.48	19.47	8.35	

1: 1996. **2**: Referred to the Czechoslovak Republic. **3**: Weighted averages.
Source: Fox 1993, The World Bank 1994, IMF, OECD, Local Authorities.

The figures reported in Table 6 allow to draw some light on the problem of unsustainability of public pension schemes for selected transition economies. The data

collected refer to the years 1993 to 1996; the statutory male retirement age is in average sixty years for all countries in the region; average demographic and system dependency ratios are 30 and 48 per cent respectively; pension expenditure is in average 8.4 percent of GDP. Pension expenditure reaches its maximum in countries like Belarus, FYR Macedonia, Georgia, Hungary, Poland and Slovenia where between 1994 and 1995 more than 10 per cent of GDP was spent in public pensions. The highest percentage is observable in Poland where in 1995 pension expenditure was 14.6 per cent of GDP. In general, public pension systems in the transition economies are characterised by a large unification of pension benefits between the various professional categories, near-universal coverage and high statutory replacement rates. Furthermore, initial pension benefits are often calculated on a very progressive formula taking into account earnings just prior to retirement and the full service record (Fox 1993, Holzmann 1993). Importantly, since the share of labour income in GDP of the transition economies is far lower than in OECD countries, contribution rates are generally higher. Average contribution rates range from 20 per cent in Estonia to 45 per cent in Poland while Italian pension contributions (the highest in the EU) are 27 per cent.

Table 7 Social indicators: average comparisons.[1]

Developing Countries	Per Capita GDP ($ppp)	Male retirement age	Demographic dependency ratio (per cent)	System dependency ratio (per cent)	Social security (per cent of GDP)	Education (per cent of GDP)	Health (per cent of GDP)	Pensions (per cent of GDP)
South Asia	1,260	55.2	15.1	11.2	7.0	3.4	1.4	1.8
East Asia	3,210	55.7	15.5	11.6	3.4	2.8	2.2	2.3
Eastern Europe, Baltic's and CIS	5,210	60.0	30.0	48.3	12.3	4.8	5.2	8.4
Latin America	5,360	60.8	14.9	21.0	3.4	4.2	2.4	2.0
OECD Countries	19,000	64.4	32.9	39.2	16.3	4.9	5.9	9.2

1: Weighted averages except for the system dependency ratio of Asia, Latin America and OECD.
Source: Fox 1993, Sachs 1996, The World Bank 1994, IMF, OECD, Local Authorities.

Table 7 reports similar figures for other sets of emerging and developed countries. On the one side, emerging countries in Latin America, South Asia and East Asia have a relatively young population which is confirmed by the fact that demographic and system

dependency ratios are very low; consequently, pension expenditure as a percentage of GDP is around 2 per cent. On the other side, OECD countries have a relatively old population and demographic and system dependency ratios are 33 and 40 per cent respectively; consequently, pension expenditure is in average 9.2 per cent of GDP. Transition economies, although they are classified as emerging markets, have a demographic structure similar to the OECD countries (demographic and system dependency ratios are 30 and 48 per cent respectively) and therefore, similar average pension expenditure as a per cent of GDP (8.5 per cent).

Notice also that per capita GDP in transition economies and Latin American countries is considerably higher, in average, than the per capita GDP in the Asian areas. Nevertheless, average pension expenditure, as a per cent of GDP, in transition economies is close to the OECD countries while pension expenditure in Latin American countries is close to the average expenditure in Asian countries. This seems to confirm how pension expenditure is strictly related to the demographic structure of a country, rather than to its wealth.

The problem of unsustainability is particularly serious for some OECD countries, especially when the projection of demographic and system dependency ratios are considered (Chand and Jaeger 1996). Vittas and Michelitsch (1995) give some projections of system and demographic dependency ratios for selected transition economies: by 2020, the system dependency ratio is expected to reach 62 and 72 per cent in Hungary and Poland respectively while the demographic dependency ratio is expected to reach 44 per cent in the Czech Republic, 54 per cent in Hungary, 44 per cent in Poland and 50 per cent in Russia. As a result, given existing entitlements and contribution rates, most schemes have large implicit debt liabilities; the fact that the transition economies have weaker fiscal systems than the OECD countries makes their situation even more acute.

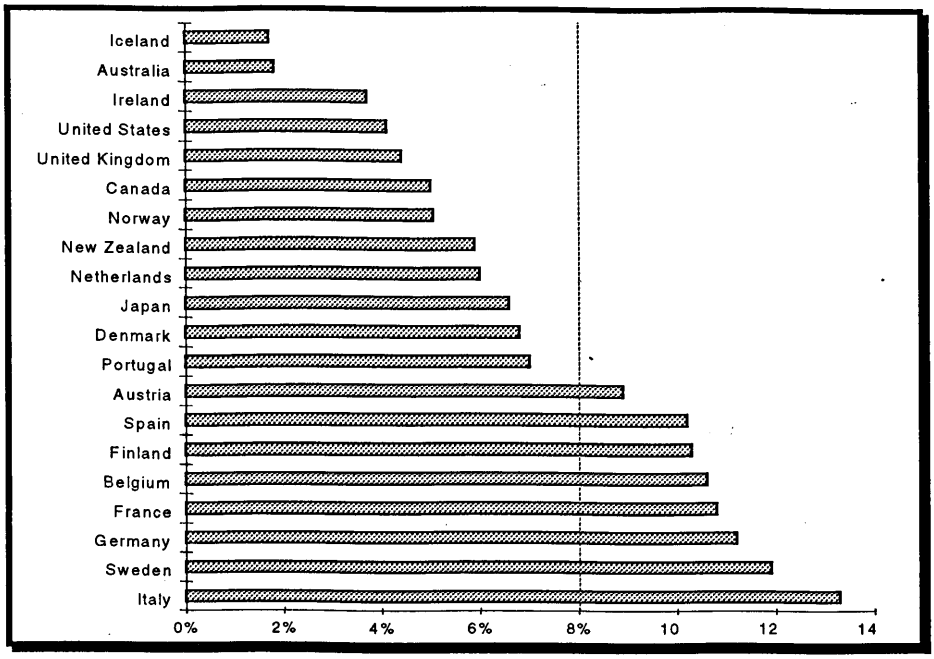

Figure 20 1995 pension expenditure in OECD countries as a percentage of GDP.

The similarity in public pension expenditure between transition economies and OECD countries is even more obvious when a country by country comparison is made. Figure 20 reports the pension expenditure in OECD countries as a percentage of 1995 GDP. It is possible to divide OECD countries in two separate groups. In the first group (roughly all countries with expenditure below 8 per cent of GDP) are countries with a low implied replacement ratios[48] and with developed private pension fund schemes such as the United States or the United Kingdom. In the second group (all the others) are countries with high replacement ratios,[49] undeveloped private pension funds and heavy PAYG schemes (notably Italy, Germany and Japan).

[48] The implicit replacement ratio (ratio of gross pension spending to average gross wage earnings) is for instance, 13% in Iceland, 25% in Ireland, 45% in Norway.

[49] Italy 49%, Sweden 54%, Germany 46%, Belgium 63%, Finland 65%.

11.3 Nature of reform

Once assessed the need for reform of mature PAYG schemes it is necessary to analyse what pension reforms really involve. Reforms want to achieve at least three fundamental aims: 1) to strengthen the link between contributions and benefits and reduce the distortions in the labour market; 2) to maintain the redistributive function of the PAYG scheme and provide income support to the old age poor; 3) to make explicit the government debt accrued with the PAYG scheme.

As far as the first two objectives are concerned, these can be achieved by a two pillar arrangement. The first pillar would entail a small compulsory defined benefit demogrant,[50] or even better means-tested, managed by the state. Its aim would be to guarantee support to retired workers with low lifetime earnings and limited savings. The presumption that workers, especially young workers, are myopic regarding their retirement needs requires that this first pillar to be compulsory. The first pillar would also preserve the redistributive aspects of the old PAYG scheme to a minimum extent; compulsion would overcome the adverse selection problem characteristic of private annuity markets and allow for intragenerational redistribution; eventual indexation of both contributions and benefits would account for inflation risk. Of course, political risk would not be avoided. The second pillar would entail fully funded, individually defined contribution accounts financed by payroll taxes held in private financial institutions and directly managed by participants. The scheme could be mandatory or voluntary. This would strengthen the link between contributions and benefits thus reducing the distortions in the labour market. The redistributive impact of the second pillar would be limited only to a redistribution along the life cycle of participants.

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[50] In a flat demogrant benefits are indexed pensions of the same dollar amount for all retirees who had contributed over a full lifetime work.

This pillar would be free of political risk, although management risk would be unavoidable as privately managed schemes are exposed to the risk of frauds.

In practice most countries go for a three pillar arrangement according to a "risk diversification" principle that is not well specified: a first compulsory public pillar with the limited objective of reducing old age poverty and insuring the different types of risk outlined before; a second compulsory or voluntary pillar, fully funded and privately managed based on personal saving accounts and occupational plans; a third pillar based on voluntary personal savings. The general aim of the three pillar system is to achieve an improved target redistribution, to lower social costs and to achieve more efficient savings allocation with the third pillar satisfying the needs of more sophisticated investors.

The third objective of making explicit the government debt implicitly accumulated under the PAYG scheme and the funding of the transition can be particularly difficult to address in countries with weak fiscal systems. Large fiscal deficits are likely to be created in the period of transition from an unfunded to a fully funded scheme due to the shortfall of current worker contributions. As a matter of fact, current workers would redirect their contributions to personal pension fund accounts under the fully funded scheme without being able to provide pensioners with income.

Governments have in general two extreme alternatives for paying their implicit debt. One extreme alternative is to transfer on the day of reform the full value of the implicit pension assets to pensioners and current workers by issuing bonds. The other extreme alternative is to keep on paying the PAYG pensions to the extent that they have been contributed for prior to the reform.

The two extreme alternatives have both positive and negative aspects. On the one hand, the positive aspects of the one-shot strategy relate to the reduced period of time for

which the transition deficit is likely to last and, above all, to the credibility of the reform. Nevertheless, it is likely to require the existence of several economic conditions that in general are not yet present in Eastern Europe. First of all it requires a functioning government debt market since current pensioners and retiring workers have to sell bonds to purchase annuities. Agents need to understand the nature of the lump sum payment so that sufficient long-term savings are accumulated for retirement (issue particularly important if the private fully funded scheme is not mandatory). Stock markets have to be able to absorb the large liquidity increase and a well structured legal framework and property right system must exist in order to guarantee worker pension accounts. Finally, governments should be able to correctly enforce existing laws.

On the other hand, the long-term strategy gives more time to the economic and legal systems to develop but it has the drawback that pension payments and hence the transition deficit would last until the fully funded scheme is mature, i.e. the last contributor under the PAYG system has passed away (Arrau and Schmidt-Hebbel 1993). This leaves time to possible unwanted deviations from the strategy due to political reasons.

Governments can of course choose an intermediate option which is basically a convex combination of the two extremes previously analysed. From the second option they can run an "operational" deficit to pay current pensions to existing pensioners and from the first option they can run a "recognition" deficit by issuing bonds in order to transfer to workers, once they retire, the implicit value of their PAYG pension assets accrued prior to the reform (Arrau and Schmidt-Hebbel 1993). Such intermediate system is substantially the one chosen for the Chilean reform (de Fougerolles 1995, Vittas 1995a).

This intermediate solution, could reflect the positive aspects of the two extreme solutions just mentioned. The operational deficit would not be as large as in the long-term strategy and the recognition-bond deficit is likely not to last as much as in the one-shot

strategy. The time needed for the transition to be complete can be defined by adjusting the relative size of these deficits.

In any case all three solutions need financing and this can be done either by raising taxes or by issuing new debt. Unfortunately, it is not possible to say which source of funding is best to finance the transition from a PAYG to a fully funded scheme. As a matter of fact, although the transition increases Pareto efficiency by eliminating the distortion imposed by the pure-tax component of the PAYG contributions, such increase in efficiency may be offset by the increase in general taxation needed to directly finance the transition or to repay the interest on issued debt. The net effect is therefore ambiguous (Arrau and Schmidt-Hebbel 1995).

12. IMPACT OF PENSION REFORM

Any pension reform attempting to downsize the public unfunded scheme in favour of a privately managed, fully funded scheme is likely to have a considerable impact on most of the features of PAYG plans outlined before. In this section I briefly summarise the results of the literature on the effect that a pension reform is likely to have on insurance and redistribution and on aggregate savings. In the following sections I focus more specifically on the likely consequences of pension funds development.

12.1 Reform, insurance and redistribution

Any pension reform would modify the risk sharing and redistributive properties of the old social security system. Intragenerational insurance would be maintained only by the first public pillar and progressivity could be increased by making benefits subject to progressive income tax. In any case, it is unlikely that the reformed system would provide the same level of insurance than the old one to the extent that private defined contribution

schemes do not provide intergenerational and intragenerational redistribution due to their defined contribution and voluntary nature.[51]

Insurance against longevity would be provided by the new system through the private market for annuities. The problem with such market is that it is affected by severe problems of adverse selection because agents with a longer life expectancy are more likely to buy annuities. To the extent that the new second pillar is not mandatory, this form of adverse selection cannot be mitigated. Insurance against inflation is also likely to be higher in the new system if contribution and benefits are indexed. Finally, participants to the new system will bear the investment risk embedded in all defined contributions schemes. A privatised system would considerably reduce the political risk characteristic of state managed schemes as governments would not be able to alter social security rules in response to political pressures. This, for instance, has been the case with the Chilean privatised mandatory pension system which seems to provide high insulation against political risk (Diamond 1995a). Nevertheless, a private system would need a well developed regulatory framework to insure against the risk of frauds; furthermore, regulation has to be effectively implemented by the relevant authorities. Both conditions are unlikely to be met in transition economies and a hurried pension reform is likely to jeopardise the already weak social security system of many countries.

Several criticisms have been made by advocates of egalitarian income redistribution about the redistributive impact of reforms. Such people tend to stress the redistributive characteristics of the first pillar and do not favour any reduction of its role. Nevertheless, there is empirical evidence of limited redistributive impact of PAYG systems (Nelissen 1987) and furthermore, some authors (Valdés-Prieto 1994) claim that it is not necessary to

[51] The statement has to be interpreted in general terms as for instance, limited intragenerational redistribution can be still achieved for industry-based plans.

provide income redistribution through the social security system because progressive taxes and transfers can be used instead, leaving the first pillar to provide adequate pensions on an individualistic basis. In any case, even if reduced redistribution make low expected income agents worse off in the short-run, pension reform and contractual saving development more generally are likely to have a considerable impact on stock markets, as explained in section 13. At least in the long-run the poor is likely to benefit from increased real wages resulting from an increased capital stock per worker. If short-term compensatory programmes are implemented, low expected income agents do benefit from pension reforms (Valdés-Prieto 1994).

12.2 Reform and savings

There are numerous studies related to the effect of pension reforms on aggregate and/or individual savings and they provide contrasting results about the sign of such effect.[52]

There are reasons for which pension reforms have a positive impact on aggregate savings. For instance a reform aiming at limiting the redistributive function of the social security system to a small flat demogrant first pillar would reduce the amount of insurance provided by the system and thus boost savings by low expected income agents (Hubbard *et al.* 1995). Nevertheless, this argument is somewhat weakened by the already mentioned empirical evidence of limited redistributive power of PAYG schemes. Another reason for a positive impact on savings is due to the presence of credit rationing. Credit rationed agents tend to have a higher propensity to save than unrationed agents as savings represent their only available means for asset accumulation. In case of compulsory participation to pension funds, it is likely that agents would face liquidity constraints especially at the beginning of

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[52] For an general and analytical reviews, see: Arrau and Schmidt-Hebbel 1993; The World Bank 1994; Corsetti and Schmidt-Hebbel 1995; Davis 1995; Hubbard, Skinner and Zeldes 1995; Mitchell and Zeldes 1996.

their life cycle as they would be unable to borrow to offset their forced savings. This is especially true for lower income agents for which forced pension saving should boost overall savings more markedly (Davis 1995).

Nevertheless, the impact of reforms on aggregate savings can also be negative. Assuming that the reform would act as a mean preserving spread (Rothschild and Stiglitz 1970) the increase (decrease) in risk would increase (decrease) precautionary savings. Since the reduced political risk of the reformed system may not offset the increase in risk due to the investment risk and reduction of insurance levels, the net effect of the reform on aggregate savings is ambiguous (Mitchell and Zeldes 1996). Furthermore, even if funding would increase personal savings, it is difficult to assess whether such increase is reflected at the national level. This may be due to at least three factors: 1) it is difficult to say whether personal saving is or is not offset by government dissavings as a consequence of tax concession to pension funds; 2) it is difficult to estimate to what extent personal savings increase as a consequence of increased rate of return on pension savings; 3) it is difficult to estimate whether at a company level, savings through pension funds is not offset by dissavings elsewhere (Davis 1995).

In general, the reason for the ambiguous net effect of funding on aggregate savings is related to the fact that there is no direct relationship between level of savings and pension funding. Savings do not depend exclusively on the nature of the pension systems but also on many other factors such as per capita income, income growth, structure of the population and nature of financial markets. For instance, countries with high levels of pension funding such as the United States or the United Kingdom have also low saving ratios compared to countries depending on PAYG unfunded schemes such as Italy for instance.

13. PENSION FUNDS AND STOCK MARKET DEVELOPMENT

A pension reform has the immediate effect of re-allocating savings from the state to institutional investors which invest them in order to guarantee the highest possible retirement income to contributors; subsequently, the institutionalisation of savings is likely to have an important impact on the development of financial markets. In the first part of this section I focus on the impact that the development of pension funds is likely to have on stock markets; further in this section I will focus on the impact that the development of stock markets is likely to have on pension funds.

13.1 Pension funds development

The reason why, within the framework of savings institutionalisation, only pension funds are here taken into consideration, is related to the fact that pension funds are more likely to have an important impact on stock markets than other institutional investors. In countries where the pension system does not rely on a PAYG scheme, such as the United States or the United Kingdom, pension funds differ from other institutional investors essentially for either of the two following reasons: they benefit from a constant flow of funds from contributors due to legal and/or contractual arrangements, and they have particularly long liabilities as benefits are only distributed at the time of retirement. Although constant flow of funds and long-term liabilities are also characteristics of certain close-end investment funds, pension funds tend to be the largest institutional investors in countries with no PAYG pension schemes and this fact suggests that the most important impact on stock market due to institutionalisation of savings is likely to derive from the development of pension funds rather than from the development of other institutional investors.

Life insurance companies tend to be associated with pension funds when analysing the effects of their development on financial markets. This is related to the fact that pension-

type products are also sold by life insurance companies which also tend to have long-term liabilities. Nevertheless, although financial liberalisation implies that the boundaries between the activity of different institutions become extremely vague, pension funds and life insurance companies differ for several reasons. Pension funds collect essentially workers' contributions and invest them while life insurance companies tend to be active in the market for annuities, once benefits have to be disbursed and if pension funds do not already provide such service. Although life insurance companies provide pension-type products, they tend to do so exclusively on a voluntary basis and furthermore, the term of the liabilities deriving from such contracts can be considerably short. Reflecting these differences in liabilities, regulation tends to be more liberal for pension funds; an important difference is that life insurance promises are often fixed in nominal terms while those of pension funds are not. Institutionally, the differences between pension funds and life insurance companies are reflected by the fact that in pension reforms, pension funds are associated with the activity of the second pillar while life insurance companies tend to be associated with the activity of the third pillar. As it was mentioned in previous sections, the second pillar usually represents the principal element of the new funded pension scheme, both when it is based on voluntary or compulsory participation. Instead, the third pillar is essentially aimed at catering for the needs of more sophisticated investors. Furthermore, participation to the third pillar is assumed to be subject to the participation to the second pillar, and often, to the first pillar. All these differences imply that pension funds and life insurance companies tend to cater for the needs of different types of individual investors and therefore, their impact on the development of stock markets is likely to be different.

The development of pension funds, can contribute to the development of stock markets in important ways. On the one side, potential benefits relate to the impact on the asset distribution of investment portfolios and on allocation efficiency due to

institutionalisation (Davis 1995, The World Bank 1994, Vittas and Michelitsch 1995); to financial innovation; to the creation of specialised intermediaries providing financial services and finally to corporate governance. On the other side, the development of pension funds can have a negative impact on stock markets as their activity may increase volatility in stock markets. This is an important issue in emerging markets where the fragility of financial markets in general is of particular concern among policy makers. Finally, the impact on stock market development can be limited in the absence of foreign exchange controls as local pension funds may want to diversify risk by investing abroad (Reisen 1997).

13.1.1 Portfolio distribution

Pension funds tend to compensate for the increased risk of defined contribution schemes by pooling across assets with uncorrelated returns more efficiently than what the personal sector can do. This implies a different distribution in the portfolio structure of domestic assets and a higher concentration of foreign assets where foreign investments are allowed.

Table 8 and Table 9 show the asset structure of pension funds in 1994 and personal sector in 1990 for selected countries. The differences in portfolio structure across countries are generally explained by differences in the depth of security markets, in the structure of liabilities, in regulatory restrictions and in investment culture (Davis 1995, De Ryck 1996). Nevertheless, a common feature in all countries is that pension funds tend to have a portfolio distribution more skewed towards equities than the portfolio distribution of the personal sector. For instance, Table 8 shows how in 1994 equity holdings of pension funds were 80 per cent of the portfolio in the United Kingdom, 52 per cent in the United States and 29 per cent in Japan. Short-term and deposit holding were only 3, 8 and 5 per cent of the portfolio of the same countries respectively. In 1990 the equity holding of the personal sector were 12

per cent of the portfolio in the United Kingdom, 19 per cent in the United States and 13 per cent in Japan. Liquidity and deposit holding represented instead 47, 33 and 23 per cent of the portfolio of the same countries respectively.

Table 8 Asset structure of pension funds, 1994.

In per cent of total assets	Equity	Fixed income and mortgage loans	Real estate	Short-term and other investments
United Kingdom	80	11	6	3
Ireland	55	35	6	4
United States	52	36	4	8
Belgium	36	47	7	10
Netherlands	30	58	10	2
Japan	29	63	3	5
Denmark	22	65	9	4
Germany	11	75	11	3
Switzerland	11	64	16	9
Spain	4	82	1	13

Source: De Ryck 1996.

Table 9 Asset structure of personal sector, 1990.

In per cent of total assets	Equity	Bonds	Loans	Liquidity and deposits	Life insurance, pension funds
Japan	13	5	0	53	23
France	34	3	0	51	12
Italy	22	18	0	49	12
Germany	6	18	0	48	22
Canada	21	6	2	39	28
Australia	17	13	0	34	36
United States	19	10	1	30	33
United Kingdom	12	4	0	29	47
Netherlands	6	8	0	29	54

Source: Davis 1995.

The specificity of the pension funds' portfolio distribution is also evident when compared with the portfolio distribution of life insurance companies. Table 10 provides information on pension funds and life insurance companies in the United Kingdom, United States, Germany and Italy in 1995. Countries like the United Kingdom and the United States have a pension system essentially based on fully funded private pension schemes while Germany and Italy rely mainly on public PAYG pension schemes.

The first difference to be noticed between pension funds and life insurance companies in these is their different relative importance. In the United Kingdom and the

United States pension funds are considerably larger than life insurance companies: in the United Kingdom the assets of pension funds and life insurance companies are 75 and 69 per cent of 1995 GDP respectively while in the United States the corresponding percentages are 56 and 30. In Germany and Italy the relative importance of the two institutional investors is inverted. In Germany pension funds' assets to GDP are almost one tenth of life insurance companies' while in Italy the same ratio is only one half. The reason for this asymmetry is likely to lie in the fact that in Germany and Italy pension funds are not fully developed as the role of sustaining the pension system in these countries is performed by the PAYG public scheme.

Table 10 Pension funds and life insurance portfolio distributions, 1995.

	United Kingdom		United States		Germany		Italy	
	Pension funds	Life insurance	Pension funds	Life insurance	Pension funds	Life insurance	Pension funds	Life insurance
Assets[1]	74.92	69.44	55.66	29.59	2.90	20.52	5.73	9.57
Equity[2]	80.00	58.95	52.50	17.05	11.00	2.76	7.83	5.40
Equity[3]	49.40	33.74	37.47	6.47	1.33	2.37	2.54	2.92
Loans[2]	0.02	1.45	3.03	14.54	40.24	66.68	0.00	0.00
Long-term bonds[2]	12.41	16.44	27.20	57.44	na	na	na	47.35
Liquidity[4]	4.41	7.96	4.38	8.77	15.52	34.36	376.16	24.22

1: per cent of GDP; **2**: per cent of assets; **3**: per cent of stock market capitalisation of the London, New York, Frankfurt and Milan stock exchanges respectively; **4**: proxied by the ratio between cash deposits and equity.
Source: OECD.

The second difference between pension funds and life insurance companies lies in their asset portfolio distribution. Both in the United Kingdom and the United States pension funds invest more in equities and less in bonds (even long-term bonds) than life insurance companies. In the United Kingdom, for instance, pension funds investment in equities represents 80 per cent of total assets which means that they own almost 50 per cent of the 1995 London stock market capitalisation. Comparative percentages for life insurance companies are instead 59 and 34 per cent respectively. The same pattern arises in the United States although with a lower magnitude. Notice in fact, that life insurance companies in the

United States own only 6 per cent of the New York stock market capitalisation as most of their financial assets are allocated in mortgage loans and long-term bonds.

Investment behaviour of pension funds is similar in Germany and Italy in the sense that equity investment is higher than for life insurance companies. Nevertheless, the underdevelopment of stock markets in these countries implies that assets are mainly allocated to mortgage loans (Germany) and long-term bonds (Italy) and in general in non financial assets.[53] This also implies that both pension funds and life insurance companies in Germany and Italy tend to have more liquid an asset position than in the United Kingdom and the United States. The last row in Table 10 reports the percentage of cash deposit over equities and it is meant to represent a proxy of asset liquidity. In the United Kingdom and the United States, where pension funds perform their role of sustaining the pension system, portfolio distributions are more skewed towards equities and therefore, pension funds positions are less liquid than life insurance companies'. In Germany and Italy this is not the case as there is no incentive for pension funds to allocated contributions to high risk, long-term assets as retirement income is mainly provided by the state through the PAYG scheme.

It seems to be the case that pension funds invest more in equities than life insurance companies in all four countries. Nevertheless, mainly because of their longer term liabilities, only in the United Kingdom and the United States can pension funds have an impact on stock market. The incentive to invest equities is there particularly strong as only high real returns determine the payment of high pensions in a fully funded scheme. This suggests that an eventual pension reform can be particularly beneficial for investment and public finance in the transition economies because of the specific structure of the balance sheet of pension funds. The weakness of firms in transition is such that external funding is often available

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[53] Italian non financial assets of pension funds and life insurance companies were, in 1995, 37 and 44 per cent of total assets respectively.

only to few well reputed companies and even for them funding is on a short-term basis. The development of pension funds would increase the availability of long-term finance via equity and corporate bonds; it would help reduce leverage and cost of capital if aggregate volume of financial savings is raised by the diversity of instruments available to households. Ultimately this would reduce firms' sensitivity to short-term shocks. The government debt finance by means of domestic securities could benefit in similar ways.

13.1.2 Innovation

Pension funds development can also be beneficial to product innovation in capital markets by stimulating the use of hedging strategies and derivatives. For instance, the effect of pension funds development on innovation is well documented in the United States with the introduction of ERISA in 1974. The requirement of fixed duration for investment instruments has stimulated the creation of new financial instruments such as zero coupon bonds and collateralised mortgage obligations. The long-term maturity of liabilities of pension funds has also stimulated the development of immunisation strategies based on long-term CPI-indexed bonds and index-linked mortgages. Notice that inflation-hedging is particularly important where benefits are linked to final salaries but its relevance for pension funds should not be overstated. In the United Kingdom index-linked bonds represent only 3 per cent of pension funds assets as returns on equities seem to more than compensate for the decreased matching between assets and liabilities (Davis 1995). Another area where innovation can be stimulated by the development of pension funds is in the use of derivatives. For instance, futures can be use to improve asset allocation between different national markets when derivatives markets are more liquid than the market for the underlying instruments. Options instead, can be used to profit from shifts in currencies. In general, innovation would be particularly beneficial in developing stock markets. Even if most of the developments seen in the United States would not be on the immediate agenda in transition

economies, the creation of *ad hoc* instruments suiting the needs of pension funds would only increase efficiency if only through an expanded set of investment opportunities.

13.1.3 Volatility

The major counter argument to the beneficial impact of pension funds development on stock markets is given by the possible increase in volatility that larger pension funds and institutional investors in general may generate in the stock market. A general perception about emerging equity markets is that security prices are subject to substantial variation around their fundamental values. Among the authors supporting this view: Gooptu (1993), for instance, argues that increased volatility may be the result of herding behaviour, portfolio activities and general short-terminism of institutional investors. Williamson (1993) suggests that herding behaviour among foreign investors may cause the development of bubbles in asset prices. Howell (1993) argues that the absence of long-term domestic investors causes foreign investors to be marginal and their mobility causes high price volatility among securities. Nevertheless, in a more recent study, Richards (1996) finds no empirical evidence to support the view of positive correlation between the development of institutional investors and increasing volatility in emerging stock markets. He shows that emerging stock markets are indeed more volatile than mature markets but volatility has not increased in recent years. It may actually be possible that emerging markets have become less volatile with the increasing participation of foreign institutional investors since more investors now share a given amount of risk and therefore, volatility of returns is expected to decrease.

13.1.4 Foreign investment

In the case of absence of foreign exchange controls, pension funds may want to invest abroad in order to diversify risk and Reisen (1997) argues that this is likely to be the case in developing countries. Because of their lower per capita income, investors in

developing countries are likely to be more risk averse and hence, they would buy a higher share of foreign assets than investors in developed countries. This seems to assume that a developing and developed countries have the same asset return distributions. But if the underlying distributions are different, covariances are different and the respective shares of foreign assets do not necessarily reflect anymore only the degree of risk aversion in one country. He also adds that institutional investors display a "home bias" for assets and in the OECD countries this seems to be related to the fact that pension funds may wish to limit the currency exposure of their portfolios, pension fund trustees may have a low risk tolerance, a track of high real returns on domestic bonds and loans may exist. These same reasons would only partially apply to developing countries which would therefore display a less pronounced "home bias".

13.2 Stock market development

The development of stock markets in transition economies is strictly linked to the question of optimal configuration of the financial markets in these countries. Given the specificity of the transition process to market based economies, the optimal configuration of the financial sector should guarantee that newly privatised firms be restructured, effective mechanisms of corporate governance be in place and finally, that short and long-term liquidity be available to firms at low costs in order to promote economy-wide growth.

Naturally, the achievement of these objectives is strictly related to reforms in other sectors such as fiscal reforms, enterprise reforms and legal reforms. For instance, banks rely on the legal system, including procedures for collateral recovery and bankruptcy laws to enforce their claims and perform their role of monitors of firms. Stock markets require company laws which define the rights of shareholders and protect minority shareholders. Enterprise reform, including privatisation and free entry of new private firms, is needed to

impose financial discipline on entrepreneurs. Fiscal reform would release the pressure on banks to lend to the government sector and relax the fiscal burden on firms, already exposed to the macroeconomic shocks embedded in the transition process. In this section I analyse how the lack of long-term finance and effective corporate governance can be addressed through the development of stock market.

Between 1990 and 1994 gross financial savings of enterprises funded 33.7 per cent of investments in Russia, 79.3 per cent in Romania and an average of 129.2 per cent in the Czech Republic. The net borrowing from banks and other financial institutions averaged 8, 12.6 and minus 14.3 per cent in the same countries and over the same period respectively. It seems that in transition economies, weaknesses in the financial sector requires firms to rely on internal financing (Johnson *et al.* 1997). Given the relative weak governance structure of enterprises, further external financing would improve financial discipline and allocative efficiency of investments. Nevertheless, banks in transition economies are in general still ill equipped to perform the governance and allocate funds efficiently. Among the reasons for this are a general lack of historical information about enterprises; lack of a satisfactory system of ongoing monitoring of loan portfolio quality; lack of qualified personnel able to deal with areas of credit risk, lack of appropriate loan restructuring and insolvency functions within banks; lack of appropriate prudential regulations and loans and credit risk assessment procedures linked to the specificity of transition economies. In this framework the establishment of a well functioning banking system and prudential supervision rules is essential for the restructuring of enterprises and for governance improvement. For instance, it has been argued that emerging economies mostly need the existence of a reasonable efficient, ordinary banking system that collects short-term deposits, handles transfers of funds, provides firms with working capital and which is sufficiently well capitalised to cover ordinary banking risks (Gross and Steinherr 1995).

This stress on the banking sector may lead to underestimate the importance of sufficiently flexible corporate governance mechanisms in a transition period. Even a well functioning banking system may have severe limitations in performing an effective corporate governance role and sustain long-term growth in the period of transition because of banks' short-term objective of loans repayment and the fact that working capital and short-term investment loans do not represent major components of firms' long-term growth. If the banking sector cannot provide long-term finance through loans, it may be provided through equities by the stock market. Its development is likely to benefit the financial sector in several ways as it is likely to create new lending opportunities and therefore, lower the cost of capital for firms. It is also likely to improve corporate governance through the promotion of information disclosure and stock brokers' activity. The larger availability of information, in turn, can help the banking sector in assessing risk and resolve the bad loan problem, largely at the origin of most banking crisis.

13.2.1 The role of stock markets.

Stock markets are supposed to perform two main roles:

- Stock markets provide long-term finance to firms.
- They provide evaluation of the financial information produced by firms and improve corporate governance.

King and Levine (1993) argue that financial development influence long-term growth by improving the probability with which innovative projects are financed.[54] In this sense, the absence of a stock market can be seen as an "internal" constraint for the financial

[54] For a review of the literature on the relationship between financial development and growth see: de Gregorio and Guidotti (1995).

sector and economy-wide development. The principal reasons being that an efficient stock market represents a means to attract long-term and cheap equity finance, to attract foreign capital as a circuit for transferring know-how, to improve resource allocation and accelerate economic growth. Large stock markets may decrease the costs of mobilising savings and facilitate investment by lowering the costs of equity finance. Bencivenga, Smith and Starr (1996) and Levine (1991) underline how liquidity is important for growth as this allows long-term investments to be undertaken without investors needing to relinquish the control of their savings for long periods of time. Levine and Zervos (1995), using a cross section of 49 countries from 1976 to 1993, show how stock market size and integration is positively linked to growth.

The development of stock markets implies also that an increasing volume of financial information be produced. Firms have a private incentive to produce reliable information as this allows them to lower the cost of financing capital (Dhaliwal 1979, Diamond 1985, Diamond and Verrecchia 1991). It is also likely that positive externalities exist in producing information, both for other listed firms and for other agents operating in the stock market. Firms listed on the stock exchange are asked to produce a standardised set of information and it is likely that average profits increase with the number of firms being listed. This for the simple fact that standardised information may decrease transaction costs among participating firms.

Holmstrom and Tirole (1990, 1995) argue that liquid stock markets create demand for information about firms and therefore, improve corporate governance. An increase in market liquidity can ease shareholders' exit and lively take-over activity which could represent an important discipline factor in controlling managerial incompetence. Alternatively, Diamond and Verrecchia (1982) and Holmstrom and Tirole (1990) argue that information in stock prices allows for effective managerial schemes to be implemented as the

mitigation of the principal agent problem makes it easier to link manager compensation to stock performance. In this framework, the development of stock markets is likely to promote liquidity and information disclosure and therefore, promote firm restructuring and effective governance.

Several criticisms have been made about the importance of stock market development with reference to the issues before mentioned. As far as the resource allocation role of stock markets is concerned, Mayer (1988), in his study of France, Germany, Japan, UK and US, argues that stock markets did not represent an important source of firm finance in the period 1970 - 1985 while the most important source of funds was retained earnings. The allocative efficiency of stock markets can be limited by problems of asymmetric information. When firms cannot effectively signal their type though the stock market, the cost of capital for the good (bad) types is higher (lower) than it would be in case of perfect separation. This form of subsidisation, typical of pooling equilibria, implies that funds are not allocated in an efficient way. Allen (1993) argues that the relative importance of stock markets and banks in corporate finance varies with time. Stock markets are more important in those countries and/or time periods when there is disagreement about production functions while banks are desirable institutions for allocating resources where there is agreement on technology and the main problem is monitoring firms. On the informational role of stock markets, Stiglitz (1985, 1994) argues that the quality of information about firms produced by the stock market is too low to address investors' decisions and that investors have to rely on specific intermediary agents for such service. Criticisms have also been made of the idea of take-overs as a corporate governance mechanism as both theoretical and empirical literature have not produced unambiguous results on this issue (Davis 1995, Filipovski 1996).

Finally, the inference that banks are likely to benefit from increased information is somehow weakened by the argument that banks do not necessarily rely on public information

but on customer relationship and borrowers' reputation in their lending policies. Nevertheless, there is empirical and theoretical evidence that banks do benefit from the increased information in their lending operations as stock market and banking sector represent a complementary rather than alternative source of finance for firms as suggested by Demirgüç-Kunt and Maksimovic (1995), Levine and Zervos (1995) and by Boyd and Smith (1996). This is inferred by observing that debt-equity ratios tend to increase in the initial stage of stock market development in developing countries. The emergence of equity as a major instrument of external finance occurs in more sophisticated economies where debt-equity ratios tend to be lower. This is confirmed by a study by Demirgüç-Kunt and Levine (1995) who show how, in a panel of 41 countries over the period 1986 - 1993, countries with well developed and efficient stock markets also have well developed and efficient bank and non-bank financial intermediaries.

13.3 Stock markets and pension funds development

If pension funds can influence the development of stock markets for the reasons before mentioned, it is also possible to find a feedback from stock markets to pension funds development which goes through the promotion of information disclosure on the part of firms which, in turn, is an important element for the development of efficient mechanisms of corporate governance.[55]

Two main models of corporate governance can be identified. The "insider model" relies on the direct representation of specific interests on the board of directors and through direct monitoring and disciplining of management via capital or debt. This model can be found in many OECD countries (Japan, Germany, France, Netherlands, Switzerland). The

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[55] For an analytical survey of the issues of corporate governance in transition economies see: Frydman, Gray and Rapaczynski 1996.

"outsider model" is used in the United Kingdom and the United States where monitoring and disciplining takes place via the capital or debt market. Hence, corporate governance can be seen as the result of four main forms of control on management behaviour. Control can be direct and/or indirect and it can be exerted through equity and/or debt.

A first form of control is exerted indirectly by the market through equity where the threat to managers is given by the threat of take-overs. This acts as a constraint on managerial behaviour as management deviations from shareholders interests is likely to be reflected by a low share value as shareholders dispose of their holdings. The likelihood of acquisition increases and therefore, the probability of a change in the management. Laffont and Tirole (1988) and Scharfstein (1988) argue that well functioning stock markets that make the threat of take-over credible induce manager to maximise firms' profits. Pension funds are major shareholders and their role in take-overs can be crucial. Nevertheless, with exception of South Africa where pension funds seem to exercise a direct control of the management (Vittas and Michelitsch 1995), little empirical evidence exists that suggests an important role of pension funds in take-overs (Davis 1995).

A second form of control is exerted indirectly by the market through debt. The causes of constraint managerial behaviour are here the decreased internal resources at disposition and the inspection of the stock market related to debt issues (Jensen and Meckling 1976). The extent to which this form of control is desirable is probably limited as increased leverage exposes firms to temporary shocks and can raise bankruptcy rates. Pension funds would represents an alternative source of finance and the eventual decrease in corporate governance which derives may be offset by increased control through equity.

A third form of control is the direct control through equity that the board of directors exercises on behalf of the shareholders. Institutional investors are likely to exercise this control more efficiently than individual investors. The role of pension funds seems to be

increasing in this area (Davis 1995) partly motivated by concerns on the effectiveness of take-overs and leverage as a means of corporate governance.

Finally, the direct control exercised by banks through debt is the last form of management control. In this area banks have a comparative advantage deriving from ongoing credit relationships, the knowledge of borrowers' deposit history and the use of transaction services. Nevertheless, the privileged relationships with banks have some major drawbacks for firms' financing policies. Bank loans tend to represent a short-term resource for firms which limits the possibilities for growth. Furthermore, information acquired through reputation is likely to be non-transferable and this can limit the ability of borrowers to switch to equity finance. Pension funds clearly have a passive role in this area but they can contribute by providing an alternative source of finance and by stimulating the diffusion of information. Information is likely to improve corporate governance in general and banks' loan monitoring activity.

The main issue related to the reciprocal impact of pension funds and stock market development is not to determine which of the corporate governance models previously outlined is likely to emerge in the transition economies. The main issue is to outline that the development of both stock market and pension funds is possible only if firms have strong incentives to disclose information about their types. Firms, especially good firms, have a strong incentive to disclose information if this allows them to obtain equity finance at a lower cost. In the next section I will show how this is likely to be the case. In a simple signalling model, I will show that firms seeking finance without the possibility of signalling to investors their true type are likely to be pooled and treated as being the average type. This means that in a pooling equilibrium the same premium is paid for a given level of equity finance by all firms. If instead firms can fully separate themselves, different firms will be paying different premia for the same level of finance with good type paying less then bad

types of course. The incentive to separate lies exactly in the fact that types better than the average type would obtain the same level of equity finance at a lower cost.

Information disclosure is also beneficial to pension funds and to the quality of corporate governance. Factual evidence suggests that pension funds invest in companies on a portfolio basis more than as controlling agents. This means that they rely on third-party credit assessment for their investment decisions in order to contain transaction costs and hence, they have an interest in supporting the development of a wide range of services, such as credit rating, accounting and auditing services. Vittas and Michelitsch (1995) argue that in many countries, specialised agencies have also emerged that scrutinise the governance structure and monitor the corporate performance of different corporations in order to advise pension funds in the exercise of their voting rights. High liquidity and capitalisation together with an increased availability of information and the consequent development of a wide range of information-related services, would allow pension funds to operate on a portfolio basis, to diversify risk more efficiently and to represent an important supply of long-term finance which would contributed to liquidity. The stock market activity of sorting entrepreneurs coupled with superior ability in providing appropriate financing to investors can lower the cost of investing in productivity enhancement and stimulate economy-wide growth.

14. PENSION FUNDS, STOCK MARKET AND FIRMS' INFORMATION DISCLOSURE

The following model analyses the relationships among three sets of agents: a continuum of firms, a stock market and pension funds. The complex interactions among these agents are simplified to highlight the impact on the creation of information on the part of firms. Such information is processed by the stock market and then sold to pension funds.

Pension funds rely on the evaluative function of the stock market in order to address portfolio policies and provide firms, through the stock market, with long term equity finance. The development of the stock market is strictly related to the development of pension funds with cyclical feedback among the two sets of agents.

On one side of the economy, firms with different probability of survival (hazard rate) seek long term equity finance to boost their net revenues and this is obtainable only if firms meet some given information disclosure requirements. Firms' incentive to produce information is strictly related to the fact that information allows them to obtain equity finance at decreasing costs. I used a stylised signalling game to model the disclosure of information on the part of the firms. In equilibrium, the amount of information disclosed is a positive function of the heterogeneity of firms listed on the stock exchange as a higher level of signal is needed to separate a larger number of different firms.

In the middle, the stock market is composed of a stock exchange and a set of information intermediaries such as brokers, credit rating companies, audit firms *et cetera.* The stock exchange represents the only means where firms can sell their shares. In principle, the stock market promotes information disclosure by allowing a certain number of firms to be listed on the stock exchange as this represents a source of revenue. Nevertheless, as the stock market is the only agent responsible for the evaluation of information, entry may be limited to a number of firms smaller than what is socially desirable. I will show that social welfare is not maximised when the stock market maximises monopoly profits.

On the other side of the economy pension funds purchase firms' financial information processed by the stock market. Contrary to individual investors, pension funds possess the technology to efficiently process the information produced by the stock market and the larger the availability of information the more efficiently savings are likely to be allocated by pension funds while addressing their portfolio policies. Pension funds represent

also a strong supply of long term finance in the economy since the structure of their liabilities forces them to have a portfolio distribution markedly skewed towards equities. This means that their presence in the economy is likely to promote both information disclosure on the part of firms, and the development of information intermediaries. I will show in a framework of bilateral monopoly with efficient bargaining how pension funds are likely to promote the development of the stock market through increasing bargaining power and thanks to a general increased efficiency of the financial sector. The growth of the stock market in turn, positively affects the development of pension funds as a larger number of listed firms implies more information being produced and therefore, a more efficient allocation of funds.

The fundamental assumption made here is that long term equity finance favours economy-wide growth and that information disclosure improves on the one side corporate governance as it offsets the possible negative impact on governance of institutional investors portfolio policies; on the other side it facilitates risk diversification policies of pension funds and therefore, it promotes their development. Improved governance, together with the increased efficiency represented by the development of pension funds, can lead in turn to a decrease in the cost of capital with positive feedback on economy-wide growth through its impact on the supply and demand for long term finance.

14.1 Firms

In the economy there is a continuum of risk neutral, profit maximising firms uniformly distributed[56] over the interval $H = [0,1]$. Firms differ only by the quality of their management which is translated into firms having a constant but different probability of

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[56] The use of the uniform distribution simplifies the treatment of the model without limiting the generality of results.

bankruptcy at any given time. In other words, a firm with a hazard rate h_0 has a probability of failure lower than a firm with a hazard rate $h_1 > h_0$. Firms' individual types (realisation of h) cannot be observed by investors and firms alone cannot credibly inform investors about the quality of their management.[57] Nevertheless, investors know the distribution of types over the interval $H = [0,1]$ and therefore, they know the average hazard rate $\bar{h} = \frac{1}{2}$ in the firms' population.

Each firm has been in operation for an indefinite period of time producing profits very close to zero. It is possible to assume that firms have been financing their activity through bank loans and that at a specific point in time they see the possibility of running a project which will increase their gross revenue flow to X during their infinite lifetime horizon. For simplicity I assume that such a project is the only way that firms have to produce positive profits. Therefore, given a safe rate of interest r, the expected present value of the revenues from the project for an h type firm is given by:

(48) $$\frac{X}{r+h} = \int_0^\infty X e^{-(r+h)t} dt$$

Firms have to rely on the local stock market for financing the project since they are assumed to have insufficient internal resources to meet the necessary investment and banks are unlikely to lend either than for the short term projects. Foreign stock markets are also assumed to be out of the reach of firms and this is a plausible assumption for firms located in emerging markets with low performance levels and/or inability to meet western information disclosure standards.

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[57] The banking sector is not explicitly modelled here. Its introduction would not affect the level of information possessed by investors about firms' types as the information gathered by banks through their ongoing credit

The total investment cost to be sustained in order to run the project is given by two components. The first component is a fixed level of equity finance I provided by investors and the second component is a signalling cost i met by firms' internal resources. The reason for introducing signalling costs is that one of the functions of stock markets is to evaluate firms and new investment projects; the variable "i" synthesises both the costs and the level of information produced by firms before equity transactions take place.[58] In this sense, the production of information is seen as a necessary condition for firms to be listed on the stock exchange.[59]

The equity finance I is provided by risk neutral investors against a claim share $s \in [0,1]$ on the expected present value of the firm. Hence, the expected present value of an h type firm is simply the value of the infinite stream of gross revenues from the project minus the investors' claim on such revenues and minus the pre-floating costs i, all in expected present value terms. Thus:

$$V_h = [1 - s(h)]\frac{X}{r+h} - i \qquad (49)$$

where:

$$s(h) = (r+h)\frac{I}{X} \qquad (50)$$

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relationships with borrowers is private to banks and not likely to be transferred.

[58] Even if floating costs are fixed for all firms, this allows for the possibility that better firms may want to sustain higher pre-floating costs (by choosing better audit firms to analyse their books, for instance) in order to present themselves to investors as better investment.

[59] The same set-up can be re-interpreted as a problem of a single firm facing a continuum of projects ranked according to their probability of failure $h \in [0,1]$. In this situation the unique firm would choose a different levels of signal i according to which project is financed.

is the capital share that an h type firm needs to sell in order to obtain the equity finance I.

Two implications of (49) are worth mentioning. First, the expected value of a bad firm is lower than the expected value of a good firm because: *a*) for any given level of signal, good firms discount time at a lower rate (they are more patient) and *b*) as $s'(h) > 0$, good firms pay a lower premium[60] than bad firms on the same level finance I. Second, a participation constraint exists for a firm to undertake the project given by $X \geq (I + i)(r + h)$. The possibility of firms selling more than 100 per cent of their shares is here excluded as this would imply making negative profits.

14.1.1 Pooling equilibrium

Firms are motivated to produce information about their type since, as previously mentioned, this may reduce the cost of capital. Nevertheless, if the stock market does not perform its evaluating function, firms' signal becomes unobservable by investors.[61] In such a set-up, the optimal level of information produced by firms is $i = 0$; firms are pooled together and they are all perceived as being the average type $\overline{h}$.

In a pooling equilibrium all firms sell the same capital share and investors make on average zero profits. The fact that the same level of shares is sold by different types of firm means that better types are subsidising the presence of worse types. As a matter of fact,

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[60] Notice that the amount of shares sold against I can be seen as the firms' cost of capital or in other words, the premium that bad firms have to pay for the low quality of their management. Alternatively $s(h)^{-1}$ can be interpreted as the price at which a type h firm is selling its shares: the shares in good firms cost more than the shares in bad firms.

[61] Without the intermediation of the stock market, investors are not likely to possess the resources needed to screen the volume of information produced by the firms. The absence of stock market intermediation makes information *de facto* unobservable.

firms whose value is higher than the average firm value would be better off by separating themselves as this would yield a lower cost of capital.

14.1.2 Separating equilibrium

If the stock market performs its informational function the pooling equilibrium is not stable. Better types can use the signal i to reveal their type to investors and therefore, lower their cost of capital. In our simplified world the stock market performs its informational function when it provides a mechanism to reveal the signal i of every firm h to investors. For the moment I will assume that such activity is costless; later on this will be relaxed and results compared.

Firms use the signal to reveal information about their type and investors observe the signal and form an inference about types. A separating equilibrium exists when types are correctly inferred and no type has incentive to mimic anybody else in equilibrium. Following Bernheim (1994) let $\phi(b,i)$ be the function that for any signal i assigns a probability to each possible investors' inference b about type h. Such a function must therefore satisfy:

(51)
$$\int_H \phi(b,i)db = 1 \qquad \forall\, i$$

Each firm will decide the optimal level of signal by solving the following problem:

(52)
$$\max_i \; V_h = \left[1 - s(\phi(b,i))\right]\frac{X}{r+h} - i$$

s.t.
$$s(\phi(b,i)) = \left[r + \phi(b,i)\right]\frac{I}{X}$$

and a fully separating equilibrium is characterised by a function $\phi_s(i)$ such that:

(53) $$\phi(b,i) = \begin{cases} 1 & b = \phi_s(i) \\ 0 & \text{otherwise} \end{cases}$$

(53) implies that a type h firm choosing to signal i is perceived by investors as being type b with probability one. In equilibrium, indifference curves must be tangent to $\phi_s(i)$ in the choice-inference space (i x b) and the signal i must be self-fulfilling[62] in the sense that $\phi_s(i) = h$.

After totally differentiating V_h, applying the equilibrium condition $\phi_s(i) = h$ and solving the resulting differential equation, one obtains the following equilibrium inference function:[63]

(54) $$r + h(i) = (r + \hat{h})e^{-\frac{i}{I}}$$

where $\hat{h}$ is the type that finds optimal to signal $i = 0$ before flotation, also called the marginal type.

The inference function correctly reveals individual firms' type h to investors once i is signalled; its inverse is therefore, the signalling function that yields the optimal level of signal produced by each individual firm. Thus:

(55) $$i(h) = \left[\log(r + \hat{h}) - \log(r + h)\right]I$$

Figure 21 shows the signalling function for all possible types. Notice that the level of signal is monotonically decreasing in h: the best type will produce $i(0) = i_{max}$ and the worst type will produce $i(1) = i_{min}$.

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[62] The self-fulfilment condition requires that in equilibrium, for any given signal i, the type h signalled by the firm coincides with the investors' inference b; i.e. $b = h$.

[63] See Appendix 17, page 164 for formal derivation.

If the marginal type is internal to H as shown in Figure 21, then types $h > \hat{h}$ produce a negative level of signal. This makes little sense as it is possible to show (by substituting (54) into(50)) that types $h > \hat{h}$ would require to sell more than 100 per cent of their capital in order to obtain the equity finance I. This is not possible because the presence of the participation constraint would imply that types worse than the marginal type make negative profits. The exclusion of some types has to be incentive compatible in the sense that excluded types do not want to be in the equilibrium. Furthermore, incentive compatibility needs to hold for all possible types in order for the equilibrium to be stable.

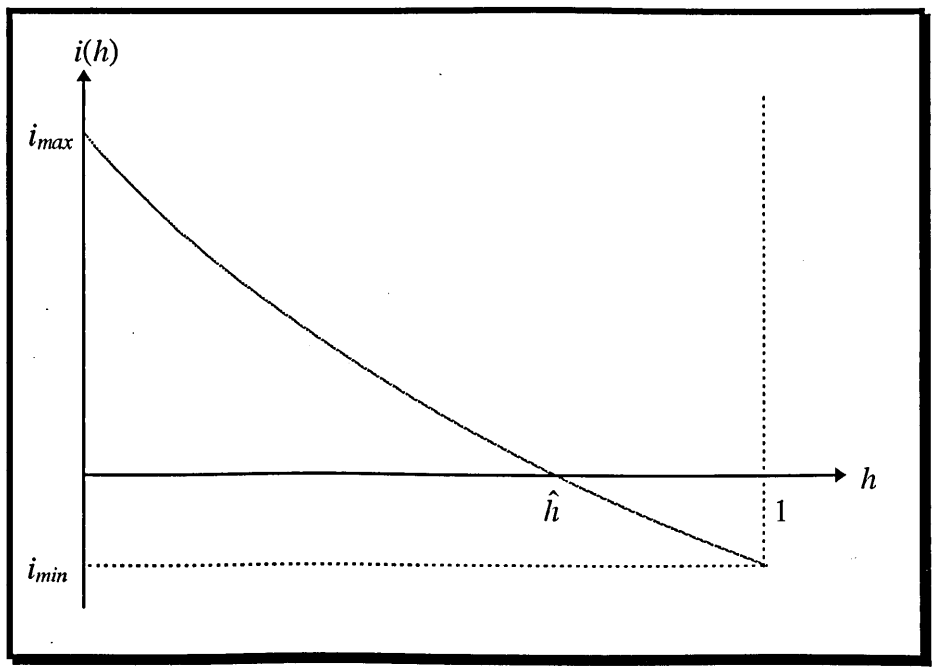

Figure 21 Signalling function in a partially separating equilibrium.

Let's start by showing that incentive compatibility holds for types $h \in [0, \hat{h}]$ by considering the following two functions:

(56)
$$V_h^* = [1 - s(h)]\frac{X}{r+h} - i(h)$$

and

$$V^*_{h_j|h} = [1 - s(h)]\frac{X}{r + h_j} - i(h) \qquad (57)$$

where $i(h)$ is defined by (55). Equation (56) is obtained by substituting (55) into (49) and it yields the equilibrium expected value of all possible firms $h \in [0, \hat{h}]$. It is strictly decreasing with h and strictly convex over the same interval. Equation (57) yields the equilibrium expected value of an h_j type firm mimicking some other types $h \in [0, \hat{h}]$. It is non-monotonic in h and strictly concave over the same interval. Both functions are shown in Figure 22 where (57) is shown for two different types $h_1 > h_0$.

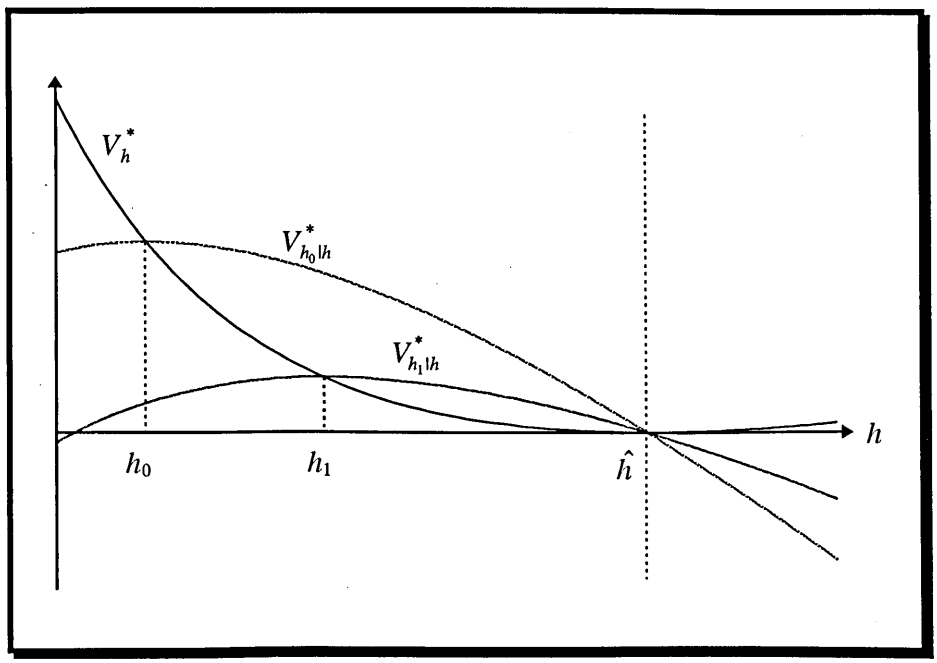

Figure 22 Optimal value functions and mimicking behaviour.

Incentive compatibility implies that types are always worse off, in the sense that they make lower expected profits, if they decide to produce a level of signal different from the optimal one given by (55). This be shown by differentiating (57) with respect to h. Thus:

(58) $$\frac{\partial V^*_{h_j|h}}{\partial h} = \begin{cases} \leq 0 & h \geq h_j \\ > 0 & h < h_j \end{cases}$$

Notice how the mimicking value function reaches its maximum[64] when firms signal correctly their type, i.e. when $h = h_j$. Therefore, any signal level different from the one yielding the correct inference, yields a lower expected present value for the firm and, therefore, it is not chosen.

Incentive compatibility holds also for types $h \in (\hat{h},1]$ who weakly prefer to be excluded. This is possible only if the marginal type makes zero expected profits in equilibrium. In order to prove this let's assume for one moment that it makes positive expected profits, i.e. $V^*_{\hat{h}} > 0$. In this case, it is possible to find an $h' \in (\hat{h},1]$ excluded from the stock market (and therefore making zero profits) which has incentive to mimic $\hat{h}$. Notice that in this case $V^*_{h'|\hat{h}} > 0$ as positive expected profits for $\hat{h}$ imply $s(\hat{h}) < 1$. Since this violates the incentive compatibility requirement of the equilibrium, $\hat{h}$ has to make zero profits. In this case excluded types are indifferent between being excluded and mimicking $\hat{h}$; i.e. $V^*_{h'|\hat{h}} = 0$ since $s(\hat{h}) = 1$.

The zero profit condition for the marginal type implies that $\hat{h}$ is defined by:

(59) $$r + \hat{h} = \frac{X}{I}$$

This in turn allows us to identify two possible cases for the separating equilibrium given earlier.

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[64] The second order condition is verified as $\frac{\partial^2 V^*_{h_j|h}}{\partial h^2} = -\frac{I}{(r+h)^2} < 0$

1. If $\frac{X}{I} \geq r+1$ the marginal type is $\hat{h}=1$ since no $h>1$ type exists. The marginal type produces a signal $i(1)=0$ as he needs not to separate himself from any other type; it sells an optimal equity share $s(1) \leq 1$ and makes expected profits $V_1^* \geq 0$. In this case we have a fully separating equilibrium. Notice that in a fully separating equilibrium the marginal type may be making positive expected profits without this undermining the incentive compatibility requirement as there are no types left outside the equilibrium.

2. If $\frac{X}{I} < r+1$ the marginal type is $\hat{h} \in (0,1)$ producing a signal $i(\hat{h})=0$, with an optimal equity share sold is $s(\hat{h})=1$ and making expected profits $V_{\hat{h}}^* = 0$. In this case we have a partially separating equilibrium, fully separating for all "active" firms.

14.2 The stock market

In the previous section, the stock market functions were limited to the provision of long term equity finance through the stock exchange and to the evaluation of firms and firms' projects. The first function was performed by allowing firms to sell equities and the second function was performed at a zero cost by simply enabling firms' signal to be observed by investors. In this situation we saw that a partially separating equilibrium can be obtained with types $h \in [0, \hat{h}]$ allowed to float and types $h \in (\hat{h}, 1]$ excluded from the equilibrium. In equilibrium, the expected value of the marginal type $\hat{h}$ is zero, a necessary condition for the equilibrium to be incentive compatible.

In this section I relax the assumption of costless stock market evaluation as it is unlikely that information is simply transferred to investors at a zero cost. Legal requirements

provide that firms' financial information be certified by specialised institutions. Furthermore, it is often the case that information needs to be tailored by a large series of intermediaries such as stock exchanges, credit rating companies, brokers, auditing firms *et cetera*, as the quality of information produced by firms may be unsuitable to address investors' choices. Information intermediaries process the signal produced by firms and repackage it in order to facilitate investors' decisions.

In the presence of information processing costs, a monopolist stock market has an incentive to limit the entry of firms: i.e. it has an incentive to limit the number of firms listed on the stock exchange. This derives from the fact that firms with a high hazard rate produce a low level of signal in equilibrium and this signal may too low to produce enough revenues to cover the processing costs. Since firms with a high hazard rate have also low expected profits, the stock market can exclude these types by imposing an entry fee that cannot be afforded by the bottom end of the distribution of firms.

The stock market maximises monopolist profits by establishing an optimal entry level for firms, which in turn determines an optimal entry fee and therefore, an endogenous level of excluded firms. In order to write the maximisation problem of the stock market, lets' define revenues and costs involved in the information processing activity.

In the presence of information processing costs, the revenue sources to the stock market are now two: the revenue related to the stock market activity of processing the information produced by firms, and the entry fee levied in order to exclude "non profitable" firms. The first source of revenue depends on the entry level (equilibrium marginal type) g

established by the stock market[65] and be will be denoted by $i(g,h)$, which is the equilibrium signal that an h type firm produces when the marginal type is g: basically (55) with $\hat{h} = g$.

The entry fee is also a function of the stock market's optimal marginal type and it will be denoted by $\xi(g)$. In order to determine the functional form of the entry fee, let's consider the expected value of a firm paying it: this is given by (49) to which ξ has been subtracted. Thus:

(60)
$$V_h^* = [1 - s(h)]\frac{X}{r+h} - i - \xi$$

In equilibrium, the marginal type produces a level of signal equal to zero; furthermore, it is required to make zero expected profits otherwise it is possible, like the previous section, to find at least one excluded $h' \in (g,1]$ that would make positive expected profits by mimicking g. The zero profit condition on g defines the entry fee imposed by the stock market on all types $h \in [0,g]$. Thus:

(61)
$$\xi(g) = \frac{X}{r+g} - I$$

The revenues from information intermediation are likely to be positively correlated with the level of signal produced in the economy and for simplicity I will assume that total level of signal and revenues coincide. The costs of intermediation are also likely to be positively correlated with the number of firms listed on the stock exchange and for simplicity I will assume that costs increase at a constant rate; i.e. $C'(g) > 0$ and $C'' = 0$.

It is now possible to define the profit maximisation problem of the stock market:

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[65] I will define the new marginal type with g in order to distinguish it from $\hat{h}$ which is the equilibrium marginal

$$(62) \qquad \max_{g} \ \pi_{sm}(g) = \int_{0}^{g} [i(g,h) + \xi(g) - C'] dh$$

The maximisation (62) yields the following first order condition:[66]

$$(63) \qquad \left(\frac{X}{r+g} - I \right) \frac{r}{r+g} = C'$$

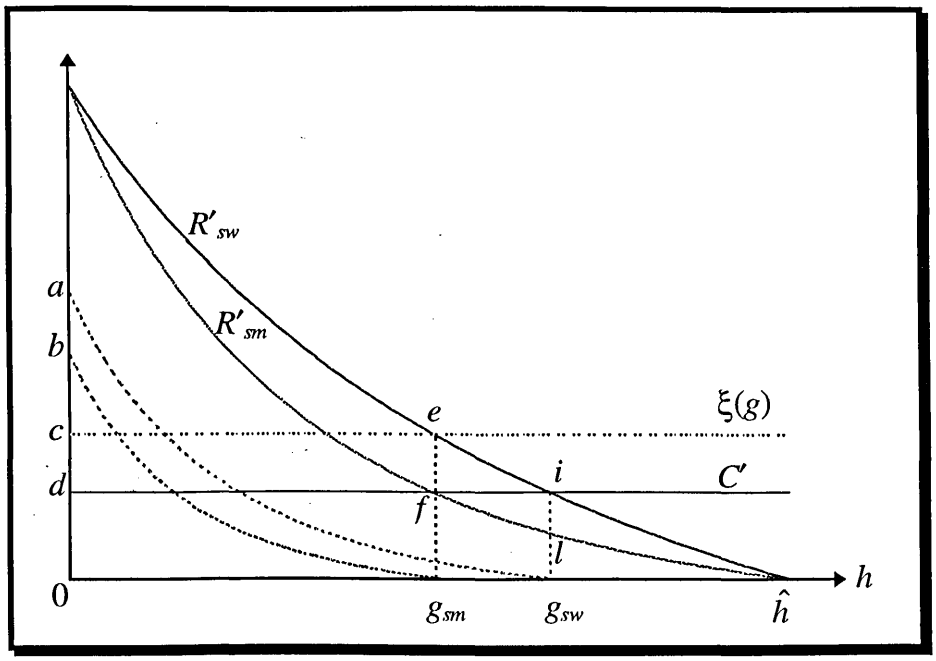

Figure 23 Stock market and social welfare maximiser problems.

The left hand side and right hand side of (63) are the stock market marginal revenues and marginal costs respectively.[67] Notice that the presence of information processing costs implies that the solution to the problem has to be an interior solution; i.e.

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type with no information processing costs.

[66] See Appendix 17, page 164 for formal derivation.

[67] The second order condition is verified as: $\left(I - \frac{2X}{r+g} \right) \frac{r}{(r+g)^2} < 0$

$g_{sm} < \hat{h}$. The solution $g_{sm} = \hat{h}$ is feasible only in the absence of information processing costs.

The solution just derived is illustrated in Figure 23, where R'_{sm} represents the marginal revenues and C' the marginal costs of the stock market. The stock market maximises $\pi_{sm}(g)$ when $R'_{sm} = C'$ which in turn implies that entry is allowed only to types $h \in [0, g_{sm}]$.

14.2.1 Limited entry and social welfare

This solution is a typical monopoly solution and it is clearly inefficient from a social welfare point of view. While the monopolist stock market limits entry after taking into consideration only its own private incentives, a social welfare maximiser would instead limit the entry into the stock market by maximising the total welfare in the economy.

In order to show the inefficiency of the stock market solution let us define the social welfare function as the sum of investors' profits, stock market profits and firms' profits. These are given by:

$$(64) \qquad \begin{cases} \int_0^g \left[s(h)\dfrac{X}{r+h} - I \right] dh = 0 \\ \int_0^g \left\{ \left[1 - s(h)\right]\dfrac{X}{r+h} - i(g,h) - \xi(g) \right\} dh \geq 0 \\ \int_0^g \left[i(g,h) + \xi(g) - C' \right] dh \geq 0 \end{cases}$$

The social welfare function is given by the sum of the elements in (64). Thus:

$$(65) \qquad SW = \int_0^g \left\{ \left[1 - s(h)\right]\frac{X}{r+h} - C' \right\} dh$$

The social welfare maximisation with respect to g gives the following first order condition:[68]

$$(66) \qquad \left(\frac{X}{r+g} - I\right) = C'$$

The left hand side gives the social marginal revenues R'_{sw} and the right hand side gives the social marginal costs C'. Notice that, since $R'_{sw} > R'_{sm}$ for all possible g, it must be the case that a social welfare maximiser allows more entrants in the stock exchange than a monopolist stock market: i.e. $g_{sw} > g_{sm}$.

With the aid of Figure 23 it is now possible to compare the stock market solution (g_{sm}) with the social welfare maximiser solution (g_{sw}) and show how the former is less efficient than the latter. The elements shown in Figure 23 are: the stock market marginal revenues R'_{sm}; the social marginal revenues R'_{sw}; the stock market (or social) marginal costs C'; the entry fee $\xi(g_{sm})$ when the marginal type is g_{sm}; the signalling function (the bg_{sm} curve) when the marginal type is g_{sm}; the signalling function (the ag_{sw} curve) when the marginal type is g_{sw}. Notice that when the marginal type is g_{sw} the entry fee becomes $\xi(g_{sw}) = C'$.

The stock market sets an entry limit equal to g when $R'_{sm} = C'$; in this way it maximises its profits which are given by the difference in the areas below R'_{sm} and C'. Notice that the area below R'_{sm} is given by the sum of the areas below the bg_{sm} curve and $\xi(g_{sm})$. The social welfare maximiser, instead, sets an entry limit equal to g_{sw} when $R'_{sw} = C'$; in this way it maximises social welfare which is given by the difference in the areas below R'_{sw} and C'.

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[68] The second order condition is verified as: $\frac{\partial^2 SW}{\partial g^2} = -\frac{X}{(r+g)^2} < 0$.

It is easier to identify the changes in welfare when the equilibrium is attained at g_{sw} after re-arranging the expression for the stock market profits. Thus:

$$(67) \qquad \pi_{sm}(g) = I\left[g - r\log\left(\frac{r+g}{r}\right)\right] + g\left(\frac{X}{r+g} - I\right) - gC'$$

The total stock market profits are the sum of three elements appearing to the right hand side of (67). The first element gives the gross revenues from firms' signal (area $b0g_{sm}$); the second element gives the gross revenues from firms' entry fee (area $c0g_{sm}e$); the third element gives the total costs (area $d0g_{sm}f$).

In the social welfare maximiser solution an extra $(g_{sw} - g_{sm})$ firms are allowed to entry and the stock market gains the area $(fg_{sm}g_{sw}l)$ in terms of extra gross revenues. This is equal to the increase in the signal $(abg_{sm}g_{sw})$[69] minus the loss in entry fee $(cdfe)$ given by the fact that all entrants pay a lower entry fee, plus the gain in entry fee $(fg_{sm}g_{sw}i)$ given by the fact that now there are more firms paying the entry fee. At the same time, the stock market loses the area $(fg_{sm}g_{sw}i)$ representing the costs undertaken when processing the signal of the extra $(g_{sw} - g_{sm})$ firms. The net welfare loss for the stock market is therefore given by the area (fli) above R'_{sm} and below C'. With similar reasoning the net welfare gain for the society is given by the area (efi) below R'_{sw} and above C'.

Therefore, when the equilibrium conditions change the welfare modifications among agents are as follows: investors are indifferent when the equilibrium changes as their profits are always zero; the stock market has a net welfare loss given by the area (fli); the society has a net welfare gain given by the area (efi); therefore, it must be the case that firms have a net welfare gain given by the area $(efli)$. Notice that the area between R'_{sw} and C′ is the total

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[69] Notice that the increase in the signal from bg_{sm} to ag_{sw} is due to the fact that more firms are allowed to be floated and therefore each type has to produce a higher level of signal to separate himself from all other types.

welfare of the economy and the area between R'_{sm} and C′ is the total welfare of the stock market. Therefore, the area between R'_{sw} and R'_{sm} is the total welfare of firms. When the equilibrium is attained at g_{sw} firms increase their signal but pay a lower entry fee so that profits increase. The extra profits are composed by a shift in welfare from the stock market to firms equal to the area (*fli*) and by an extra welfare gain given by the area (*efi*) which represents a net gain for the society. The marginal firm makes zero expected profits as its only costs are $\xi(g_{sw})$, equal to $V^*_{g_{sw}}$.

14.3 Pension funds

In the previous section we saw how the stock market may have the incentive to limit firms' entry in the stock exchange as this maximises monopoly profits. Limited entry is achieved through an entry fee that cannot be afforded by the bottom end of the distribution of firms and the consequence of the monopolistic behaviour of the stock market is that social welfare is not maximised. Welfare can be increased if a higher number of firms were listed on the stock exchange. In this section I consider how the development of pension funds can offset the monopolistic power of the stock market, force a more competitive solution and contribute to the development of the capital market in general.

The ability to offset the monopolistic power of the stock market relates to the fact that pension funds are a major supply of long term equity finance and at the same time they are major buyers of financial services from the stock market. In particular they benefit from a developed market of information intermediaries as this allows them to assess portfolio policies and diversify risk more efficiently. The monopsonistic power of pension funds may force the stock market into bargaining over the quantity of information produced in the economy as the demand for information perceived by the stock market is likely to increase with the presence of pension funds. Furthermore, the development of pension funds may

contribute to the development of capital markets as funds' activity stimulates the creation of new financial instruments and improves the efficiency with which the financial sector allocates savings. Both pension funds and new financial instruments represent a diversification in the portfolio of investment opportunities for individuals. A richer portfolio of investment opportunities in the utility function is likely to increase individuals' savings, contributing therefore, to the development of the stock market.

14.3.1 Bilateral monopoly

In this section, I analyse how pension funds can offset the monopolistic power of the stock market in a framework of bilateral monopoly with efficient bargaining. In order to do so, it is necessary to define the profit functions of both stock market and pension funds.

The stock market's profit function is given by the maximand in (62) to which an extra term F has been added. This new term captures the revenues from the sale of information at a fee F.[70] Thus:

$$\pi_{sm}(g,F)=\int_0^g\left[i(g,h)+\xi(g)-C'\right]dh+F \qquad (68)$$

Pension funds' profits will of course depend on the amount of information in the economy, on the fee charged for such information is bought from the stock market and finally on the degree of bargaining power that pension funds have in the determination of price and quantity traded. Let's assume for the moment that only one pension fund exists and that its profit function is given by:

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[70] I use g as a proxy of the volume of information produced in the economy as information is monotonically increasing with the number of firms listed on the stock exchange. Therefore, in what follows "information" and "number of listed firms" will be used interchangeably.

(69) $$\pi_{pf}(g,F,\alpha) = Q(g,\alpha) - F$$

where $\alpha \in [0,1]$ is a measure of the pension fund's bargaining power.[71] The "production function" Q captures the gross revenues to pension funds deriving from the number of firms listed on the stock exchange for a given level of bargaining power . Revenues are assumed to be increasing in g and α. Furthermore, $Q''_{\alpha,g} > 0$: i.e. the marginal product of information increases with the bargaining power of pension funds.

The assumptions just made need to be justified. Pension funds benefit from a large number of listed companies for at least two main reasons. Firstly, the number of listed firms is positively correlated with the level of information produced in the economy, as we have seen in the first part of the model. Information decreases uncertainty about investment outcomes as it allows investor to know the exact probability of success h of their investment and therefore, the right price to be paid. Secondly, a high number of listed firms makes it easier for pension funds to find investments with expected returns with low (or even negative) correlation with the market portfolio returns; i.e. it facilitates the adoption of risk diversification strategies. Notice that projects are all independent and hence, they have zero covariances. If separation allows investors to correctly infer the probability of success of their investments, it certainly does not enable them to diversify risk. Individual investors do not possess sufficient funds to invest in all listed companies and therefore, reduce the variance of their investment; this can be done only when savings are pooled together in a pension fund. Hence, the level of information processed by the stock market is an intermediate good that enters the "production function" of pension funds and it is here proxied by the number of listed firms. Thus, $Q'_g > 0$.

The other idea is that pension funds, unlike individual investors, are not perfectly competitive and therefore, they have some form of bargaining power. If the market of pension funds is perfectly competitive, each pension fund will make zero profits; i.e. $Q(g,0) = F$. Although they still posses a superior ability to process information and can diversify risk, they have no bargaining power in the determination of the fee F at which they purchase information g from the stock market; i.e. the stock market will set fee and quantity such that no surplus is left to pension funds. The central assumption of this last part of the model is that pension funds are not perfect competitors as they are major providers of long term finance and also the most important beneficiaries of the evaluating activity of the stock market: this distinguishes them from small individual investors with no market power. Thus, $Q'_{\alpha} > 0$.

It is easy to justify the last assumption about pension funds production function: i.e. $Q''_{\alpha,g} > 0$. Pension funds are simply more efficient than individual investors in processing information. Such efficiency is likely to increase with the importance of pension funds if we agree that the larger a pension fund the better qualified its fund managers. This means that the marginal product of information increases with the bargaining power of pension funds.

After having defined the profit functions of the stock market and of pension funds it is possible to analyse the bargaining problem between the two monopolists. What is likely to happen in the bargaining process over the fee of the intermediate good g is that firstly, pension funds and stock market will bargain on an optimal pricing rule for information for any given level of g. This is due to the fact that pension funds cannot directly determine the entry level of firms but they can certainly commit to a specific pricing mechanism.

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[71] For instance, $\alpha = 0$ means, that pension funds have no bargaining power in the determination of fee and quantity traded.

Subsequently, the stock market will maximise its profits by setting an optimal entry level, given the optimal pricing rule. Since this "two-step" procedure is equivalent to an efficient bargaining problem where pension funds and stock market bargain simultaneously on price and quantities, it is possible to re-write the problem just outlined in terms of a generalised Nash bargaining problem. Thus:

$$(70) \qquad \max_{g,F} \ \Pi = \pi_{pf}^{\alpha} \pi_{sm}^{1-\alpha}$$

where $\alpha \in [0,1]$ is the pension funds' share of joint profits $\pi_I = \pi_{sm} + \pi_{pf}$ which determines the bargaining power of each agent;[72] π_{pf} and π_{sm} are the profit functions of the pension funds and stock market respectively and the maximisation is conducted simultaneously with respect to price and quantities, as we are considering an efficient bargaining solution. The maximisation of log(Π) yields the following two first order conditions:

$$(71) \qquad \frac{\partial}{\partial F}\log(\Pi) = \frac{1-\alpha}{\pi_{sm}} - \frac{\alpha}{\pi_{pf}} = 0$$

and

$$(72) \qquad \frac{\partial}{\partial g}\log(\Pi) = \frac{\alpha}{\pi_{pf}} Q_g' + \frac{1-\alpha}{\pi_{sm}}\left[\left(\frac{X}{r+g} - I\right)\frac{r}{r+g} - C'\right] = 0$$

From (71) it is possible to derive the optimal fee charged to pension funds for the purchase of information. Thus:

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[72] Notice that the bargaining power of each agent is determined by the relative shares of joint profits. This of course may not be the case if for instance, the evaluating costs for the stock market are considered sunk costs

$$F=(1-\alpha)Q-\alpha\int_0^g[i(g,h)+\xi(g)-C']dh \quad (73)$$

which can be then substituted into (72) in order to obtain the optimal firms' entry level. This is given by the value of g that solves:

$$\left(\frac{X}{r+g}-I\right)\frac{r}{r+g}+Q'_g=C' \quad (74)$$

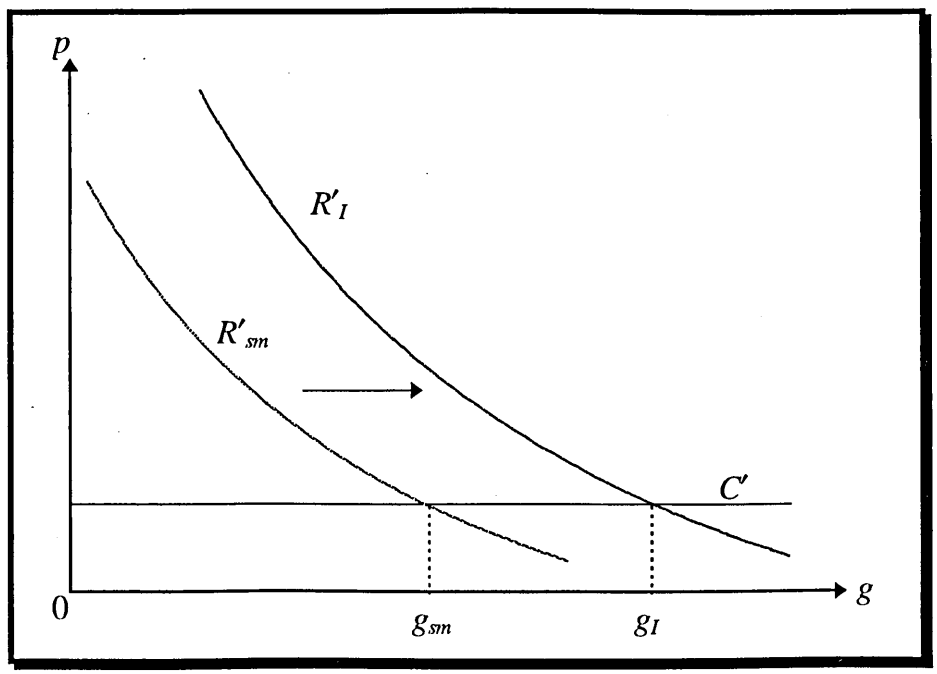

Figure 24 Shift in the demand for information with the introduction of pension funds.

By comparing (74) with (63) it is possible to establish that as long as pension funds' marginal product for information Q'_g is positive, their creation is likely to positively affect the development of the stock market. This can be seen in Figure 24 where C' is the marginal cost schedule of the stock market; R'_{sm} is the schedule of the marginal revenues in

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when pension funds and stock market enter the bargaining process. Nevertheless, changing the structure of the problem would not affect the qualitative results.

the absence of pension funds and R'_I is the schedule of marginal revenues of a vertically integrated stock-pension funds market.

If $Q'_g > 0$, the introduction of pension funds produces an increase in the demand for information in the economy which is reflected by a shift to the right of the marginal revenue schedule: i.e. in Figure 24, R'_{sm} shifts to R'_I. With unchanged marginal costs, the introduction of pension funds is likely to positively affect the size of the stock market as the number of listed companies increases from g_{sm} to g_I.

14.3.2 The development of pension funds

In the previous section, we saw how the creation of pension funds is likely to positively affect the size of the stock market. This is related to the fact that funds are more efficient than individual investors in the use of information produced by the stock market which in the model is summarised by a positive marginal productivity of information. In this section I will show how the development of pension funds can have a further impact on the development of the stock market through two different channels: through an increase in bargaining power and through a general increase in the efficiency with which savings are allocated.

The development of pension funds is likely to be translated into an increasing bargaining power in the allocation of joint profits; i.e. into an increase in α. The study of the comparative static of the equilibrium (i.e. the solution to (73) and (74)) can be done with the aid of and Figure 25.

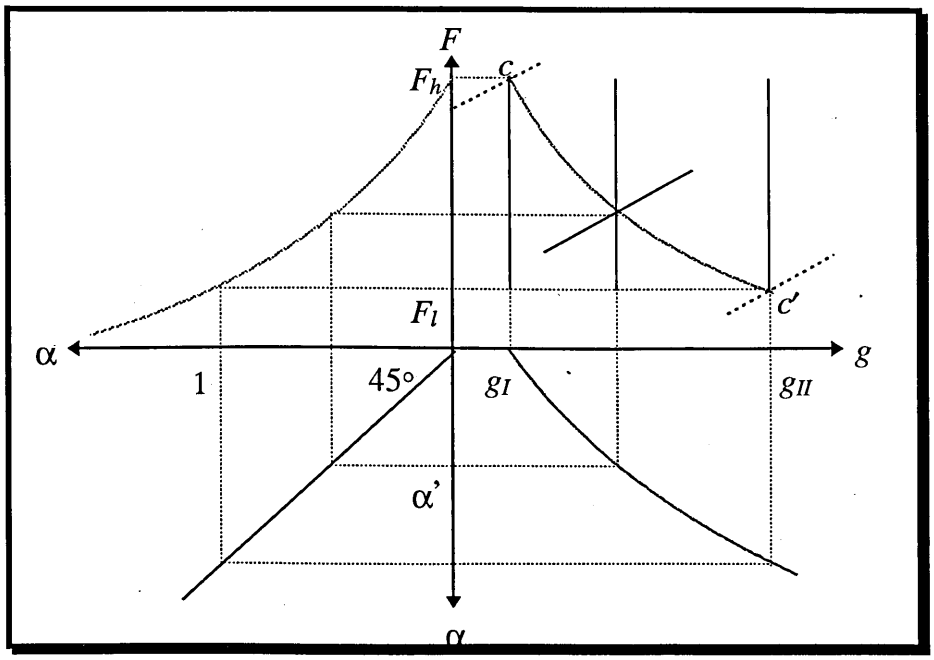

Figure 25 Nash bargaining solution and bargaining power.

Figure 25 allows us to determine the behaviour of the equilibrium $\{g,F\}$ in the first orthant, for any level of $\alpha \in [0,1]$ which is measured on the axes of the other three orthants. In the first orthant, the upward sloping and vertical curves intersecting at c are the cost of buying information for pension funds, given by (73), and the solution for g of the bargaining problem, given by (74), when $\alpha = 0$. In the second orthant there is the plot of the information cost for pension funds F as a function of the bargaining power α. Notice that the first derivative of (73) with respect to α is strictly negative as long as $Q + \int_0^g [i(g,h) + \xi(g) - C']dh > (1-\alpha)Q'_\alpha$. This conditions implies that total profits of the integrated market are greater than the stock market share of the marginal product of information. In the third orthant there is the plot of the solution g to (74) as a function of α. Notice that because of the assumption of increasing marginal product of information

$Q''_{\alpha,g} > 0$ for pension funds, any increase in bargaining power α must be matched by an increase in the number of listed firms g in order to attain again the equilibrium.

When the bargaining power of pension funds is null, the equilibrium solution is given by a fee for information that sets pension funds profits to zero: i.e. $F_h = Q(g_{sm},0)$, with a total number of listed firms equal to g_{sm}. When α increases to α', the marginal revenue to the integrated stock-pension funds market will increase and as a consequence, for a given level of g, (73) will shift down and to the right hand side in the first orthant. Notice that the cost of information F is not defined above F_h and to the left hand side of g_{sm} as a higher price and/or lower quantity would violate the participation constraint for pension funds. At the same time, since the marginal product of information increases with the bargaining power of pension funds, a larger number of listed firms is necessary to attain again the equilibrium; i.e. the solution to (74) shifts to the right. Finally, when $\alpha = 1$, pension funds will set quantity and price such that the stock market profits are zero: i.e. $F_l = \pi_{sm}$ and $g = g_{II}$. Notice again that below F_l and to the right hand side of g_{II} functions are not defined as this time, the stock market would not participate to the market. The intersections between (73) and the solution to (74), for all $\alpha \in [0,1]$ defines the contract curve cc' of the bargaining problem between pension funds and stock market.

It is interesting to compare this solution with the standard theory on bilateral monopoly.[73] As far as the equilibrium information fee is concerned, the standard result of the theory still holds true. The fee represents a mechanism for sharing joint profits between the upstream and the downstream monopolist and it decreases with the bargaining power of the upstream monopolist. Things are slightly different as far as the equilibrium quantity of the intermediate good is concerned. In a bilateral monopoly framework with efficient bargaining

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[73] See for instance Blair, Kaserman and Romano (1989).

and where the bargaining power of the downstream monopolist increases joint profits, the contract curve is not vertical anymore at the level of g that solves the joint profit maximisation problem as standard textbooks suggest. Since the marginal product of the intermediate good (here, information or number of listed firms) increases with the bargaining power of the downstream monopolist a higher volume of intermediate good must be traded to be in equilibrium and the contract curve is therefore, downward sloping.

The development of pension funds has a further long-run impact on the development of the stock market through the efficiency with which savings are allocated and therefore, through the level of interest in the economy. In the previous sections, it has been argued that pension funds activity stimulates the creation of new financial instruments and improves the efficiency with which the financial sector allocates savings. This increase in investment opportunities is likely to foster individuals' savings as new instruments modify individuals' utility function. The increase in the supply of funds is likely to drive down the level of interest in the economy in the long-run further stimulating the development of the stock market.

This can be seen by noticing that the marginal revenue in (74) is a decreasing function of the exogenous level of interest in the economy. Thus:

(75) $$\frac{\partial}{\partial r}\left(\frac{X}{r+g}-I\right)\frac{r}{r+g}<0$$

for $r>\left(\frac{2X}{I}-1\right)$ which is the condition that has to be met for an internal solution $g \in (0,1)$ of the optimal entry level.

In other words the increased efficiency in the financial market and the increase in the supply of funds from households drives down the interest level in the economy. This

reduces the cost of equity finance in the sense that for the same long term investment levels, firms have to sell a smaller share of their capital. A lower cost of capital implies that the present value/profit of firms increases and a larger volume of information can be disclosed. An increase in information disclosure, in turn, is likely to have a positive effect on firms' corporate governance and on the development of the stock market.

Stock market revenues increase with information disclosure and a larger number of companies are likely to be listed on the stock exchange. This increases the ability of pension funds to diversify risk and allows them to offer portfolios with a higher expected return to risk ratios to individual investors.

The increase of portfolios expected return is likely to promote individuals' savings and therefore, increase the bargaining power of pension funds. On the one side, the development of pension funds may have a negative impact on corporate governance, as it has been argued in the previous sections, since pension funds tend not to exercise a direct control on assets. On the other side, the increasing levels of information disclosure that accompanies the development of pension funds is likely to offset such negative impact

Eventually, improved governance, together with the increased efficiency represented by the development of pension funds, can lead in turn to a decrease in the cost of capital with positive feedback on economy-wide growth through its impact on the supply and demand for long term finance.

15. PENSION FUNDS AND STOCK MARKET DEVELOPMENT IN THE TRANSITION ECONOMIES

15.1 Evidence of pension funds development

Only three countries in Eastern Europe have so far enacted a law regulating the activity of private pension funds. These are Hungary (law on Voluntary Mutual Benefit Funds, November 1993), the Czech Republic (February 1994) and the Slovak Republic (July 1996). Other countries have prepared drafts of new laws to be enacted in the near future or simply have laws providing the existence of private pension funds but not their regulation. Russia is an example of where pension funds exist but are completely unregulated.[74]

Legislation in each country provides the existence of privately managed pension funds based on voluntary provision and membership, and determined both on a defined benefit and contribution basis (with the exception of the Czech Republic where pension funds are determined only on a defined contribution basis). In these countries, the provision of pension funds is generally not linked to a radical reform of the public pension system. Nevertheless, a more advanced reform attempt is taking place in Hungary where a draft for a law providing pension funds determined on a compulsory basis has just been prepared.

In general, efforts to reform the public PAYG systems in most transition economies are aimed at raising retirement ages, limiting occupational privileges, strengthening the link between contribution and benefits (for example, by lengthening the base for calculating pension entitlement to cover as much as possible of the working life-time) and establishing clear rules of indexing (EC Commission, 1996). This means that private pension funds,

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[74] For a detailed description of private pension fund laws and drafts for selected countries see: Lankes and Impavido 1996.

rather than a chance of reform, seem to be perceived as an instrument targeting professionals willing to increase their retirement savings. Furthermore, participation to the private schemes is always subject to participation to the public PAYG scheme and this represents a considerable constraint to the development of pension funds.

Table 11 Pension funds development, end 1996.

Country	Number of funds	Members ('000)	Assets % of GDP
Hungary	212	300	0.40
Czech Republic	44	1,200	0.14
Russia	1,000	na	0.05
Slovak Republic	0	0	0.00

Source: Communication with supervisors and EU task managers.

Table 11 reports some information relating to the size of the pension funds market in the Czech Republic, Hungary, Russia and Slovak Republic. Private pension funds are significant only in Hungary and in the Czech Republic where, at the end of 1996, the share of assets in GDP was 0.4 and 0.2 per cent respectively. Assets in Hungarian funds have reached HUF 24 billion (US$ 136 million) against HUF 6.6 billion (US$ 47.3 million) at the end of 1995. In the Slovak Republic no pension funds exist although the new pension funds law was enacted almost one year ago and the only pension-type product is sold by life insurance companies. Funds in the Russian Federation have been operating in a legislative vacuum and therefore, have been unable to attract significant contributions. The shares of assets in GDP are very small even when compared to the same shares of German and Italian pension funds reported in Table 10. Nevertheless, the number of funds that have been set up since legislation was passed is high both in Hungary and in the Czech Republic. In these countries almost one quarter and one fifth of the corresponding working population contribute in one way or another into pension funds.

According to laws and drafts for laws not yet enacted, regulation in Eastern Europe on asset allocation varies greatly from country to country. Table 12 reports information

about the legal investment requirement, minimum capital requirements and tax treatment of pension funds. Already at a first glance, the differences in regulation across countries appear evident.

Table 12 Pension funds legislation.

					Investment limits (*in per cent of total assets*)			
Country	**Min. capital requirement**	**Foreign participation**	**Taxation[1]**	**Portability**	**State bonds and cash (*min.*)**	**Other state securities (*max.*)**	**Listed shares (*max.*)**	**Real estate (*max.*)**
Czech Republic	CZK 20m	Unlimited	TTT[2]	Full no fee	free	free	free	free
Hungary	HUF 20m[3]	Unlimited	EEE	Full with fee	10	30	60	30
Lithuania,	TBA	TBA	EET	Full no fee	TBA	TBA	TBA	TBA
Poland	TBA	TBA	EET	Full no fee	10	30	30	10
Russia	na	na	TTT	Full no fee	TBA	TBA	TBA	TBA
Slovak Republic	SKK 30m	na	EET	Full no fee	free	free	na	20

1: "T": taxed; "E": exempt. First position refers to contributions, second to investment income and third to benefits. **2**: State subsidy for contributions instead of exemption. **3**: The minimum capital requirement of HUF 20 million is required for funds established as legal entities separate from the sponsor.
Source: Pension funds regulation.

Generally, pension funds have to invest a minimum of 30 per cent of assets in State bonds of or other government securities. Such minimum investment requirement in risk free assets is studied to force funds to have low risk portfolios. Low risk portfolios have been proven to be necessary in the initial stage of reform to prevent the occurrence of theft, fraud or mismanagement (de Fougerolles 1995). At the same time different legislation provide different limits for equity investment. For instance, funds can invest in listed shares with limits of 30 and 60 per cent of assets in Hungary and Poland respectively while in the Czech Republic a "prudent man rule" exists with no normative prescriptions on investment behaviour. In any case, even for the Czech Republic where no positive portfolio regulation exist, active pension funds in Eastern Europe invest mainly in State bonds or in other government securities and for the moment it looks like as if pension funds in Eastern Europe play an important role only in debt financing.

Also the way pension funds are taxed differs considerably across countries. In Hungary strong tax incentives exist for pension funds (exemption of contributions paid by corporations, investment income and benefits) while in the Czech Republic the tax treatment is almost diametrically different (taxation at all three stages).

In any case, although the establishment of a supportive legal and regulatory framework constitutes an important step towards the development of pension funds many other steps have to be taken before the sector is likely to fully develop. Consistency of existing law with other commercial legislation remains mostly untested. The management of pension funds during the transition process is complicated by the instability of the general economic and political environments. Challenges include institutional weaknesses such as the shortage of local providers, regulators and consumers. At the same time, underlying assets and liabilities risks are high and capital markets are considerably immature. This, together with the shortage of local long-term funds implies that the distribution of assets is markedly skewed towards bonds and other government securities. Finally a concrete willingness of reforming the state pension system has not fully emerged in any transition economy All this means that although pension funds have the potential to contribute to the development of stock markets, the realisation of this possibility is unlikely to take place in the short-run.

15.2 Evidence of stock market development

Stock markets in transitional economies are still far from performing the roles before outlined in an effective way. Feasible stock markets have been established only in the Russian Federation, the Czech Republic, Poland, Hungary and the Slovak Republic.

Table 13 reports some information related to the size and activity of the major stock exchanges in transition economies and comparative information for other emerging and developed markets.

Stock markets in transition economies possess characteristics typical of emerging markets in early stages of development: a small number of listed companies (notice that Table 13 reports the aggregate figure of listed and non listed companies), relatively small market capitalisation, high concentration, low turnover and high volatility.

Table 13 Stock market development in the transition economies, end 1996.[1]

Stock exchange	Number of shares[2]	Shares capitalisation (US$ million)[3]	Turnover per Session (US$ million)[3]	Annual Turnover (US$ million)[3]	Share turnover (per cent of capitalisation)	Share capitalisation (per cent of GDP)
Russia (RTS)[4]	160	19,911.50	41.00	10,800.00	54.24	3.94
Prague	1,671	19,790.15	36.84	9,172.60	46.35	40.03
Warsaw	83	8,155.99	41.73	10,432.39	127.91	6.43
Bratislava	950	5,632.66	12.80	3,200.00	56.81	30.93
Budapest	45	5,269.09	12.23	3,031.99	57.54	12.55
Zagreb	68	1,359.12	na	103.86	7.64	7.52
Ljubljana	52	1,229.47	0.58	145.25	11.81	7.32
Vilnius	350	899.93	0.33	47.23	5.25	8.98
Tallinn	16	896.20	1.39	366.30	40.87	18.80
Kiev	0	600.00	na	17.00	2.83	1.38
Riga	34	115.23	0.12	11.67	10.13	2.34
Bucharest	21	72.64	0.24[5]	6.24	8.60	0.28
Skopje	3	63.61	na	0.40	0.63	1.83
Sofia	26	4.86	0.04[5]	0.01	0.17	0.17
NYSE	–	*5,654,815.40*	–	*3,082,916.10*	*54.52*	*77.99*
London	–	*1,346,640.70*	–	*1,153,221.30*	*85.64*	*121.32*
Germany	–	*577,364.80*	–	*593,936.20*	*102.87*	*23.96*
Paris	–	*499,989.60*	–	*716,507.60*	*143.30*	*32.25*
Kuala Lumpur	–	*213,757.40*	–	*60,792.40*	*28.44*	*254.17*
San Paulo	–	*147,635.80*	–	*57,024.50*	*38.62*	*21.94*
Thailand	–	*135,774.20*	–	*59,303.30*	*43.68*	*81.31*
Mexico	–	*90,694.00*	–	*35,037.20*	*38.63*	*37.63*
Santiago	–	*72,927.70*	–	*11,411.60*	*15.66*	*108.36*
Buenos Aires	–	*37,783.80*	–	*31,932.60*	*84.51*	*13.45*
New Zealand	–	*31,949.80*	–	*8,718.00*	*27.28*	*54.89*

1: data for comparative stock exchanges refer to 1995; **2**: data for transition economies refer to listed and unlisted shares while data for comparative stock exchanges refer to listed shares only; **3**: exchange rate of 6 Jan 1997; **4**: 90 stocks on RTS-1 and 70 stocks on RTS-2, all other data refer to RTS-1 only. Annual turnover is a projection of Jan 1997 total turnover; **5**: US$ thousands.
Source: communication with individual stock exchanges.

Other common features are the predominance of individual investors although it is claimed (Euromoney 1997) that the presence institutional investors is quickly rising. Nevertheless, activity varies greatly across stock markets in the transition economies, mainly

reflecting the different structure of the privatisation programmes recently implemented. Differences in activity are summarised in the last two columns of Table 13 where the ratio of market capitalisation to GDP measures the extent to which securities are used to raise capital and diversify risk and the ratio of annual turnover to capitalisation reflects liquidity and transaction costs.

In the Czech Republic, the Prague Stock Exchange (PSE) includes three levels of listing and trading: the main, secondary and free markets. Stocks are divided among these levels on the basis of size, liquidity and information disclosure requirements. Companies and funds in the main and secondary markets (44 and 54 stocks respectively) are required to provide quarterly financial statements while all companies are required to report transaction in excess of US$ 7,500. Continuous trading takes place only in the main market for selected stocks (11 stocks) while the other stocks have price fixings five times a week. In the Czech Republic, the two waves of mass privatisation programmes (1993 and 1995) resulted in more than 1650 companies being floated across the three tiers of the stock exchange and capitalisation has reached almost US$ 20 billion at the end of 1996 (40 per cent of GDP). The mass participation of the population in the voucher programme as well as the activity of the Investment Privatisation Funds (IPF) have produced the potential for high volumes of transactions. As a matter of fact annual share turnover has been increasing by 150 per cent in average since 1993 and reached at the end of 1996 a level of 40 per cent of total capitalisation. Although the PSE turnover is far from being comparable to the turnover in developed markets, it is still one of the highest in the region.

In Hungary, the absence of an aggressive mass privatisation programme has implied a slower development of the stock market. At the end of 1996, the number of listed and non listed shares at the Budapest stock exchange (BSE) was considerably small (20 shares in the listed "A" and 25 in the listed "B" category respectively) and the share of capitalisation in

GDP was 12 per cent. Nevertheless, the annual share turnover reached US$ 3 billion, corresponding to 57 per cent of share capitalisation.

Similar relationship between privatisation programme and stock market development can be observed in Poland. The combination to different approaches to privatisation and the favourable tax treatment (capital gains are tax exempt as well as re-invested dividends) has contributed to making the Warsaw stock exchange (WSE) the most active in the area. Average session turnover equalled US$ 40 million during 1996 (113 per cent more than in 1995), corresponding to nearly 128 per cent of share capitalisation. Capitalisation of the WSE is considerably small (6.5 per cent of GDP) but it has increased in average by 133 per cent since 1993 reaching at the end of 1996 a level of more than US$ 8 billion. The mass privatisation programme which got under way only recently should promote the development of the stock market as it did in the Czech Republic.

In the Slovak Republic, the Bratislava stock exchange (BSE) has 33 full members; of which 17 banks and 16 brokerage houses. The equity market is divided between listed and non-listed shares. As of November 1996 the number of listed shares was 18 (of which 11 in the senior market and 7 in the junior market) while the number of unlisted shares was around 939. In order to be listed in the senior market companies need to have, among other things, a minimum capital of SKK 500 million (SKK 100 million for the junior market) and need to have been in activity for at last 3 years (1 year for the junior market). At the end of 1996, total equity market capitalisation was US$ 5,632 million (15 per cent more than the previous year) which corresponds to 30 per cent of GDP while annual turnover was US$ 3,200 million (57 per cent of capitalisation). Similarly to the Czech republic the high number of listed and non-listed shares is due to the voucher privatisation programme but only few of them are actually traded. (Gilson 1997).

In the Russian Federation the bulk of equity trade takes place in the Russian Trading System (RTS) that since 1995 has been regulated by the National Associations of Security Market Participants (NAUFOR). The RTS is the single most important development in the infrastructure of the equity capital market. The system accounts for around 50 per cent of all trading activity in Russian equities and it consists of more than 150 members. On level one there are almost 90 stocks and recorded volume reached US$ 900 million in January 1997. Trading over the second level of the RTS (the second-tier stock listing) began in December 1996 and at present 70 common and preferred shares are listed. Estimated capitalisation on RTS-1 was US$ 20 billion at the end of 1996 with an annual turnover of US$ 11 billion. Average turnover per session is estimated to increase by 75 per cent in 1997 reaching the value of US$ 70 million at the end of the year (Euromoney 1997).

Although stock markets in the region show some degree of diversity, the common feature is that they are still in a state of infancy if compared to stock markets in developed and other emerging markets. Underdeveloped securities markets can be a serious constraint to the privatisation process particularly when public offers of shares is used as a method. Furthermore, underdeveloped securities markets do not represent an efficient corporate governance mechanism and this may hamper restructuring where it is actually mostly needed. The development of stock markets in transition economies can promote information disclosure and have positive spillovers on the restructuring of the newly privatised companies and on the liquidity of the companies already restructured.

16. CONCLUSIONS

Public PAYG pension schemes in Eastern Europe are characterised by a high expenditure share in per cent of GDP, normally accounting for between two thirds to three quarters of total social security outlays. Although these countries are classified as emerging

markets, their average public pension expenditure is by far out of line with respect to the average expenditure of Latin American and South East Asian countries, for instance. This can be explained by the differences in demographic structure between Eastern European countries and other emerging markets. Many transition economies have a demographic structure similar to the one of OECD countries with high demographic and system dependency ratios; therefore, average expenditure levels are also similar. Public PAYG pension schemes in Eastern Europe are also characterised by almost universal coverage, high replacement and contribution rates, and low retirement age. As a result, most schemes have large implicit debt liabilities which can only increase with the progressive ageing of population. Furthermore, the transition process has contributed to eroding the real value of pension benefits, therefore giving rise to concerns about increasing old age poverty levels.

The development of pension funds, which can be seen as an immediate consequence of a pension reform, can have a profound impact on the development of financial sectors and more specifically of stock markets. Pension funds represent an important source of long-term finance deriving from employers and employees' contributions. In developed countries where pension systems are not based on public PAYG schemes like in the United States and in the United Kingdom, pension funds are the strongest institutional investors in the stock market.

Pension funds can also play an important role in promoting efficient mechanisms of corporate governance. Factual evidence shows that pension funds do not play an active role in corporate governance as controlling shareholders but they rather adopt a portfolio approach and control is possibly exerted through take-overs activity. Hence, pension funds rely on the evaluative function of the stock market in order to address portfolio policies. This means that if pension funds do not play an active role in corporate governance, they may as well play an indirect role by stimulating the production and diffusion of information

about firms. The development of stock markets, together with increased capitalisation, liquidity and efficiency, implies exactly that a higher volume of information is produced. Firms seek long-term equity finance to boost their net revenues and they can obtain it on the stock market only if they meet some given information disclosure requirements. The larger the number of firms that are allowed to be listed the higher the volume of information needed to separate bad firms from good firms.

The fundamental assumption made here is that long-term equity finance favours economy-wide growth and that information disclosure improves on the one hand corporate governance, if it offsets the possible negative impact on governance of institutional investors portfolio policies; on the other hand it facilitates risk diversification policies of pension funds and therefore, it promotes their development. Improved governance, together with the increased efficiency represented by the development of pension funds, can lead in turn to a decrease in the cost of capital with positive feedback on economy-wide growth through its impact on the supply and demand for long-term finance.

17. APPENDIX

17.1 Derivation of the inference function $r+h(i)=(r+\hat{h})e^{-\frac{i}{I}}$:

Let

$$V_h=[1-s(\phi_s)]\frac{X}{r+h}-i$$

be the value of the firm h which is perceived as being $\phi_s = b$. The total differential of $V_h = V_0$ is given by:

$$dV_h=-di+\left[-\frac{X}{r+h}s_b'\right]db=0$$

Noticing that $s(\phi_s)=[r+\phi_s]\frac{I}{X}$, the slope of firms' indifference curve in the space (i x b) is given by:

$$\frac{db}{di}=-\left[\frac{X}{r+h}s_b'\right]^{-1}=-\frac{r+h}{I}$$

Following Bernheim (1994), a fully separating equilibrium is characterised by the function $\phi_s(i)$ tangent to the indifference curves and choices i must be self-fulfilling in the sense that $\phi_s = h$. This means that:

$$\phi'_s(i)=-\frac{r+\phi_s(i)}{I}$$

The general solution to this first order separable differential equation is given by:

$$r+h(i)=Ce^{-\frac{i}{I}}$$

where $\phi_s = h$. We only need to define the initial condition in order to find a specific solution to our differential equation. This can be found by denoting with $\hat{h}$ the marginal type investing $i = 0$. This means that the constant of integration takes the form of:

$$C=(r+\hat{h})$$

which yields the signalling function characterising the fully (partially, if $\hat{h}<1$) separating equilibrium:

$$r+h(i)=(r+\hat{h})e^{-\frac{i}{I}}$$

17.2 Derivation of (63):

The problem

$$\max_{g} \quad \pi_{sm}(g)=\int_0^g [i(g,h)+\xi(g)-C']dh$$

where $i(g,h)=I[\log(r+g)-\log(r+h)]$ and $\xi(g)=\frac{X}{r+g}-I$ can be solved by using Leibniz's rule. Thus:

$$\frac{\partial \pi_{sm}}{\partial g}=i(g,g)+\xi(g)-C'+\int_0^g [i'(g,h)+\xi'(g)]dh=0$$

$$=\frac{X}{r+g}-I+g\frac{I}{r+g}-g\frac{X}{(r+g)^2}-C'=0$$

$$=\left(\frac{X}{r+g}-I\right)\frac{r}{r+g}-C'=0$$

Notice that the second order condition is also satisfied as $\left(I-\frac{2X}{r+g}\right)\frac{r}{(r+g)^2}<0$.

Conclusions

The purpose of this dissertation was to apply the concepts developed by the literature of asymmetric information and the principal-agent framework to three separate issues. The first issues relates to the prolonged negative real growth, financial disintermediation, inflation and low real interest rates in eight former Soviet Union countries after the political collapse of the Soviet Union. The second issue relates to the individual behaviour of members in group credit contracts. The third and final issue relates to the mutual development of pension funds and stock markets.

The first chapter is divided into two main parts. In the first part I analyse data relative to the macroeconomic and financial development of eight former Soviet Union countries (Armenia, Belarus, Estonia, Georgia, Latvia, Lithuania, Moldova and Ukraine) over the period 1991 - 1994; i.e. soon after the collapse of the Soviet Union. In the second part of the chapter I develop a model of credit rationing with *ex ante* asymmetric information which succeeds in explaining the phenomena that the data seem to suggest.

After the political collapse of the Soviet Union, countries experienced a considerable economic instability from which only the Baltic States seem to have recovered at the end of the period analysed. The economic instability was characterised, among other things, by a sharp decrease in real GDP, high inflation, low real interest rates and financial disintermediation. Furthermore, rigidities in the labour market implied that nominal wage and employment remained relatively constant over the period. The initial instability is well explained by the hypothesis of monetary overhang. Nevertheless, the subsequent instability cannot be explained in the same way. Interest rates remained very low for several years due to a situation of hyperinflation and adjustment (partially achieved only in the Baltic States)

took place only through prices. Furthermore, the economic recovery seems to have taken place only in the Baltic States but again, in a period of time well beyond what the monetary overhang hypothesis suggests. In these countries, the level of financial deepening, measured as the ratio of domestic credit to the private sector over GDP, started increasing already in 1993, suggesting a relationship between financial deepening and growth. The Baltic States are not the only states showing such a pattern. In 1994 financial deepening increased also in Belarus and Ukraine. Since then, these countries showed signs of recovery with decreasing negative real growth.

The model developed in the first chapter gives a possible explanation for the different pattern followed in the transition between the Baltic States and the rest of the former Soviet Union countries. The explanation put forward relates to the presence of imperfect information in credit markets, coupled with a weak institutional and legal framework, especially as far as the system of property rights is concerned. In such a set up, governments have tried to increase the efficiency of the credit market by providing the banking sector with "cheap" money. Because of the low revenues from income, the only source for this extra funds has been the inflation tax. Nevertheless, by producing inflation, governments reduced the profitability of projects for borrowers and as a consequence, the real expected return to banks on each loan. As a result, banks kept nominal interest rates on loans low in order to offset the negative impact of inflation on borrowers' quality. Because of the assumption of Bertrand competitor banks, this meant that lower profits were available to pay depositors and nominal interest rates on deposits also remained low perpetuating the situation of credit rationing. A first conclusion can be drawn from the model developed. In a world of imperfect information and with Bertrand competitor banks, a policy aimed at expanding credit by providing money to the banking system and relying on the inflation tax, may not increase the supply of credit if households' supply of funds is sufficiently elastic to

the real interest rate on deposits. Furthermore, even if expansion is achieved, this may not be sustainable and it could risk the collapse of the whole financial system.

The role of inflation and collateral in this model suggests a second option available to governments to expand credit. By increasing the value of the collateral that banks can seize in the event of project failure, governments improve the quality of applicants served by banks. This policy is unlikely to be as inflationary as the previous one and it would result in higher real interest rates and increasing supply of credit from the banking sector. More specifically, governments should first stabilise their economies and through this, reduce inflation and create the conditions for a positive credit demand. Once the demand for credit exists, it can be improved by strengthening the legal framework with particular reference to the bankruptcy law and private property right systems.

This fits surprisingly well the data collected. Credit rationing has been relaxed in those countries with low inflation, with a stronger legal framework and better defined institutions. In countries with high inflation, the quality of borrowers has been too low to create any substantial demand for credit. The situation of the financial market in countries such as Belarus, Ukraine, Georgia and Armenia at the end of 1994 was a situation of virtual collapse with extremely low demand for credit despite the negative real interest rates on loans.

The analysis conducted is claimed to be original because of its marked microeconomic approach; furthermore, two other contributions to the existing literature can be identified. A first contribution to the literature which studies the macroeconomic stabilisation in the transition economies of Eastern Europe and former Soviet Union countries is made by suggesting that the failure of government policies in stabilising their economies may be related to the presence of imperfect information in financial markets. A

second contribution is made by explicitly modelling the effects that an improved property right system and legal framework would have on corporate governance and loan repayment.

In the second chapter I analyse the determinants of individual behaviour in group lending contracts. Group lending programmes of the Grameen Bank's type rely on the formation of "social collateral" which offset the lack of physical collateral of poor borrowers in marginal rural areas to improve the risk sharing properties of the equilibrium contracts. "Social collateral" is not some physical element that lenders can seize in the bad state but it is a product of group interactions. It represents the discipline that monitoring has on co-borrowers' effort and such discipline may increase the individual equilibrium level of effort so that poor borrowers can obtain more favourable contractual terms from formal lenders.

Group interactions produce contrasting effects on individual optimal effort. Effort tends to be lowered because of free riding and profit sharing; furthermore, other things equal, the monitoring activity reduces the amount of effort that each individual can dedicate to the project, thus reducing the social norm. Positive effects are related to the social norm that groups endogenously develop and to the discipline that derives from monitoring. Deviation from the norm are punished with social sanctions by peers when they can be observed and this tends to increase the equilibrium level of effort. This form of behaviour discipline is the "social collateral" that may increase banks' expected return on each loan.

Banks' expected return on each loan will decrease or increase according to whether the negative effect of group lending on effort dominates or not. The negative effect is likely to dominate when groups are either too small or too large. When groups are too small the discipline imposed by monitoring cannot offset the negative impact on the social norm and therefore, group expected payoff would decrease. When groups are too large the ability to impose sanction is too low; this lowers the discipline and therefore, the expected payoff of the group. In any case, the reason why borrowers tend not to form either too small or too

large groups cannot be explained only by the magnitude of the free riding problem as great part of the literature on group lending and peer monitoring seems to underline. There are factors of exclusively social nature that affect group formation. These factors can be identified with the ability of co-borrowers to monitor each other; with the ability of groups to impose social sanctions on deviating partners and with the individual perception of social sanctions.

The contribution to the existing literature consists in the attempt to formally study the determinants of group size in group lending contracts, highlighting the importance of social interactions as major determinants of individual behaviour in groups. The individual perception of social sanctions ("*s*" in the model) seems to play a crucial role. It was easy to show that the optimal group size is positively correlated with the individual sensitivity to social sanctions and this observation may provide an indirect answer to why difficulties have been encountered in replicating the Grameen Bank success outside Bangladesh. Very simply, it is necessary that a minimal strictly positive value of "*s*" exists *ex ante* for a group to be formed. In other words, the higher the individual sensitivity to social sanctions, the higher the likelihood that a group will be formed and the larger will be the optimal group size. If this is true, it must also be the case that group lending programmes will be more successful simply among individuals which simply have a high *ex ante* predisposition to form groups.

In the third chapter I analyse the issue of pension reform and pension funds development with particular reference to the transition economies of Eastern Europe. Public PAYG pension schemes in Eastern Europe are characterised by high expenditure share in per cent of GDP, normally accounting for between two thirds to three quarters of total social security outlays. Although these countries are classified as emerging markets, their average public pension expenditure is by far out of line with respect to the average expenditure of

Latin American and South East Asian countries, for instance. This can be explained by the differences in demographic structure between Eastern European countries and other emerging markets. Many transition economies have a demographic structure similar to the one of OECD countries with high demographic and system dependency ratios; therefore, average expenditure levels of are also similar. Public PAYG pension schemes in Eastern Europe are also characterised by almost universal coverage, high replacement and contribution rates, and low retirement age. As a result, most schemes have large implicit debt liabilities which can only increase with the progressive ageing of population. Furthermore, the transition process has contributed to eroding the real value of pension benefits, therefore arising concerns about increasing old age poverty levels.

The development of pension funds, which can be seen as an immediate consequence of a pension reform, can have a profound impact on the development of financial sectors and more specifically of stock markets. Pension funds represent an important source of long-term finance deriving from employers and employees' contributions. In developed countries where pension systems are not based on public PAYG schemes like in the United States and in the United Kingdom, pension funds are the strongest institutional investors in the stock market.

Pension funds can also play an important role in promoting efficient mechanisms of corporate governance. Factual evidence shows that pension funds do not play an active role in corporate governance as controlling shareholders but they rather adopt a portfolio approach and control is possibly exerted through take-overs activity. Hence, pension funds rely on the evaluative function of the stock market in order to address portfolio policies. This means that if pension funds do not play an active role in corporate governance, they may as well play an indirect role by stimulating the production and diffusion of information about firms. The development of stock markets, together with increased capitalisation,

liquidity and efficiency, implies exactly that a higher volume of information is produced. Firms seek long-term equity finance to boost their net revenues and they can obtain it on the stock market only if they meet some given information disclosure requirements. The larger the number of firms that are allowed to be listed the higher the volume of information needed to separate bad firms from good firms.

The fundamental assumption made here is that long-term equity finance favours economy-wide growth and that information disclosure improves on the one hand corporate governance, if it offsets the possible negative impact on governance of institutional investors portfolio policies; on the other hand it facilitates risk diversification policies of pension funds and therefore, it promotes their development. Improved governance, together with the increased efficiency represented by the development of pension funds, can lead in turn to a decrease in the cost of capital with positive feedback on economy-wide growth through its impact on the supply and demand for long-term finance.

The original contribution of the third chapter is twofold. I formally model the positive feedback between the development of pension funds and stock market and show how their mutual interactions can be beneficial to the efficiency of the stock market and the development of effective schemes of corporate governance. I show that in a bilateral monopoly with efficient bargaining and where the revenues of the downstream monopolist are allowed to increase with its bargaining power, the Nash bargaining solution is not the usual contract curve, vertical at the level of quantity that maximises the "vertically integrated" monopoly profits, but it is now a downward sloping contract curve with quantity traded increasing with the bargaining power of the downstream monopolist.

The design of effective policies for financial development is based on the crucial prerequisite of macroeconomic stability. Economic instability destroys existing financial markets and the mutual relationship between financial development and growth.

Furthermore, this necessary macroeconomic condition has to be complemented by a throughout understanding of the behaviour of microeconomic units for financial development policies to be successful. In this dissertation I analysed the response of specific microeconomic units in financial markets when market failures determined by the presence of imperfect information exist. In all three chapters I show how important it is to identify these market failures and, within the framework presented, I underlined which aspects of government actions need improving in order to design more effective financial development policies.

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