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"FINANCING TECHNOLOGY: AN ASSESSMENT OF THEORY AND PRACTICE"

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Financing technology: an assessment of theory and practice

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Abstract: Financing technology poses a special challenge to economic institutions for several reasons. First, the uncertainty surrounding all the investment decisions is particularly acute and pervasive in the case of R&D, as well as developing and testing process and product innovation. Second, while the banks appear to have an important role to play, for many types of innovative businesses, they cannot be the sole source of financing. Third, technology ventures appear to face a basic trade off between profit and growth, which may be exacerbated by a difficult relationship with a credit institution. The paper examines these questions both theoretically and empirically, focusing on the US market as the leading financial center capable of providing imaginative solutions and on the Arab countries as a case study of developing economies facing a financial and institutional constraints.

Keywords: Innovation; finance; growth; new economy; risk evaluation; credit supply; Arab countries; government policies; science and technology parks.

FINANCING TECHNOLOGY:
AN ASSESSMENT OF THEORY AND PRACTICE

by

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Introduction

Finance represents a problem for technology at two different levels: first, research projects have to be funded and their results properly developed to insure effectiveness and applicability; second, these results have to be transferred from universities and research centers to firms in order to foster innovation and growth. For both these stages adequate financing instruments hold a *prima facie* claim as an important element for economic success.

The importance of finance for technology, in reality, is not easily established and, in spite of its intuitive plausibility, rests on so many different arguments that it is ultimately difficult to ascertain with clarity. *A priori* arguments for finance as a key determinant of technology success range from its effect on the actual applicability of innovation, to the comparative disadvantage of high tech firms in obtaining capital. For example, no less economist than John Hicks [1, 143-145] claims that the industrial revolution in England did not occur when the main inventions were made, but only, much later, when the financial system was sufficiently developed to offer the appropriate financial instruments to develop and apply the innovations.

From a more micro-economic angle, economists such as Arrow [2] and Stiglitz [1993] have argued that firms engaging in innovation are likely to be more highly constrained by liquidity, and the financial market imperfections arising from informational asymmetries and moral hazard. Others, such as Bhattacharya and Ritter [3], have pointed out that innovators may themselves be unreliable as information sources for would-be financiers, because the defense of property rights implies that a

crucial part of the information on the projects undertaken remain closely guarded against potential competitors. In 6the United States, for example, patent law cannot be applied unless the invention is considered sufficiently unrelated to "prior art", and even if applied, in many cases "[…] would be held invalid if ever litigated. Trade secret laws (protection against the theft of ideas) is also difficult to implement because of the strategies used by firms to avoid legal challenges and the difficulty to establish legal proofs" [4, 191].

Empirical evidence on the effects of finance on technology has been initially based on the sensitivity of Research and Development (R&D) expenditure to the cash flow of the enterprise. The results of these tests have been originally mixed, in spite of the strength of prior arguments, and only recently appear more convincing. Cross sectional studies conducted in the '60s by, among others, Schrer [5], Hamburg [6], and Muller [7] failed to turn up significant effects of the cash flow on R&D. The studies conducted in the '90s and based on panel data, instead, are more successful. For example, Hall [8] measures a strong effect of the cash flow on R&D over a large panel of US manufacturing firma. Himmelberg and Petersen [9], by investigating a short panel of high tech firms find also a similar, strong and positive effect and so do Hao and Jafee [10] on a small and long panel of US firms and Guiso [11] on a panel of Italian firms. Event studies by Greenwald, Salinger and Stiglitz [12] point to the same result for the US automotive and airline industry.

Starting from the ambiguos results of this literature, this paper look at the relationship between technology and finance, both from theoretical and the empirical point of view. The paper focuses on the US financial market as the main laboratory for institutional solutions in the field of industrial development and finance. It also analyses the Arab countries as a major case study of unconventional developing economies facing both institutional and financing constraints. The plan of the paper is as follows. Section 1 reviews the literature of innovation and finance from the broad point of view of financing technological change. Section 2 examines the question of the relationship between risk and creditworthyness, with special attention of the differences between traditional banking, investment banking and equity financing. Section 3 looks at the case of the Arab countries, striving to modernize their economy, by combining the Islamic credit tradition with the modern forms of finance. Section 4 looks at some

specific issue of financing the so called "new economy". Section 5 describes some of the problems related to government policies and financial support for innovation. Section 6 offers some conclusions.

1. Innovation and finance

The credit instrument, specially for small and medium enterprises (SME), represents by far the main source of finance of technology and innovation. Most of the recent empirical evidence shows that, in spite of the development of financial markets, R&D projects are still financed in order of importance: 1) by the entrepreneur with possible recourse to his family and friends; 2) by a short term credit relation with a Bank; 3) by third party equity investors and venture capitalists [13].

Because R&D as well as innovation projects are generally affected by high, non diversifiable risks, the financial structure of the firm provides an allocation of risks between the participants to the enterprise. Any change in that structure thus implies subsequent changes in the risk borne by each class of claimants, as well as in the expected value of their claims. By its very nature, however, investment in technology require very specific expertise for expert evaluation, it does not provide collateral because of intangibility and may modify substantially the expected value of the owners (e.g. shareholders') claims in the course of project life.

Not only SMEs may thus face severe constraints in capital scarce countries with low capital labor ratios and undeveloped financial markets [14], but they may be affected by a specific anti-innovation bias.

Risk transfers between claimants - due to debt financing - may affect shareholders investment incentives in two different ways. On the one hand, shareholders can undertake a negative net present value (NPV) project if debt financing allows them to capture part of the project gains by transferring part of their risk to debt-holders (over-investment incentive). Conversely, shareholders can reject a positive NPV project if most of the gains accrue to debt-holders (under-investment incentive) without a corresponding increase in the risk level. The resulting sub-optimal investment decisions cause deadweight losses which are commonly referred to as agency costs of debt.

The standard framework of the agency costs of debt assumes that investment decisions go before the firm financing strategy and that operating decisions are taken by

shareholders (or managers) in order to maximize the value of equity. When there is no debt in the financial structure, an equity maximizing policy is equivalent to a value maximizing policy. When debt is present, on the contrary, investment incentives can be distorted by the conflict of interest that originates when the project NPV is shared between claimants according to their relative “seniority”. This distortion of incentives induces sub-optimal investment decisions that result in a difference between the levered and unlevered value of the firm (agency costs of debt).

The impact of the agency costs of debt have been envisaged in situations like "asset substitution" [15], "over-investment" and "under-investment" [16; 17]. Jensen e Meckling [15] show how the shareholders of a levered firm have incentives to increase the riskyness of a firm's assets, thus increasing the risk for debt-holders, even if the greater risk is associated with lower present values of future cash flows. Shareholders are in fact interested only to the "upper" side of the probability distribution of firm results, that is to the part where cash flows are greater than the face value of debt. Debt-holders, in contrast, receive only the full payment of debt as specified in the contractual provision but nothing of the cash flows greater than the face value of debt. Therefore, they are interested to the "lower" part of the probability distribution of firm results: the addition of risk increasing projects to the firm reduces the expected value of their claim. In this case, the agency cost of debt consists in the increased cost of financing that debt-holders require when they assess the shareholders incentive to accept a risk-increasing investment project.

Myers [16] shows how shareholders of a levered firm can have incentives not to accept a positive NPV project: the "under-investment" incentive arises because existing debt-holders get a share of the project NPV while shareholders suffer the investment cost. In presence of risky debt in the financial structure, debt-holders appropriate the positive results of the project financed with internal funds up to the face value of their claim, leaving to the shareholders only the residual. The agency cost of debt is directly related to the change in firm value that the project would have produced if adopted, but that was lost because of the decision to reject the project.

While in the Myers contribution the agency costs of debt are due to the under-investment incentives that origin from risky debt, Berkovitch e Kim [17] show that also risk-shifting incentives can produce significant deviations from the NPV rule. Using a

model based on a different probability level for each state (high and low) and on a project entirely financed with an exogenous specified amount of debt, the authors show how under- and over-investment incentives can arise from the "seniorship" of debt. In particular, the issuance of senior debt to finance a new investment project can have two effects on the shareholders investment incentives. On the one hand, a greater seniority of new debt with respect to existing debt makes the former less risky because increases its probability to be paid back in case of default. This reduces the cost on new debt and makes easier to use senior debt to finance the investment, thus reducing the under-investment incentives. On the other hand, however, the low cost of new debt, if senior to the existing one, can generate incentives for excessive investment expenses and can result in the acceptance of negative NPV projects (over-investment). Also in this case, the agency costs of debt depends on the relative weight of the two incentives and can be defined as the difference between the firm values that originate from the acceptance/rejection of the project.

Scandizzo [18] shows how this effect is exacerbated in the case of R&D projects. Once a SME has achieved a given threshold of leverage, in fact, it is in the interest of shareholders, i.e. both the owners, partners and venture capitalists, to engage in risky innovation since the debt-holders will bear part of the risk without participating to the possible payoffs. While this effect may partly counteract the under-incentive problem that affect R&D projects for private entrepreneurs, its consequence is that financial institutions will have to step up supervision activities for innovative firms. They will thus be more reluctant to fund projects that concern firms likely to invest in new technology, *even when these projects do not directly involve R&D activities or innovation*.

Traditional managerial economics (e.g. Reekie and Crook [19]) predicts that financing of the firm will follow a “pecking order” depending on the degree of control of each financing source. Because ownership resists the relinquishing of control and residual rights, internal finance, i.e. the re-investment of profits will be the favored option. This will be followed by debt, which is simply a commi8tmnet to repay without any foregoing of control rights, and only as an extreme ratio, by enlarging the platform of residual and control rights to other equity partners. According to Brouwer and Hendrix [20], however, this order is reversed in the case for high-tech start-ups, because

of *actual* constraints, rather than a reversal in pecking *preferences* [14]: "Since internal finance (cash flows) cannot meet (the firm's) capital demands and debt is hard to coma by, equity capital figures as the prime financial resource" [20, 334].

Financing technology may thus engineer a dilemma for the owner-manager of a SME. His natural preference for debt financing, magnified by the possibility of risk shifting offered by high risk technology projects, in fact, may be frustrated by the unwillingness of banks to grant her credit. According to this approach, high tech firms may be perceived by banks, and also by potential bondholders, as subjects continually threatening to disrupt the basic conditions of credit contracts. This would be accomplished through the shift of the risk burden that innovation could induce by incorporating increasingly riskier projects into the financial structure of the firm.

On the other hand, the reluctance of the potential creditors to supply finance to high-tech start-ups would not be matched by an equal reluctance by management to relinquish control over the firm to equity owners, for two main reasons. In the first place, in fact, the SME – high-tech manager may see debt as a too great commitment, in the face of the uncertainty created by the investment in innovation. Because debt repayment appears dominated by external constraints, owners-managers of small start-ups may fill less inclined to be fussy about control rights in exchange for the clear risk sharing agreement provided by the equity contract. In the second place, the financial constraints for SME will appear much more stringent in the case of enterprises that are more dependent on innovation for success.

Financial constraints prevent external finance from being made available to firms, rather than merely reducing it [21]. They can be summarized under three hypotheses: 1) the collateral hypothesis states that the collateral value of a firm will reduce the discounted value of its expected cash flow, thereby reducing the creditworthiness of firms depending on intangible factors more than proportionally; 2) the bank lending hypothesis states that restrictive monetary policy will cause a reduction of activity for bank dependent firms; 3) the internal finance hypothesis, finally, implies that capital market imperfections and agency costs arising from asymmetric information will cause profit levels, rather than growth to be the main determinant of investments. Given that large corporations (LCs) face themselves finance constraints under these three hypotheses, SMEs, and, even more, SMEs

operating in the high-tech sectors can be expected to face more stringent constraints. In support to this contention, we may add the result by Brown [22] that innovative firms are financially constrained because "the assumption of perfect capital markets is least likely to be satisfied for the class of firms which devote resources towards the development of innovative products or processes".

2. Risk and creditworthiness for innovation

2.1 The performance of enterprises

What are the signals that creditors can utilize to decide if they may trust debtors? This question is particularly important in the relation between the bank and the high-tech start up, because, due to the intrinsic random nature of the credit contract, the bank is forced to discriminate among firms on the basis of signals predicting their future performance as debtors. What are then the most reliable signals?

In the *classical* tradition, that can be traced to Joe Bain [23], industrial economists regarded the market or the industrial sector as the research unit. Differences among firms were considered transitory or unimportant, unless they were based on scale economies. These, on the other hand were considered non significant, or destined to disappear with the firms expansion. Differences in *performance* among firms of different sectors, on the other hand, were attributed to differences in the capacity of successful firms to restrict entry and to promote cartels, in order to perpetuate their economic dominance through market power. The degree of concentration of the industry was thus the key variable of the econometric studies aimed at demonstrating the importance of market power in explaining the different performance of firms in different industries [24; 25].

A series of studies in the years '80s challenges this point of view on the basis of an opposite hypothesis: it is not the sector that determines the performance differentials, but at least some industries show significant internal differences in efficiency and innovation. Because market power depends on the relative size of sales (market share) and this is the consequence of the success of the firm, cross sectional studies will tend to reveal a positive correlation between industry concentration and performance of leader enterprises. The causality link, however, is reversed: it is not market power that determines the differences in performance, but the differences in the degree of success among firms that determines the differences in concentration in the various markets [26; 27; 28].

A further approach to the problem of the differential performance of the firm is the so called *managerial* school, which claims that the differences are explained by managers' *quality*. This brings to persistent differences in firms' profitability, even coeteris paribus, with consequences on the budget structure, the equilibrium of development, asset quality and innovation capacity. Studies by D. Muller [29; 30], M. Porter [31], F.R. Lichtenberg [32; 33], L.P. Lang e R.M. Stulz [34] are some examples of the many, interesting studies that reflect this line of thought.

In sum, while belonging to the high-tech sector may be important, the capacity to introduce successful innovation seems to enter only tangentially the consideration of firm performance, as these conclusions drawn from Schmalensee's comprehensive study of the FTC data [28], suggest:

(1) there are no success factors characterizing the firm (i.e., we can reject the hypothesis of the managerial school);

(2) sector effects exist and are important, as they explain at least 75% of the variability of returns;

(3) market shares are a statistically significant success factor, but they explain only a minor part of the variability of returns;

(4) the market share effects are negatively correlated wit the sector effects.

2.2 Credit supply and risk evaluation

Let's now look more specifically at the determinants of creditworthiness for the high-tech start-ups and the innovation projects. Because of adverse selection [35], banks may not efficiently ration credit through interest rates. Thus, the main element that guides their decision to grant a loan to a firm is evaluating and controlling credit risks.

Once confronted with a loan request, in particular, credit institutions find themselves facing the need of a two-fold evaluation:

a) select the enterprises that present a sufficient degree of creditworthiness;

b) define, for the firms selected, loan conditions in terms of interest, timing and other characteristics of financing.

The concept of creditworthiness has a wider significance than the mere concept of credit capacity [36]. In fact, while the former derives from an evaluation of the degree of

trust that the bank grants its client, the latter requires an appraisal of the particular situation of the enterprise and of the potential of the project whose funding has been sought. Thus, while creditworthiness may be considered an absolute: i.e. it either exists or it does not, credit capacity may vary instead with the circumstances and the risk embedded in the operation proposed.

The degree of risk created by a loan depends on the characteristics of both the creditor and the debtor. In addition to traditional instruments (debt covenants, maturity, building a relationship with the borrower), financial and technological innovations have in fact made available to credit institutions new instruments that allow a partial or total coverage for risk (e.g. securitizing the loan, swapping, etc.) or greater control (data banks, sophisticated surveillance systems). On the side of the debtor, risk depends on the structure of the balance sheet of the firm, the owner's wealth, the capacity of the enterprise to generate cash flow, thereby insuring that the loan will be repaid and the supply of collateral and guarantees.

Strictly connected with project risk is the interest rate, which plays a many-fold function:

a) it is a charge for the risk of default of the borrower;
b) is an instrument for risk sharing;
c) is a premium for loss of liquidity;
d) is a compensation to defer consumption.

Interest rates applied by credit institutions include all the charges corresponding to the functions above plus the coverage of implicit costs (loss of money purchasing power, credit risk), and the production costs (costs of provision, operational and administration expenses). Interest rates are inversely correlated to the price of debt and, as a price-like variable, they summarize market information, in a way, which at least for a given range of rates, contributes to market efficiency. In particular, all other things being equal, the greater the risk of financing, the greater the interest charged by the credit institutions.

There is, however, a threshold of maximum acceptability for project risk (which is a function of the degree of the bank risk aversion and of innovation capacity) beyond which the credit institution will switch to straight out rationing. In this respect, two types of rationing may be distinguished:

type one rationing, when all customers receive a quantity of credit lower than the one desired. In this case the client is considered creditworthy, but her demand is greater than the amount granted;

a) *type two rationing,* when some customers are denied credit altogether. In this case the client does not pass the creditworthiness test.

The literature on credit rationing is rather extensive. Initially its interest was focused almost exclusively on the effects of the adjustment lags of the interest rates. Credit rationing was explained through hypotheses of price rigidities determined by exogenous factors, such as market imperfections, upper limits on interest rates, etc. In a second moment, Hodgman [37], Freimer and Gordon [38] claimed that the causes for rationing were to be found in factors internal to the bank and linked to the objective of profit maximization. These contributes identified the real cause for rationing in the fact that beyond a certain size of the loan, no increment in the interest rate would be capable to compensate the expected losses from the corresponding increment in bankruptcy risk.

More recent theories have tried to explain rationing from the existence of asymmetric information [35] and the hypothesis of multi-period contracts. The asymmetric information thesis[1] demonstrates that the fact that a perspective borrower possesses more information with respect to the banks on the probability of success of a project determines a situation where the banks, in order to avoid adverse selection and lack of incentives, do not finance investment projects that would be willing to pay high interest rates. Small firms seeking finance for high tech projects are clearly among the most difficult to assess and, as a consequence, the most likely targets of credit rationing exclusion.

The second line of thought, based on multi-period credit contracts[2], identifies in the stipulation of one period contracts between the bank and the borrower, a way to provide an incentive to the borrower to be repay her debt. If this does not happen, rationing occurs as a sanction. In other words, the possibility of exclusion from credit, combined with the existence of one period contracts, is used as a disincentive to default.

As I have indicated before, the relationship between the bank and the borrower may be framed by the principal-agent model, which has received much attention in the economic literature [39; 40; 41]. On one hand, in fact, we find the credit institution attempting to maximize the returns to the loan, while, on the other hand, its customers try to exploit as much as possible financial leverage, to maximize the enterprise net worth.

Furthermore, the productive firm sends signals on its creditworthiness and credit capacity to the bank to obtain as high a rating as possible. The bank, on its part, tries to perform an effective selection, by denying credit to the unworthy and limit the size of the loans to expected capacity for the worthy ones.

Both the signals sent by the firm and the activities of the banks to assess credit risks are such that, small firms with little track record, involved in high tech products or markets are at comparative disadvantage in obtaining credit. This is particularly true if their projects appear to revolve on untested ideas, require technical expertise and are associated with risks that are difficult to diversify. Furthermore, while adverse selection via interest rate may be limited by rationing, the cost of appraising innovation may itself be correlated with project complexity and success chances. Thus, in a different form, adverse selection may re-enter the scene, since more complex projects may be discriminated against simply because they are more costly to assess. Moral hazard, in the form of the over-investment incentive, may also discourage the banks from getting involved with firms and projects that propose to invest in innovation and technology.

In a hypothetical market without informational asymmetries, where both subjects (bank and client) would be able to obtain the same returns from the investments financed, there would be no reason for conflict. The two subjects are put on opposite positions, however, by the uncertainty of the business plans of the perspective borrowers and by their potential use of financial leverage as an instrument to gain value at the expense of the bank. A special form of conflict, in particular, arises for *start ups* and *high tech* projects, where enterprises naturally aim at postponing the production of cash flow favoring long term growth, against the banks' attempt to anticipate as much as possible debt repayment to minimize risk. Possible solutions to this conflict rely on two basic techniques: *monitoring* and *commitment. Monitoring* activities on the part of the bank may be performed on an *ex ante* or an *ex post* base. *Ex ante* activities aim at improving the portfolio of bank investments, by granting credit on the basis of systematic evaluation of both projects and enterprises. These techniques, which may be rather costly to set up, are not particularly biased for projects involving high or new technology, if they develop methodologies and procedures (such as feasibility studies and expert evaluations) that deal with project merits rather than with the evaluation of corporate capacity for credit.

Ex ante activities thus consist in the more traditional screening and evaluation types and concern the fundamentals of the subjects that are interested or potentially interested by financing, as well as project appraisal. As in all cases where it is necessary to undertake acceptance-rejection decisions, the possibility of error is two-fold. On one hand, it is possible to err by granting loans that should be refused (error of type one). On the other hand, one can incur in the opposite mistake of denying loans that should have been granted (error of type two). The proportion of loans of good and bad quality depends on both error types and not, as it could appear on first sight, only on the error of type one. An excess of type two error, which is particularly likely for high tech, start ups and innovative projects, may have particularly nefarious consequences on economic growth and competition, and result in high social costs.

A recent literature [42] has studied the effect on the two errors of the architecture of the economic systems, identifying two extreme typologies of organization: the hierarchy and the poliarchy. In a hierarchical organization, which we may assimilate to a traditional bank, loan proposals are examined at each of the successive levels of a pyramid of decision makers. Credit is eventually granted if and only if the proposal has been considered acceptable at all levels of scrutiny. Type one error is clearly minimized in this decisional structure, while the probability of error of type two is comparatively higher, *coeteris paribus.*

In a poliarchyc structure, on the other hand, we are closer to the case of specialized credit institutions, such as the investment banks and the venture capitalists, since projects proposed for financing are examined by a limited number (some times only one) of decision levels. The project is thus promptly accepted or rejected and does not have to go through a vertical line of positive evaluations to be financed. If it is rejected by one possible financing institution according with this procedure, the project does not receive the stigma that is inevitably associated to a candidate that is solemnly dismissed after a ponderous examination

This system clearly increases the probability of error of type one, while error of type two is minimized. Specialized institutions should be able, at the cost of a higher risk of being wrong, to capture a greater percentage of the best and most innovative projects.

The upshot of this discussion is thus that *ex ante* monitoring activities present a clear comparative advantage for projects based on innovation and for specialized

institutions. These are called, one could say, to perform a social function, by discriminating among projects, with the objective of not letting the best opportunities escape for lack of sufficient attention to the error of type two. The same activity, on the other hand, is exposed to two different risks, which tend to attenuate its benefits, at least from the point of view of financial agents.

The first risk is the consequence of the fact that financial intermediaries, and specially the larger banks, deprived of the information and of the decision structure adequate to capture the best projects, are tempted to behave as free riders. They can do so by exploiting the monitoring activities of specialized operators, to select part of the projects, thereby avoiding to incur in direct monitoring costs. This risk may imply higher social costs, even though the optimal combination of hierarchy and poliarchy is decided by the interaction of the intermediaries and the market. Specialized operators, in fact, may see their competitive advantage severely compromised by the opportunistic behavior of larger and un-specialized banks, and, as a consequence, scouting and other monitoring activities aimed at finding new project ideas may be hampered.

The second risk concerns the so called "winner's curse", associated with the winner of a competitive auction, who discovers to have bid a higher price than what he should be willing to pay. The financial equivalent of this curse is the fact that the specialized operator, investment bank or venture capitalist, may be financing prevalently those projects which everybody else has rejected because of the excessive risks involved. This financing is apparently the fruit of competition, but at the same time it may be a poisonous fruit, since in the long run it may both do damage to the specialized operators, which will be affected by a higher degree of failures, and the high tech firms, which will find fewer financing opportunities.

Ex post activities aim at improving the performance of firms who have already been granted financing, through supervision and control. Because of the general uncertainty characterizing innovative projects, the often long gestation lags, the tenuous property rights and the prevalence of intangibles in the assets owned by the high tech enterprise, monitoring may be costly and only partially effective. The fact that the bank may try to audit the firm's accounts and to prescribe actions of some sort does not generally help on the front of moral hazard. When it is tied to the possibility of renegotiating loan terms, it may hamper project success by either unduly restricting the

firm's impulse to grow (under-investment incentive), or by inciting it to take excessive risks (over-investment incentives) at the expenses of senior lenders who may not be able to renegotiate.

Ex post monitoring activities may be divided in two groups: (a) surveillance and control actions, to collect information on the firm that may be relevant for the bank; (b) supervision actions. These include assistance, advice and provision of services, thereby involving prevalently information that may be useful to the firm financed. In a regime of *financial deepening,* with both banks and specialized operators competing to promote the success of the projects financed, both activities of type (a) and (b) should be growing. This would be specially true for start ups and projects that require technical expertise and innovative or at least state of the art technology to be successful. Both activities, however, are linked to a relationship between intermediary and enterprise that may go much beyond unilateral monitoring. Specialized operators may develop a competitive advantage in type (b) activities, but they may not be sufficiently numerous to satisfy the demand for know how and technical capability where innovation and technology is at stake.

The relationship between the intermediary and the enterprise has been recently evolving towards forms of delegated monitoring, where the incentives provided to the two parties constitute the essential elements of the financing relationship. Monitoring activities of type (a) and (b), in fact, tend to eliminate the problems of *moral hazard* deriving from the fact that the firm and the intermediary may both have an interest to hide information to one another and to operate under conflict of interest. The contract of delegated monitoring with incentives, instead, aims at creating a unity of behavior of the two parties, which may be particularly beneficial for long term performance.

Can we say that the specialized intermediaries hold a competitive advantage, at least a potential one, as agents for monitoring financing in behalf of banks and enterprises. While many activities may be conceivable as part of this type of a relation, it is evident that a contract of delegated monitoring may of great interest for small firms, local banks and operators, such as closed funds, that are also often operating on a local basis. This activity is very difficult to organize, because in most cases both banks and specialized operators are unprepared to go beyond traditional monitoring and control. On the other hand, the experience of *capital deepening* in the areas of concentration of technological progress,

such as many industrial districts and science parks indicate that this may be a most productive area of business.

Commitment activities aim at reducing adverse selection and moral hazard by incorporating incentives in the structure of contracts or of its implementation procedures. They include a panoply of instruments, the most important being collateral, loan agreements, debt covenants and what is generally referred to as "building a relationship" [14].

Collateral may take the form of a pledge of inside assets, i.e. assets owned by the firm, or outside assets, owned by the shareholders, sponsors or other stakeholders. Because it attenuates the implications of limited responsibility (the value of a failed project is negative rather than zero), collateral reduces both adverse selection and moral hazard. On the other hand, the fact that the bank has required an independent pledge to back the project, significantly reduces the value of the loan as a signal of approval and trust to the enterprise. Nevertheless, collateral is the main instrument to overcome the conflict of interest between the bank and the firm, specially in the case of SMEs, *start ups* and *high techs*. In the United States, about 40% of loans [43] and 60% of their value [44] to small business are backed by outside pledges.

Loan commitments are forward contracts committing lenders to provide loans over a given period, at fixed rates. Lines of credit are "generally pure revolving credits that allow the firm to borrow as much of the line as needed at any given time over the interval time specified" [13, 41]. Even though these instruments appear to be conceived to provide working capital, they may be used to finance machinery and innovation. It is also typically utilized to open a credit door to the firm by allowing her to slowly upgrade her credit capacity over time. In general, however, the short term and conditional nature of this type of credit, allows the banks to hold an option *not to finance* the enterprise, and limits its commitment to any longer term venture. While it may mitigate the effects of rationing for small enterprises, it makes them dependent on the credit institutions to the extent that they may not be able to implement a new project without prior consent from the main bank that finances their current operations. Loan commitments and lines of credit, furthermore, are not generally sensitive to positive news, including the favorable characteristics of good innovation projects. They tend to be, in fact, rather dependent on bad news, to deny credit

when the firm enters the gray zone of financial difficulties, low cash flow and, depending on the circumstances, temporary low returns due to high growth prospects.

Debt covenants can stipulate that the borrower has to obtain the consensus of the lender before engaging in a new project or in a change of corporate policies. They are specifically designed to reduce the information problem and agency costs and may be rather effective for sufficiently large enterprises. Small firms, however, are more rarely disciplined by this type of instruments, because of the generally low quality of their auditing. In the case of innovative projects, furthermore, restricting the firm's ability to change its financial position may severely hamper management flexibility in the face of uncertainty, including its ability to take advantage of market and technological opportunities. More frequently, small firms are controlled through contracts of short maturity. These contracts enable the banks to monitor changes in the borrower and to renegotiate the terms of the loan if risk conditions have been modified by the evolution of its fundamentals, or by the adoption of riskier expansion policies. In the case of high tech SMEs this adds a further reason to their inability to obtain long term credit on the basis of projects' merits rather than on systemic risks.

The activities that lead to the development of a long term relationship between the lender and the borrower provide more efficient *commitment* than contractual instruments that restrict in any way the flexibility of one or both parties. Long term relations are particularly desirable because they may drastically reduce *agency costs.* These costs are due to the fact that the credit contract generally does not satisfy the requisite of time consistency. Efficient *ex ante* contracts may thus become *ex post* inefficient, if circumstances occur that determine a divergence in the interest of the two parties as to abiding by the contract terms, renegotiating, defaulting.

Under these conditions, developing a long term relationship between the bank and the firm may allow the bank to build up a credit history for the SME, by accompanying her through her life cycle and providing financing at the appropriate time with sufficient information. In the United States, for example, small business that define a commercial bank as their main financial partner have been receiving financing from the same bank for more than 9 years[3]. Bornheim and Herbeck [45, 328] illustrate the situation by contrasting gross marginal benefits from the relationship, shown as a curve decreasing with time, to costs, which are instead increasing with the length of the relationship. Costs are mainly due

to what has been called the phenomenon of *information capture.* Marginal gross benefits are mainly due to the reduction of capital costs in response to the private information about borrower quality provided by the relationship. As a consequence the price of the loans falls [46], loan size rises over time and collateral demand also tend to fall [47].

Information capture shows up as a progressive loss of options for the firm. Once caught in a long term relationship, a small firm may find difficult to turn elsewhere for funding. The broader effect may be lowering competition among banks and higher costs to the firm. On the other hand, a long term relationship does not necessarily imply an exclusive one, both in the sense that the firm may try to build up long term financial ties with several intermediaries and because after a certain number of years it may be advisable to severe one's ties with the main lender.

Relational financing has been defined by Aoki and Dinc [48] in a way directly dependent on the intermediary expected benefits, as the type of financing that is provided in the expectation of both further financing over time and the exaction of rents. In contrast, ordinary financing is referred to as *arm's length*. Relational financing is thus particularly important for start ups, high tech projects and SMEs because the prospect of the gain proposed is often sufficiently vague and long term that only the expectation of extracting a rent may provide the incentive to offer financing on a likely repeated basis. Relational financing thus includes commercial banks, investment banks and venture capitalists, but clearly favors specialized intermediaries which can fulfill the needs of growing firms through their more closeness to the firm territory, their expertise in the firm operations, and their know how on the relevant markets.

2.3. Equity financing

The rise of the Internet economy has demonstrated, somewhat spectacularly and not without the danger of a negative feedback, that high tech firms may be almost entirely financed by equity, provided that the prospects for acquiring rents are sufficiently high. In general, however, most innovative businesses have found hard to resort to equity financing. While available empirical research on this topic is almost nil, business angels appear to be the main source of third party financing (TPE), at least in Anglo Saxon economies. Nevertheless, even in the most developed countries, this source of finance, at least at first sight, appears to be of minor importance. In the USA, for example, according

to SBIC data, only 3.59% of total finance to small businesses is provided by TPE and only 1.85% by venture capitalists. These figures, however, may give a false impression, since both business angels and venture capitalists "[…] invest very selectively and target small companies with significant upside potential" [13, 40]. While a small proportion of the total, therefore, TPEs, venture capital and business angels may account for a much larger share of the outside finance obtained by successful firms.

As for innovation, one may reasonably argue that, because of the comparatively lower incidence of traditional credit, enterprises engaging in riskier projects involving research and new technology would also be more represented among the firms financed by venture capitalists and business angels. This would be the result of mutual signaling of preference for growth, as well as a result of greater competence in evaluating high tech and start up projects. Furthermore, the improved financial management obtained through the involvement of equity partners could have positive results on the performance of the firm. This conjecture has received some support a study of venture capital in the US [49], which shows that, even though it financed only 3% of total R&D, it was associated with 15% of industrial innovation.

Venture capitalists and business angels differ in their objectives in a substantial way. While venture capitalists are interested in capital gain, business angels aim at finding enterprises that can be reliable income sources. Further differences concern the *modus operandi* in the partnership. Because of their concern with maximizing returns to capital, venture capitalists generally operate through intermediaries (closed funds or other financial entities), they typically take small equity positions in the firm selected and always combine these positions with carefully designed exit strategies. Among these, the initial private offering (IPO) is the elective one. In contrast, business angels do not operate through intermediaries, are not committed to exit designs and tend to become involved in the management of the companies financed in a major way. Involvement in the company management appears indeed to hold a positive value for angels, to the point of justifying their financing of companies comparatively riskier and less liquid than those that TPEs and venture capitalists would fund.

Business Angels are also characterized by the fact that they tend operate in anonymity, often work in groups, tend to share databases and news about the best companies and generally rely on networks of consultants and special services. These

services, which are increasingly on-line, have a matching function and, by combining an application process to a growing database, look for mutuality of preferences between investors and entrepreneurs. According to Marcia Schirmer, who is President of the Colorado Capital Alliance Inc., a Colorado-based angel network, 82% of BA's expect a role in the venture, with investment ranging from $50K up to over $1 million - (Bill Gates is the largest angel of all, and has a slightly higher range) - 18 of 20 investments don't produce a positive return, while investment costs for angels is very high (due diligence - patent attorneys for example). The sectors of involvement are mostly technological, with innovation in the forefront: Hugh tech services companies, telecom, computers, Internet, manufacturing, with financing distributed over project life: 31% seed, 46% early stage, 23% mid-stage or established - 56% have sales.

According with the latest SBIC data, there are more than 2 million angels in the country (of which only 250,000 are investing), who invest $20 billion annually. While angels look for companies that have strong management, they are also interested in very high returns (40% within a few years is a common target). As a consequence, they often seek direct involvement in the company in a way that may allow them to exercise some control on growing strategies, but also effective monitoring of management practices and performance.

2.4 Growth, returns and financial constraints

Growth prospects are not equally important for all enterprises. Start-ups and innovative firms, in particular, are dominated by long term goals, rather than by short term profit maximization. In spite of the fact that the firm is free to formulate its strategy plan, it cannot always do this without taking into account of the needs and prescriptions of some of its most influential stakeholders. Among these, the credit institutions are the main subjects, not formally involved in the governance of the firm, that may nevertheless exhibit some power in evaluating and controlling corporate policies.

Wood's model [50] analyzes the relationship between development and profitability. The author claims that leverage creates a *trade-off* between profit margins and development rate. Enterprise growth requires finance to support both new investment and working capital. Finance may be generated within the firm (self-

financing) or from outside by shareholders or third parties. A corporate policy aimed at generating high short term returns to the providers of capital (shareholders as well as creditors) reduces the growth of the firm because of its inevitable recourse to funds that would otherwise be used for self-financing. In contrast, a high rate of investment of the resources generated (a high rate of self-financing) broadens the possibilities for growth and the long term returns.

If corporate returns (and, as a consequence, the returns for the providers of capital) is measured with the ratio between operating income and investment (rate of return on investment or ROI), an investment increase determines a short term reduction of ROI. Even though one of the modalities of investment selection is the exclusion of projects presenting a ROI lower than the average ROI of the firm, in fact, the rate of return of the new investment depends critically on the income that will be realized at project maturity. In the *start-up* phase, therefore, all new investments tend to have a negative impact on the average rate of return of the firm, because an increase in resources committed is not immediately matched by a growth of operating income. If the reduction in ROI deriving from the new projects takes the firm below a threshold level of profitability, credit institutions may reduce the financial flows to the firm, thereby constraining uts potential for growth.

Wood identifies two groups of subjects that may determine the equilibrium point between short term returns and growth. They are, on one hand, the entrepreneurs, who define the efficiency frontier, i.e. the *locus* of the efficient combinations of expected returns and growth rates. On the other hand, these subjects are the credit institutions which, with their financing policies, set limits to the strategic choices of the entrepreneurs.

In defining the production and organization structure, the entrepreneur determines the level of efficiency and profitability of his firm. This allows him to define the growth rate of the enterprise for each level of short-term return of the investment. Given a certain level of short term returns necessary to satisfy the needs of the providers of capital, the level of growth will depend on the level of efficiency that can be attained.

If the firm is totally financed with own capital, the entrepreneur may autonomously determine the minimum rate of return in the short-run and, as a consequence, he may freely choose the rate of growth for his firm. If the firm is in debt,

on the other hand, or is forced to seek external financing, the short-run level of the rate of return to investment will have to be sufficiently high to satisfy the requests of the capital providers. The financial market (second category of subjects who can determine the equilibrium level between returns and growth) thus defines the "finance constraint" which sets a limit to the entrepreneur's choices on the growth policies to pursue.

Assuming, for example, that an entrepreneur wishes to invest in a new project, he will face, from the financial point of view, two alternatives: risk capital (i.e. common stock or self-financing), or credit. Once the financing is secured, the entrepreneur will be solely responsible of investment choices in the first case, with no external constraint. In the second case, instead, the release of financing may be conditioned upon a continuous positive evaluation on the part of the bank. While in the first case the analysis of investment choices will be only subject to the evaluation of the entrepreneur, in the second case it will be subordinated to a positive evaluation on the part of the bank. One of the parameters utilized by the bank for granting credit is represented by the capacity of the initiative to create short term wealth. In this respect, the bank tends to appraise the firm's capacity to reimburse the debt contracted by generating a cash flow. It is thus possible to identify different alternatives:

1) the project realized generates a cash flow that allows the amortization plan to be respected;

2) the cash flow of the project is not deemed sufficient to cover the amortization plan, but it may give the firm the opportunity to grow in a way that ultimately may allow the repayment of the loan;

3) the projected cash flow may not be sufficient to repay the loan unless the firm is carefully steered along the construction stage of the project, so that no other projects are undertaken that may interfere with its debt obligations.

The possibility of obtaining external resources depends critically on the risks of the initiative proposed. The greater project risks, the greater the expected variability of the cash flow generated by the project and, therefore, the probability that these may not be sufficient in every moment to assure the reimbursement of debt. Faced with the greater uncertainty surrounding innovative projects and start ups, therefore, banks require higher cash flows, as if higher risks were at stake , thereby excluding from financing projects with

inadequate expected cash flows even when, on an ex post basis, these appear to have been credit-worthy and economically valid as expansion options for the enterprise.

In conclusion, the recourse to external sources of financing may force the firms to secure the financier a short term level of cash flow commensurate to the perceived project risks. This requirement may actively discriminate against projects which, even though characterized by a positive net present value, including an allowance for the risk aversion of the entrepreneur, do not insure a sufficiently high short term level of the cash flow. Even though in theory the bank has no control on the firm, its power to discriminate against the projects without a convenient short term profile may in practice severely restrict the firm strategic choices and severely hamper its innovation capacity.

On the basis of Wood's model, therefore, the capacity of the enterprise to grow by enacting an innovative project is constrained by the following variables:

1) project risks (in terms of what is perceived by the banks);
2) capacity of the project to generate adequate cash flows (or to guarantee a minimum income) in the short run;
3) the degree of financial leverage.

3. Risk and credit supply in the Arab countries

3.1 Islamic Banking

Arab countries present an interesting picture of development and finance, in that on one hand they fully participate to world financial integration, and in some cases are even among the protagonists, while, on the other hand, they have been actively seeking viable alternatives to western banking and traditional credit practices. As a consequence, the Arab world does not only present the usual dualism between the banks and the financial markets, but also, within the banking system, a further dualism between western-like banking and Islamic, i.e. interest-free banking. The prohibition of charging interest or holding/trading in interest-bearing instruments, in fact, has determined since 1400 years ago the preference for equity holdings and for a variety of credit substitutes in Islamic countries. Various financing techniques, originally developed by traditional Islamic jurists since the early days of Islam, have evolved into a credit system which is not based in any way on interest charges to recover credit costs

and remunerate financial intermediaries. The fact that interest rates have never been used to recover higher risk charges makes credit rationing almost automatic and, even in the most recent evolution of Islamic banking, rather sophisticated in the use of monitoring and commitment techniques to reduce informational asymmetries and moral hazard. Today, Islamic banking is considered the fastest growing sector in the Arab financial services market. Since the beginning of the 70s, the years where active experimentation of the new system started, an estimated $US 70 billion worth of funds are now managed according to Shari'ah. Deposit assets held by Islamic banks were approximately $US5 billion in 1985 but grew over $80 billion in 1999.

The main principles of Islamic Banking may be summarized under the following headings[4]:

a) any predetermined payment over and above the actual amount of principal is prohibited;

b) the lender must share in the profits or losses arising out of the enterprise for which the money was lent;

c) making money from money is not Islamically acceptable;

d) gharar (Uncertainty, Risk or Speculation) is also prohibited;

e) investments should only support practices or products that are not forbidden.

The basic credit contract of the Muslim tradition is called *Murabaha* (or cost plus financing). It consists of a deferred sale in which a bank purchases the goods and sells them to the customer for a pre-arranged price, which can be paid by installments. In this sense *Murabaha* is similar to the technique of "Build, operate and transfer" (the so called "BOT") of project financing, since credit is used as a devise to share risks over time between the bank (which finances the first stage of the project) and the sponsor (who finances the second stage). The two stage purchase agreement that results from this typology of contracts has proved to be suitable for a variety of financial ventures, such as real estate investment, purchase of machinery and project financing.

In practice, *Murabaha* is a form of short term credit, that is considered consistent with more specific forms of lending, such as: a) *loans with a service charge,* where no

interest charges are levied on the loan, but banks cover their expenses by levying a service charge, which may be subjected to a maximum set by the authorities; b) *no-cost loans,* where each bank is expected to set aside a part of their funds to grant no-cost loans to needy persons such as small farmers, entrepreneurs, producers, etc. and to needy consumers; c) *overdrafts,* which may be provided, subject to a certain maximum, free of charge.

In the ten years since the establishment of the first private commercial bank in Dubai, more than 50 interest-free banks have come into being. Though nearly all of them are in Muslim countries, there are some in Western Europe as well: in Denmark, Luxembourg, Switzerland and the UK. Many banks were established in 1983 (11) and 1984 (13). The numbers have declined considerably in the following years.

While in most countries interest-free banking was created by the private sector, in 1981 in both Iran and Pakistan the government introduced legislation aimed at establishing compulsory country-wide interest-free banking. In Pakistan, starting on January 1st, 1981 all domestic commercial banks were allowed to open deposits on the basis of PLS principles. After a series of intermediate steps, from July 1985 PLS was extended to all existing and new deposits. In Iran, starting on February 1981, banks were prohibited from carrying out operations involving interest. Lending was permitted only on a cost plus basis, with a 4% maximum service charge and a 4 to 8% 'profit' rate depending on the type of economic activity. Banks were also prohibited from paying interest on deposits, but they were allowed to offer a 'guaranteed minimum profit'. By March 1985, after the introduction in August 1983 of the Usury-free Banking Law, the whole credit industry was converted to a no-interest, PLS system.

While the participatory features of interest free banking may be appealing under several aspects, the loss of a key price-like variable such as the interest rate, creates an informational gap that both debtors and creditors find very difficult to fill. Above all, the key problem created by the kind of lending generated in the PLS framework is that there is no specific provision for investment financing. Bank lending, in fact, is limited to either no-cost loans (mainly consumer loans) including overdrafts, or loans with service charges. Both these types of loans may produce income for the bank only to the extent that they mobilize other sources of revenue, either through services, or through the acquisition of deposits. Investment financing may thus be accomplished only

through either trade financing or through partnerships, which are both supposed to be carried out by banks only on a profit and loss sharing (PLS) basis. This is where the banks' main income is to come from and this is also from where the holders of investment deposits (a special type of deposits that are equivalent to shares of investment funds) are expected to derive their profits from.

Musharaka is the second basic Islamic financing technique. It consists of a contract of two or more parties on a joint venture where they contribute capital as well as other factors production and agree to share profits and losses according with a predetermined ratio. In technical terms, Islamic scholars have referred to *musharaka* as *shirka* (partnership). Within this broad category, they have distinguished two main contract typologies: *sharikat mulk* (property partnership), which denotes a joint ownership without joint exploitation, and *sharikat 'aqd* (contractual partnership), which denotes joint ownership and exploitation.

In parallel to what happens in banking and finance outside the Arab countries, most of the Islamic financial institutions are heavily involved in cost plus financing on a short term basis (*Murabahah* and *Bai Bithaman Ajil*), rather than in the partnership contract (*Mudarabah* and *Musharakah*). This latter form is clearly a more effective way to address the needs of investment financing. *Mudarabah* is also known as *qirad* and *muqaradah*. It consists of a contract between two parties in which one party supplies capital to the other party for the carrying on of some trade on the condition that the resulting profits be distributed in a mutually agreed proportion while all loss is borne by the provider of the capital.

The bulk of technology financing, specially where innovation is incorporated into machinery, equipment and other tangibles, however, takes the form of a sales contract rather than of a financing contract.

Even though cost plus financing may be interpreted as a loan contract where interest is deprived of some of its speculative components, its pure *Murabaha* version relies too much on the trading aspect to be really equivalent to loan contract. The consequences of the "split personality" of this kind of short term financing on technology projects may be negative. In fact, while this contract may work relatively well in the cases where credit is sought to buy advanced equipment that can be amortized quickly, it is clearly inadequate in all cases where product or process

innovation requires investment in research, development, prototype building and acquisition of know how. The anticipatory nature of the contract, therefore, is likely to impart a distinct bias in favor of imitation (through the purchase of already made equipment) and against the development of new hardware and software.

The concentration on short-term financing through the *Murabahah and Bai Bithaman Ajil* (BBA) typology has made most Arab institutions accumulate surplus funds. This represents a form of extreme rationing, partly explainable with the failure to use a price-like variable, such as the interest rate, to select borrowers below the threshold of adverse selection. For example, a research conducted by the *New Horizon* in UK (a magazine which deals with Islamic Banking and Insurance) suggests that by the year 2000, Islamic financial institutions may have developed surplus funds of more than 30% out of total assets exceeding US $100 billion.

Recent data from Sudin Haron [51] show that Murabaha is by far the most common form of credit and that manufacturing finance is a relatively minor proportion of the total, except for the single case of Bahrein. Other figures suggest that long term financing may be less than 15% of total lending for the 20 major Islamic banks. In part, these characteristics may derive from the general features of the PLS system. The preoccupation for eliminating interest charges from the loan contract, in fact, has two consequences. First, it prevents the de-coupling of the sources from the uses of funds, by forcing bank management to allocate savings to investments in a way that allows the imputation of profits and losses from specific investments to specific funds. Second, it does not allow *ex ante* monitoring activities to be carried out in a straightforward manner. Project evaluation under PLS, in fact, requires a detailed appraisal of both the characteristics of the project and of the subjects providing the funds for financing. If a firm needs fresh funds to exploit an expansion option or a market opportunity of some sort, for example, these funds may be provided only if an additional project may be formulated and appraised.

On one hand, therefore, the PLS philosophy challenges the very basis of banking. This relies on the capacity of the bank to create liquid instruments (deposits and other securities), to finance illiquid investment in real estate, machinery, infrastructure and technology. Because savers are reluctant to relinquish the liquidity of their assets for long periods of time, banks achieve, by pooling short term assets, the capacity to transform

liquid claims into illiquid ones. This feat is accomplished because savers are unlikely to want simultaneous access to their assets, they are compensated for the limited loss of liquidity with different interest rates, and the banks reduce transaction costs by standardizing and de-personalizing, through intermediation, the contracts between providers and users of funds. By collecting savings, and turning them into a pool of funds, the banks make possible to respond to third parties financing needs without having to report to deposit holders. Eliminating interest rates, an operation that seems innocuous per se, if interests are substituted by service charges, in reality may render the bank unable to provide funds to enterprises and investors, unless viable alternatives are identified to remunerate funds collected from the public. In non Arab countries, cooperative institutions, such as credit unions, have indeed been operating side by side with regular banks by paying "dividends" to depositors, so that at least this alternative seems already solidly established.

It seems *a priori* plausible that small scale businesses and innovative firms may have been hit particularly hard in the early stages of the establishment of the PLS system.

On the other hand, the PLS system does not share the most conspicuous sources of inefficiency of banking credit, such as adverse selection and agency costs. Because interest rates are not used as a rationing variable, even for limited groups of perspective lenders, Islamic banking suffers to a much lower extent of the *ex ante* informational costs that characterize ordinary banks. As a consequence, it should be able to secure credit to innovative enterprises more quickly and efficiently than ordinary banking. Furthermore, because of the participatory nature of the credit contract, *ex post* inefficiencies should also be attenuated, with an emphasis naturally taken by built in incentives (commitment) with respect to monitoring, banks' oversight and their unavoidable consequences in terms of bad will, moral hazard and over and under-investment incentives.

In sum, against more pervasive rationing and more severe credit restrictions for investment and technology, Islamic financing may present some advantages for innovative firms and high technology development. While it is likely that higher risks and transaction costs will be associated with each financing operation, each investment is more likely to be considered on its own merits and a relationship between the bank and the firm may be

more easily constructed. Short term requirements on the cash flow, risk aversion considerations and harder rationing, however, may be expected, at least until the institutional arrangements are sufficiently developed. As a consequence, we should expect more stringent restrictions to credit to prevail, and harder life for start ups and innovative enterprises.

3.2 Non banking Intermediaries

In most Arab countries financial intermediaries and investment allocations are subject to direct government influence and control. Only in Jordan and in Egypt, even though government influence remains heavy, public control is indirect and less pervasive. In Egypt, the resources of the social security system are managed by the National Investment Bank, with most financing going to public projects. Malaysia, which follows a similar pattern, has the merit of paying positive real rates of interest to individual accounts. Tunisia and Morocco, on the other hand, require contractual savings institutions to hold low yield government paper and invest in low income social projects.

Table 1
Equity Markets in Selected Countries
(% of GDP)

	1980	***1985***	***1990***	***1993***
Netherlands	18.6	38.7	39.2	61.4
Sweden	10.6	32.8	38.6	61.8
Switzerland	44.4	82.0	66.0	117.2
UK	37.1	63.6	79.9	123.3
US	45.7	57.6	56	82.4
Chile		13.9	59.6	103.6
Malaysia		50.7	113.4	365.1
Singapore		60.1	90.4	239.5
South Africa	123.9	115.1	127.6	152.5
Egypt		4.9	5.0	9.7
Jordan		44.7	49.8	87.3
Morocco		1.9	3.7	9.9
Tunisia		6.8	4.3	6.5

Source: International Finance Corporation

Table 2
Value of Equity Trading in Selected Countries
(% of GDP)

	1980	*1985*	*1990*	*1993*
Netherlands	3	11	13.2	22.7
Sweden	1.4	8.4	6.6	25.1
UK	6.6	13.3	26.2	45.3
US	15.1	24.7	32.9	55.3
Chile		0.4	2.8	6.5
Malaysia		7.2	25.4	254.7
Singapore		7.6	53.5	147.3
South Africa	6.6	5.8	7.6	11.5
Egypt		0.3	0.2	0.2
Jordan		3.2	10.1	24.6
Morocco		0.1	0.2	1.9
Tunisia		0.1	0.1	0.3

Source: International Finance Corporation

Depressed investment opportunities and infant capital markets thus characterize most Arab countries (Tables 1 and 2), with the notable exception of Jordan, whose equity trading, since 1993, is already comparable to some European countries. As Tables 1 and 2 show, Asian equity markets are much more developed in countries with Islamic traditions, where business conditions and investment opportunities may even be more favorable than in continental Europe or the USA.

According to econometric studies conducted at the World Bank, Levine and Zervos [52] found that the size of the equity market and the volume of trading are robust indicators of market efficiency, low transaction costs and market liquidity. They further found that countries with more developed equity markets and more intense activities of non banking intermediaries were, coeteris paribus, better performers in terms of capital accumulation, long term growth, and efficiency. While this evidence appears to be convincing and, indeed, compelling, it is difficult to predict whether the current trends of growth

of capital markets in Arab countries will proceed in the direction of the development of a vital and productive structure. Although the preference for participatory financing should be strong in a culture which objects to interest lending, the financial resources of domestic origin are still trapped in large bureaucratic institutions (public banks and insurance companies), while foreign capital is subject to discouraging restrictions and controls.

Some countries, however, appear to be moving in the right direction. In Jordan, for example, the Social Security Corporation is a large institutional investor enjoying remarkable freedom from government interference. Even though its investments have been constrained by highly conservative policies by the shortage of attractive investment opportunities, it may be considered a great potential for investing in new companies and financing innovation.

In Egypt, since the early '90s, a number of incisive measures have been taken to revitalize the capital markets, with special emphasis on the market for corporate equities. The development of the stock market has been stimulated by the enactment of new and comprehensive legislation, the strengthening of the CMA (Capital Market Authority), the inflow of foreign capital, and an aggressive privatization policy. New listings and IPOs also showed a remarkable increase, with market capitalization reaching 20% of GDP in 1996, from 10% in 1993, and trading activity 3.4% of GDP, from 0.2% in 1993.

As a consequence of the fact that savings are trapped in low yield investments and managed under government interference, venture capital and other sources of business financing have not seen a significant development in Arab countries. In spite of the tradition of PLS financing and of the fact that most of these countries have established the legal framework for the operations of financial intermediaries specialized in risk capital, the development of the private sector and its involvement in finance still requires major changes to exploit the virtuous circle between finance and innovation [52]. The bulk of Arab countries, in fact, still lacks the basic conditions required for an efficient and stable financial system: 1) an operationally autonomous central bank; 2) private commercial banks and other financial institutions operating as profit centers and

are not captive of their borrowers or the government; 3) an adequate legal and administrative framework.

4. Financing the "new economy"

4.1 The main features of the new scenario

The so called "new economy" has received much attention as one special type of innovative enterprising both for technology and financing. What is meant by "new economy" is not altogether clear, but three main elements stand out as its characterizing features: i) the use, at the same time intensive and diffused, of the modern information and telecommunication technologies (the so called ICT's); ii) the prevalence of the network structure inside and outside the firm; iii) the absolute importance of knowledge and information in determining competitive advantage. For many aspects, we may interpret the vertiginous changes of industrial organization, by hypothesizing that we face a second post-fordist revolution (PF). This hypothesis is justified by the fact that the so called "internet revolution"(IR) displays, within a broadly different context, numerous elements of similarity with the processes of deverticalizing and reorganizing the firm that have characterized the 80's and the 90's.

The point of departure, in IR as in PF, is given by the exhaustion of some important scale economies. In the PF case, these were mainly directed to the fact that the assembly line could be substituted by more flexible production tools, capable of insuring a larger and more pervasive automation, greater modularity and, as a consequence, an ever increasing recourse to outsourcing. In the IR case, the disappearing scale economies are linked to transaction costs. These costs become so low on the electronic network, that one might possibly state that they threaten the very existence of the firm (at least as a nexus of standardized contracts in the Coasian tradition). Entry barriers shrink, since they depended on the fact that the firm was forced to put together, to start its business, a critical mass of resources, precisely to exploit the scale economies generated by its functioning as a broker of contracts on various markets.

The loss of the traditional scale economies, in IR as in PF, appears to translate itself into a push towards a reduction of the size of the firm and the increase of outsourcing. Here, however, some important differences emerge. In PF, the reduction of

firm size was aimed at transforming the old firm into a network, with the so called "core business" at its center and, around it, a series of more or less captive subcontractors. The PF organizational model is similar to a small solar system, dominated of what is left of the traditional firm (transformed into a center irradiating strategic knowledge), with many planets and satellites. These are situated at various distances from the center, according to their strategic importance, the degree of captivity and other characteristics. The PF mode of production has thus been associated with *de-localizing* and *de-centralizing* phenomena, since the traditional firm, in addition to perceiving the end of scale economies, is stimulated by the possibility of exploiting the economies of scope through outsourcing, and, by using a plurality of subcontractors, of optimizing a sort of extended location, given the space structure of prices, wages and transportation costs.

On the whole, the post-fordist revolution, even though it has signed a fundamental step forward in the conquest of new spaces to increase the productivity of the firm, at the same time has been an organizational revolution based an exploiting inequality across laborers and geographical areas. It has primarily concerned the firms that were already operating, and, by differentiating the workers by the degree of strategic knowledge, has created new classes of *insiders* and *outsiders*. It has also stratified the firm over space, creating new classes of areas less developed, depressed and trapped within low level equilibria (many "local Koreas"). It has been limited, in its capacity to de-verticalize the firm, by the persistence of scale economies in the distribution, publicity, marketing and finance. Finally, it has created company networks, but has not affected the traditional structure of the market, except in a minor form: almost always the subcontractors remain "captive" of one or more mother companies, and outsourcing networks mostly remain both vertically and horizontally small.

In some regions of the world, in particular, PF has given some impulse to a new process of "light" industrialization. It has mostly done so, however, by dissolving the traditional firms, too large and inefficient, and exploiting characteristics such as low salaries, fiscal evasion, the availability of low cost skills in the areas of craftsmen and non specialized intellectual labor. The construction of penetrating networks for outsourcing, which has concerned many Mediterranean countries, for example, has been associated with a new development of the "underground economy" in all its different shades (from the gray to the black. This has occurred with a sort of "unholy" pact

among the firms of Northern and Central Europe. These firms remained in the formal economy, prosperous and law abiding in the control of the "superior" phases of the production cycle. At the same time, they were amenable to de-localize in the less developed areas of Europe and in the Middle East, North Africa the "lower end" production phases, without being too fussy on the ways that the subcontractors used to reconcile the quality of the products requested with the prices paid.

The activity of enterprise creation, furthermore, even though notable in size and dynamics, showed two main negative characters. First, the competitive advantage of the new firms often depended on their capacity to evade taxes and elude labor legislation to survive. Second, both from the point of view of marketing and credit, the firms created were completely dependent on the mother companies, with very limited perspectives of growing out of such dependence. This process and these characteristics are emblematic in the Mediterranean countries such as Tunisia and Morocco, that constitutes a sort of *enclave* within an industrial economy such as the European Union.

In partial contrast with these characteristics, the IR appears to have found an angle of success based on additional economies with much greater potential and, what is more important, with end results much more virtuous on the industrial structure of the less developed areas. In the first instance, in fact, the reduction of firm size, which is linked, but not totally identified with deverticalization, in the case of IR is based on the disappearance of barriers to entry. The network is in fact available to all, practically at zero cost. Furthermore, it is increasingly easier to find financing for the new firms and the present euforia renders this financing even more attractive. The development of e-commerce and of its interbusiness components (the so called "b2b") will make possible a network of subcontractors to outsource any business. This implies that the degree of captivity of the small subcontractors will diminish drastically. But also the scale economies linked to marketing and the related entry barriers appear destined to dissolve. The possibility thus transpires of a global network constituted of small firms, with very low entry costs and highly competitive with one another on both products and processes: something very similar to the paradigm of perfect competition dear to the heart of the neoclassical economists.

The characteristics of the network are, in effects, the most interesting elements of this new revolution. As we have already mentioned, the IR network is different from

the PF network mainly because, instead of being a network embedding a plurality of independent networks, it tends to integrate even the smallest unit as a full member of the total network. The emerging structure thus tends to be a network whose constituent parts are individual subjects, and where everybody tend to develop connections and is potentially connected with everybody else. The scale economies (the so called "network" economies) of such a network are thus the largest possible ones: they are of the same type of the other single largest individual network that we have experienced, that is, the telecommunication network. Not surprisingly, telecommunications are the basis of Internet, which is, however, a much more complex and dynamic graph, where knots and links display an intensity of proliferation an intrinsic stability, greatly transcending the pattern of fixed or mobile telephone connections.

The PF revolution has been, for many aspects, a computer revolution: numerical control machines, automation and development of programming and control have all conspired to give the computer a crucial role in re-organizing the firm. The computer technology has led the process of de-verticalizing the Fordist company, by forming a network of firms integrated by a virtual texture of computerized programs and controls. In this phase, the role of Internet has been, everything considered, marginal, while intranets and the other tools of enterprise integration have proliferated. It is not thus surprising that this phase of industrial transformation has also been characterized by an expansion of computing capacity, the personal computer has taken off, becoming ever more powerful, lighter and inexpensive.

In an economy characterized by a global network, however, the computing power of the individual units is less important, because it is the network itself that presents the greater potential to contain and elaborate information. Communication capacity becomes thus critical. A reasonable prediction, even though not agreed on by everybody, is thus that IR, in spite of having based its take off on the development of "computing power" and of personal computers, will be itself the main cause of obsolescence of the present combination of computing power and communication capacity. Computers will become increasingly "stupid", even though smaller and lighter, and will instead develop capacity for speedy interaction, which they lack now. The network, in turn, will grow like an enormous super-computer capable of utilizing the power of the million machines permanently connected. Together with the

development of new "speed" telecommunication methods, based on a pletora of new technologies that are just entering now the scene, Internet could evolve, and this is the right word, because of the unpredictable and mutation-like character of these developments, into the ultimate communication technology. Something that, like language, connects all men, instantly, but is infinitely less constrained than language by linguistic and geographical barriers. The battle for the new standard, the so called "wide band", has to be understood in this perspective: a telematic network of permanent connection, like the electrical network, where, however, marginal connection and communication costs are truly zero.

4.2 The financing sources

As a spectacular example of inversion of the traditional financing "pecking order", Internet companies have resorted to conventional credit in very limited amounts and, at least during the "boom" years, were mostly financed by venture capitalists, with IPOs coming very fast after the first deal between the financial partners was struck. The venture capitalists responsible for most of financing were a handful of financial houses and investment banks that still dominate the market, and the risk, of the new business. These firms, who were often strategic partners for the new ventures ranged from VC kingpin Kleiner Perkins Caufield & Byers to Japanese renegade Softbank and built networks of companies that are often referred to as Keiretsu.

Kleiner Perkins is perhaps the most important venture capitalist on the Internet market, with a record of financing that includes, among others, Netscape, Amazon, AtHome, Excite and many others. Others that can be cited are: Benchmark Capital, with investments in companies like eBay, Ariba and Critical Path, Sequoia Capital that invested in Yahoo, Vulcan Ventures, Idealab and Softbank and few more worth mentioning.

These venture capitalists (VC's), however, do not work alone. While they specialize in identifying the firms with highest potential and helping them developing their strategies, they have to resort to different specialists when the time is come to bring the new born to the market. Goldman Sachs and Morgan Stanley Dean Witter are the top investment banks to back and advise the best Web companies that want to go

public. Just behind them is Credit Suisse First Boston and, as the best "technology" financial boutique Hambrecht & Quist.

The role of venture capitalists in financing the Internet firms has been critical for more than one reason. First, VC's have played a broad function for "picking the winners". This has been achieved by actively searching for ideas and companies with the highest potential, by investing in networks and strategic partnerships, and by developing imaginative ways to combine venture capital with different and new forms of financing.

The main indicator of success in these different strategies is the exit of the IPO's. Some of the most spectacular deals occurred in the summer of 1999. For example, Benchmark Capital , one of the leading VCs based in Menlo Park, California, in 1999 scored two peaks: Red Hat, whose IPO in August offered shares at $14 and closed its first day of trading at $52.06 a share, and Ariba, which in June offered 5 million shares at $23 each and saw them close at $90 the same day. In July, the public sale of Net2Phone shares, handled by H&Q, from an offering price of $15 a share scored $26.50 on the first day of trading, with shares soaring afterwards as high as $92.63. handled. In June and July, juniper Networks and Drugstore.com, both backed by Kleiner, respectively soared from a $34 opening price to $98.88 at the close of the day; and from $18 per share to $50.25 at the close of the first day of trading.

More successes and special deals followed through the rest of 1999 and the first part of 2000. At the end of this year, and in the first three months of 2001, however, the bubble burst, with Internet stock prices falling at rates and speed which were almost as spectacular as the earlier rise. Much of this fall was due to the growing evidence of companies under-performing in terms of growth and revenues with respect to investors' expectations. Financing appears to have played a role, however, since the earlier euphoria had been based on the belief that companies might almost do away with credit financing. As the price of the stocks fell, Internet companies found that they had very hard time in obtaining credit from ordinary credit sources. Extraordinary sources, such as corporate bonds and other market-linked deals were precluded by the loss of reputation created by the revenue warnings and the fall in the prices of their previously overvalued stock. A significant part of earlier financing, on the other hand, had been obtained through convertible bonds and other types of options, which, once left

unexercised by investors, turned into further loads for their income accounts and balance sheets.

5. Government policies

5.1 Principles of Government support

Partly through the credit system, partly through subsidies and direct interventions, Governments attempt to support technological innovation through several policy instruments. These may be grouped into three main categories [52]:

a) direct support;

b) indirect support;

c) support of research structures.

In the first group we can comprise: 1) non selective incentives through subsidized credit; 2) the selective incentives in special sectors or technologies and in particular areas or enterprises through credit and capital subsidies; 3) the public purchase of technology services. Among the instruments of indirect support, on the other hand, we find: 1) fiscal incentives; 2) patents and protection of intellectual property rights; 3) technical and organizational advise and assistance. Finally, intervention on research structures include the support of a network of national R&D institutions, the setting up and the financing of grants for research and development, and other policies to promote and support research centers.

From the point of view of their *modus operandi*, support policies may be classified into three different categories:

a) *financial policies*: i.e. the financing or the co-financing of R&D expenses, acquisition of innovative machinery, introducing innovative processes;

b) *innovation services*: i.e. direct interventions to assist or advise the firms in the adoption of innovative processes, or the planning of innovative strategies;

c) *network creation strategies*: i.e. developing services to support the creation of networks of enterprises to share communication, information and stimulate the dialogue on new technologies.

The analysis of the innovation policies utilized by the European industrial countries reveals two different approaches: Italy and Great Britain on one hand, who

have for long time favored policies of financial incentives, and France and Germany on the other hand, who have given much more emphasis to innovation networks.

In this respect, the French structure is notable, since the network service model dominates local and central agencies. The national structure is organized as a central agency called ANVAR (Agence Nationale de Valorization de la Recherche) and local agencies denominated CRITT (Centre Regionale d'Innovation e transferiment de technologies) and Technological Parks.

ANVAR supplies existent and new enterprises with technological know how. In particular, ANVAR provides assistance in elaborating business plans and evaluation for innovative technologies, it develops research activities and helps arranging special loans credit for the development of process and product innovation. These loans are granted without interest and are re-payd only in case of commercial success of the innovation. The role of ANVAR is thus to reduce the financial risk of the innovation project, by making the relation between risk and return more favorable to the SME.

The local agencies, called CRITT, are organisms participated by the State, the local governments and the enterprise associations. They usually specialize on given sectors, and operate mainly to favor the linkage between research centers and enterprises. Their greatest resource is a wide data base, containing all the characteristics and technological needs of the firms, the research projects under way and the products developed by the research centers. This data base, which is updated every six months through direct surveys and visits of specialists, is a key factor in establishing contact between demand and supply of innovation.

A networking role is finally played by the Technology Parks. These are areas where different subjects, such as universities, research centers, financial agencies of various sorts, firms, public bodies, meet to promote and coordinate the development and diffusion of technological innovation.

Unlike the French case, the financial approach is the main emphasis of British innovation support policies. In Great Britain, in addition to several financial programs through the government agencies and the commercial banking system, the main operator for the broader support of innovation is a non profit entity, denominated PERA (Production Engineering Research Association). This entity supplies services in the

different area of relevance for the development and the adoption of new technology (research, development, consulting services, information and training).

5.2 The experience of science and technology parks

The experience of the science and technology parks (STP) originated in The United States in the 50's, the first example being the structure realized in Stanford (California) in an originally unused area owned by the university. In response to a policy of open access on the part of the university, enterprises started by ex students or professors were located in the area. As an out-fall of that experience, in the early 70's, the so called Silicon Valley emerged, as a concentrated of enterprises, university and research centers, unique in the world for the sheer size of the phenomenon, in terms of quantity and quality, and for its capacity to attract new research and production forces.

The concept of STP has been followed by several countries and has been adapted to the needs and the characteristics of the reference area, giving rise to many structures. These were often very different from each other, in terms of organization, instruments utilized and operational strategies. While they all share the goal to encourage and facilitate the processes of innovation and technological transfer, their development has caused an intensive activity of analysis of the alternative models emerged, with the intent of discovering the most successful patterns of organization.

The OECDE defines STP's as "territorial concentrations including contiguous areas where technology related activities are carried out, such as research, development, protype production, jointly with all direct support services". According to an alternative definition, due to Rowe, an STP is an initiative of tertiary development that:

a) has formal and operational linkages with a university, an institute of high level education or an important research center;

b) is designed to promote the creation and the growth of productive activities and organizations, normally localized in the area, based on knowledge;

c) benefits of a management function actively engaged in the transfer of technology and management capacities needed for local enterprises.

The European Union, on its part, has tried to generate an official classification of the various bodies sharing the goal of research and technology transfer, by focusing on their core business. The following subspecies have thus been identified[5]:

a) the *Science Park* is generally located in a University campus and essentially specializes in activities of research, development , product design and development of prototypes. In such a structure only rarely the production and marketing phases appear;

b) the *Research Park* is also located in a University campus, but is characterized for the absolute commitment to research and the exclusion of any production related activity;

c) the *Technology Park* is composed of enterprises engaged in the commercial application of advanced technology. It is committed to activities of research, development, and production, marketing and technical assistance. The production activity is thus primarily important, while the presence of the University is not essential;

d) the *Innovation Center*, through financial, technical and administrative assistance, promotes the creation of advanced technology SMEs;

e) the *Business Park,* which does not require the presence of a university, is engaged in producing, assembling, selling and managing activities, with the goal of creating a high quality environment for enterprise creation and growth;

f) the *Business Incubation Center (BIC)* is a center housing, in a limited space, new enterprises. It offers them material (physical space, common facilities, network resources) and immaterial infrastructure (technical services, marketing support, management advise, financial counseling).

STPs historical origin is also very diverse. In the USA, in fact, the main technology parks (*Stanford Research Park*, California, *Silicon Valley*, California, *Research Triangle Park*, North Carolina and *Route 128*, Boston, Massachusetts) originated in the 50's from private business ventures. In Europe, instead, the public sector has been in the forefront. In Great Britain the most important parks (the *Aston Science Park* in Birmingham, the *Cambridge Science Park* in Cambridge, the *Heriot-Watt University Research Park* in Edinburgh) were created by a public policy that encouraged the enterprises, through financial subsidies, to start R&D activities in the high technology sectors. A characteristic of British parks, which distinguishes them from other European parks, is the active presence of financial institutions, such as the

Lloyds Bank and the Barklay Bank. These institutions have granted credit to R&D operations, on the basis of criteria that differ from those generally applied for other business loans. These criteria take into account the higher risk and longer pay out period of research ventures.

6. Conclusions

Financing technology poses a special challenge to economic institutions for several reasons. First, the uncertainty surrounding all the investment decisions is particularly acute and pervasive in the case of R&D, as well as developing and testing process and product innovation. Greater uncertainty spurs more highly asymmetric information on both sides of the financial deal, thus rendering contracts more difficult to negotiate, enforce and take successfully to completion. Further problems arise from lack of credit history for innovators, weak property rights and difficulty of supervising and monitoring increasingly intangible technologies.

Secondly, while the banks appear to have an important role to play, for many types of innovative businesses, they cannot be the sole source of financing. Indeed, in all advanced countries, regardless of the prevalence of the banking or the equity markets in their tradition, several operators have evolved that specialize in providing risk capital, combined with management skills and financial advise, to start ups and high tech ventures. Among these operators venture capitalists and business angels figure prominently and, unlike banks, do not approach financing with their "hands off", but rather with "hands on " and "gloves off". They appear to be a critical element of success in the difficult and risky enterprise of recovering and providing fresh resources to finance innovation.

Thirdly, technology ventures appear to face a basic trade off between profit and growth, which may be exacerbated by a difficult relationship with a credit institution. For this reason, combined with the harder rationing of credit on the part of the bank, innovators generally prefer to invert the traditional order of financing sources. They thus favor resorting to equity over debt financing, even though this may involve loss of control or, at the very least, heavy interference in managing the firm on the part of outside financiers. It is indicative, in this respect, that most of new capital in the US equity market has come in recent years in technology stocks. In this framework, the

financing of Internet firms, at least in the first, most euphoric phase of growth of the NASDAQ, has been accomplished with risk capital and only a minimum resort to debt.

On the other hand, the high tech financing story is still unfolding and it is difficult to predict its end. The most recent fall in equity values of technology stocks has brought traditional debt on the forefront again, but imaginative financial innovation may be needed to savage the "new economy".

Fourtly, the US market still appears to be leading as a financial center capable to provide imaginative solutions to provide funds to start ups and innovation. These solutions are being adopted by all countries in the world both because they are effective and because, in a context of globalized financial markets, the leading country is rightly or wrongly regarded as an example of best practices. Even in the USA, however, financing technology poses dificult problems in terms of adequacy and diversification of supply. Traditional credit problems such as adverse selection and agency costs appear magnified and recurrent crises spurred by financial bubbles and over-inventive intermediaries also seem to be endemic. While equity financing certainly holds the bigger promise for high technology and new products, its incarnation for small business and start ups still leaves much to be desired.

What are the conditions of the Arab countries in this context of development, difficulty and partial disarray? On the one hand, because of the traditional Islamic attitude towards interest bearing credit, debt financing was not, to begin with, popular with them even when few alternatives were available. Profit and loss sharing (PLS) does provide an alternative which may be attractive, in addition to its ethical features, because it may be free from some of the distortions that prevent traditional banking from providing efficient financing to innovative business ventures. On the other hand, while Islamic banking remains an interesting challenge, neither its variations, nor traditional banking appear todate to give adequate support to enterprise creation and technology investment. Capital markets, even though very unequally developed in different countries and often handicapped by government intrusiveness, seem to be more promising. Establishing the economic and the legal framework to develop these markets, however, does involve a fully functioning financial system, with an autonomous central bank and commercial banks and industrial business in the hands of the private sector.

From a policy point of view, it is important to enphasize that the hystorical experience shows that a market system requires a critical mass of financial institutions and that a certain degree of diversification and specialization is not only desirable, but, probably, necessary. Large monopolistic institutions, that derive their power to collect funds from a publicly endowed position in the national welfare system may be a drag on financial markets and an obstacle at developing the critical number of actors needed to put in motion the economy. Barriers to risk taking in the form of norms and regulations to maintain a minimum degree of asset liquidity may be justified for lenders of last resort, but act as disincentives to innovative business when they are applied to banks or pension funds. Similar stifling effects derive from forcing holdings of government paper on a less than autonomous central bank and the related banking system.

Does the government have a role in this respect, in addition to the obvious one of engineering the reforms, privatizing and liberalizing the economy and providing those "market friendly " policies that should help the economy to find its new course? The experience of developed countries shows that technology is perhaps the one sector where the government may exercise, without fear of going wrong in a major way, imaginative policies to promote and support innovation. While it is hard to draw a final account, the experience of government support of R&D, for example, has produced a number of centers of excellence, valuable technology transfers, active financing, and a series of structured interventions that appear, by and large, both successful and promising.

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Notes

[1] Two classes of models refer to asymmetric information to justify credit rationing. They can be represented by the model, respectively, of Jaffee and Russel [32] and of Stiglitz and Weiss [55].
[2] See Kletzer [34]; Stiglitz and Weiss [56].
[3] Berger and Udell [12], from SBIC data.
[4] See Nida ' ul Islam Magazine (1995).
[5] See UN Official Bulletin NC 186/51 printed in July 27th 1990.