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Venture capital and innovation in Latin America

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One of the drivers of economic growth is innovation, which raises productivity by creating new production methods, technologies, products and firms. This article examines an instrument that supports this process, venture capital, and highlights the need for a financing system covering each phase of innovation. It starts by illustrating Latin America's innovation deficit. It then proceeds to a general analysis of the difficulties affecting the financing of innovation and the provision of venture capital to overcome these. It goes on to examine the form taken by these obstacles in the region and, considering the experience of Brazil and Chile, the methods used to deal with them. In relation to a number of the subjects addressed, the article discusses issues connected with major problems of financial system development.

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I

Introduction

Changing production patterns are at the same time one of the most obvious manifestations and one of the determinants of economic growth. As a number of authors have pointed out, growth does not occur evenly between one sector and another or within sectors. Instead, it arises in conjunction with –and is caused by– new technologies, products and firms, while activities that lose competitiveness as a result of these advances disappear or languish. According to this view of the matter, innovation –broadly defined as the introduction of new ways of doing things, including new organizational structures and new products and processes– is one of the driving forces of growth. For innovating agents, it translates into opportunities to produce more efficiently, increase production capacity, raise market share or create wholly new markets and/or market segments by introducing new products. The effect of this process on growth will depend, among other things, on the intensity of the learning experience triggered by innovations, the extent to which these spread to other sectors and the depth of the production complementarity relationships between innovating agents and the rest of the production system (Ocampo, 2005; Ocampo and Martín, 2003).

Properly quantifying innovation and its results is not easy, as the latter often take the form of organizational changes or are intangible. It is therefore necessary to resort to indirect indicators of innovation effort; these usually include investment in research and development (R&D) and the public and private resources put into innovative firms or programmes.

The available statistics show that, in comparison with advanced economies and newly industrialized Asian economies, the region has a large R&D deficit. As figure 1 shows, investment in R&D is very low in most of the economies included and there were no significant increases between the two periods considered. Brazil has the highest levels of R&D investment in the region, well ahead of the countries that follow it in the ranking: Chile, Argentina and Mexico. At the global level, China and India have made major efforts to increase investment in R&D.

In the advanced countries, an average of over 60% of R&D investment is carried out by private

firms. In the Latin American countries for which information is available, most R&D investment is carried out or financed by governments and universities, with firms making a lesser contribution (OECD, 2007).¹ This indicates that firms in these countries have made little use of innovation strategies to raise their competitiveness vis-à-vis the rest of the world, and also that the economic structure there is less complex than in the advanced economies.

Broadly speaking, many innovations take place within existing firms. Furthermore, many firms, particularly large ones, have specialized departments permanently engaged in exploring new ideas and ways of applying them to production processes, marketing strategies or new or existing commercial products. The resulting expenditure or investment forms part of the development plans of these firms which, among other things, have to secure the necessary financing. At the same time, many innovations lead to the creation of new firms, either because existing firms or their employees decide to create a separate venture to develop innovations externally, bearing in mind the risk and expected return, or because innovations are the outcome of initiatives by independent agents. In these latter two cases, one of the conditions for turning an innovative idea into a marketable product, and thereby generating the positive effects on growth referred to above, is the provision of financing with the characteristics needed to overcome the obstacles standing in the way of support for innovation.

In the following pages, section II of this article conducts a general analysis of the challenges facing innovation financing. Section III deals with venture capital as an innovation financing instrument.² Section IV more specifically examines the obstacles to the development of venture capital in the region.

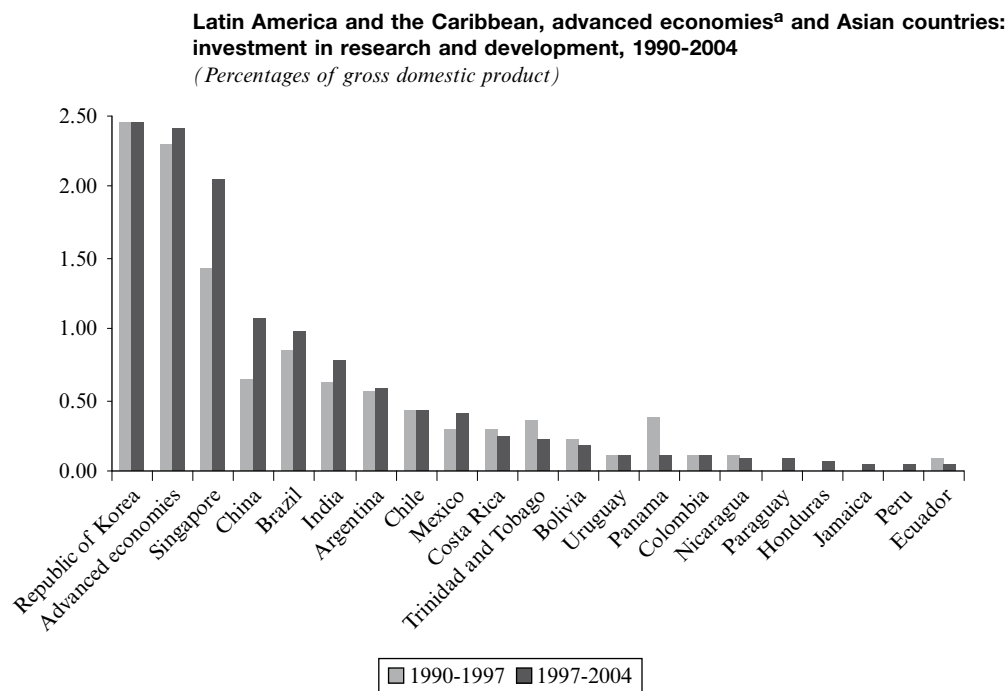
¹ According to the OECD, the share of companies in R&D investment in Chile is just over 40%, probably because of the investment carried out by the National Copper Corporation of Chile (CODELCO) and the National Petroleum Corporation (ENAP), two public-sector firms that by their nature have a substantial research budget available.

² See Jiménez (2006) for an analysis of the characteristics of other financial and tax instruments used to support innovation in developed countries.

Section V reviews the experience of Brazil and Chile in implementing financing of this kind, given that they

are the region's two most advanced countries in this area. Section VI, lastly, sets forth some conclusions.

FIGURE 1



Source: prepared by the author using data from the Ibero American Network of Science and Technology Indicators (RICYT) and World Development Indicators.

^a The advanced economies are 22 OECD member economies.

II

Difficulties affecting the financing of innovative initiatives and firms

From the financing standpoint, the experience of countries that have used innovation to raise their productivity suggests that supporting innovation requires the construction of a system capable of dealing with the specific obstacles to financing at each stage in the process.³ This reference to a

“system” does not necessarily imply an organic body or bodies under the control of a public-sector agency, or obedience to government policy guidelines. What is being emphasized, rather, is that all the links in this system are necessary to achieve the desired end. Table 1 analyses the different phases of the

³ This article focuses on the financial factors behind the transformation of an idea into a marketable product and examines how venture capital is particularly suited to the task of supporting innovation. There are other factors, such as the existence of an innovative environment and the availability

of human capital and research-oriented institutions, that will determine the success of efforts to innovate and to develop the venture capital system. These aspects are discussed in Avnimelech and Teubal (2004) and Jiménez (2006).

innovation implementation process, its financing needs and some types of stimulus and support.

The division into phases in the table is intended more for analytical purposes than as a realistic description of the innovation process. While there is a certain order of precedence, it is not one-directional; it is common, for example, for changes to be made to the original designs at the marketing and/or production stage, particularly in the case of firms that are constantly innovating and can thus be at all three stages at once. The table also illustrates the financing needs of an innovation that translates into a marketable product. Many innovations are organizational or commercial in nature and serve to increase productivity, but without necessarily resulting in new products.

The early stages of the innovation process are generally R&D-intensive and their results are

characterized by a high degree of uncertainty and by externalities that make them difficult to appropriate. For the potential financier, therefore, the likelihood of failure is high, while the chances of repayment under guarantees based on future revenue flows are small. Furthermore, there have to be large investments in some cases to create the infrastructure needed to experiment with new products and processes.

Then when it comes to organizing production and expanding it to commercial proportions, there are usually problems of information asymmetry between entrepreneurs and financiers, conflicts of interest and moral hazard, all factors that increase the cost of participating in the financing of innovative activities.

Information asymmetry exists if financiers (or venture capitalists, as they will be called from

TABLE 1

Innovation financing needs at the different phases of implementation

Innovation implementation phase	Main obstacles affecting financing	Type of financing required	Other stimuli required to overcome obstacles	Further support
Research, conceptual engineering and preparation of prototypes.	High level of uncertainty. Difficulty capitalizing on externalities. The intangible nature of innovations restricts their use as collateral.	Seed capital.	Non-reimbursable financial contributions for R&D projects.	Interaction of institutional R&D bodies (universities, research centres) with firms with a view to creating commercially viable innovations. Creation of networks of "angel" investors. Business incubators.
Preparation of business plans, detail engineering, organization of production and start of commercial production.	Information asymmetries. Lack of payment track record. Lack of collateral.	Provision of capital to establish initial production capacity. Working capital (banks and suppliers) to begin production.	Non-reimbursable contributions to prepare business and engineering plans and support R&D. Preferential credit facilities, support via credit guarantee systems.	Progress with venture capital provision mechanisms.
Equilibrium point reached. Production expanded with rates of return that make the business financially viable.	Information asymmetry and moral hazard. Agency problems and conflicts of interest: insider trading, related party transactions, prolongation of unprofitable projects.	Capital investment for expansion. Working capital.	Continuing R&D support. Capital gains tax exemptions. Continuing support for credit provision by means of guarantee mechanisms and preferential access facilities.	Regulations to allow investment funds to hold minority equity stakes. Legislation regulating the solution of conflicts of interest. Legal framework that does not penalize bankruptcy and that expedites the solution of critical situations.

Source: prepared by the author.

now on) do not have adequate knowledge of the nature of the activity they are backing and cannot easily obtain and process information about the way the business is being run. These asymmetries are particularly acute in the case of technological innovations, since such innovations usually have highly specialized characteristics. Conflicts of interest arise, meanwhile, when entrepreneurs are in a position to take decisions that favour them over other stakeholders. For example, if they find they are in possession of insider information or in a position to abuse their power, they may have an incentive to carry out transactions that are particularly favourable to them or to extend the life of a project for longer than is economically justifiable. Moral hazard, lastly, derives from the difficulty of predicting the future payment behaviour of entrepreneurs, particularly since under certain conditions (time inconsistency of decisions) they may be tempted to change their payment behaviour once they have secured the funding.

Under these circumstances, the amount of financing available for innovative ventures will be

small and probably of the wrong type, and the amount of innovation it generates will be suboptimal; given these problems, and the prevalence of bank financing in the region, innovative firms that have collateral available might resort to borrowing. But dealing with information asymmetries in innovative ventures means incurring the cost of risk assessment for highly specialized activities, and this could substantially raise the cost of financing provided by commercial banks, which do not usually have any special expertise when it comes to appraising activities of this type.

Again, while there is a place for bank financing, the nature of innovative projects (which do not usually begin generating returns for a long time) and the risk levels involved in the creation of a new product or process mean there is a preference for long-term funding and equity investments. Venture capital, whose main characteristics are described in the following section, is a system of organization and financing that aims to provide innovative firms with capital while solving the problems of information asymmetry and moral hazard.

III

Venture capital as an innovation financing instrument

After a number of designs had been tried out, the corporate structure known as the limited partnership, introduced in the United States to provide innovative firms with venture capital, has been increasingly adopted by different countries, with some variations. Its general features are described below.

1. The structure of venture capital

The core of the system is the venture capital partnership (VCP), which uses capital investment commitments by third parties to create multiple separately capitalized investment funds, each of which invests in several ventures. Each fund is administered by a general partner or administrator who invests capital on behalf of the VCP and has decision-making powers over the management of the different projects, playing an active role

in their administration in collaboration with the entrepreneurs responsible for the innovation.

The general partner or administrator is someone who has experience in organizing businesses and possesses the specialist knowledge needed to understand the content and quality of innovative projects and participate in their management.

Other venture capitalists (private individuals or institutional investment funds) also contribute to the fund as limited partners. While they follow the businesses concerned closely, they do not usually involve themselves directly in their management.

The VCP arranges capital investment pledges for each fund, which are drawn down as projects proceed. Each fund has a fixed lifetime, after which it must be wound up and the equity holdings distributed among the investors and the entrepreneur to be sold on to third parties so that the gain or loss

on the original investment is realized. Instead of proceeding to sell off the equity stakes, the fund may extend its life and continue with the projects, but this requires a new round of investment pledges.

This arrangement is designed to deal with the problems of information asymmetry and moral hazard in three ways. First, the operational project involvement of an administrator who specializes in the innovation area concerned and has experience with business start-ups reduces information costs and the risk that the innovator will use the financing provided for his own benefit, i.e., “agency problems” are reduced. Second, the fact that returns are realized via the distribution of equity stakes means that investors’ and entrepreneurs’ incentives are aligned, as both will wish to maximize the economic value of the project in which they will receive stakes. Lastly, the requirement to wind up the fund on a predetermined date forces the general partner/administrator to show a good performance if he means to continue with the project or finance new ones.

Furthermore, the fact that VCPs have experience with business start-ups (particularly when it comes to turning new technologies into marketable products) and participate in technology creation and dissemination networks means that they are able to assist with the development of the new venture, help draw up its business plans and provide backing for the launch and consolidation of production and marketing activities. If the venture is successful, they will then be in a position once some time has passed to realize large returns by selling equity stakes.

2. Exit mechanisms

Returns on investment are realized when equity stakes are sold, which means that the exit mechanisms available, the price formation process for illiquid assets, the effects of capital gains taxation and the means used to ensure the necessary secondary liquidity all become key factors.

It needs to be understood that this method of establishing returns on the funds invested does have some problems, particularly as regards the corporate governance of a VCP. Since it is very hard to mark an illiquid portfolio of innovative projects to market, fund partners who are not administrators are at something of a disadvantage in their dealings with the administrator and entrepreneur, as these may keep a project’s valuation artificially high in order

to continue receiving the funding previously agreed upon, rather than admitting to losses. This would help to explain the great variability in the amount of funding intermediated by VCPs in recent years and would appear to be behind the substantial overinvestment in “dot.com” firms in the United States and their subsequent collapse around the year 2000. The search for a solution to this problem continues. In practice, the result has been that many VCPs have disappeared and the industry has consolidated around those with more experience of setting up businesses and a greater capacity to develop advanced technology projects.

Generically, exit mechanisms are as follows: (i) an initial public offering (IPO) in formal public markets or informal private markets, (ii) the sale of the new business to another firm, and (iii) a buyout of the business by the innovating entrepreneur himself.

The natural institutional complement to the development of the venture capital industry is the existence of public and private markets that facilitate the realization of capital gains. Given the boom in this industry, some governments have tried to make it easier for innovative firms to access capital resources, in the knowledge that formal public markets impose regulatory requirements which obstruct such access, and have encouraged the creation of specialist markets for this purpose. Examples of this are NASDAQ in the United States, the AIM in the United Kingdom, the Neue Markt in Germany and the Nouveau Marché in France, among others. Given the difficulties involved in creating these specialized bourses, efforts have also been made to facilitate corporate mergers and acquisitions through private equity markets. In the region, Brazil and Chile have carried out reforms that have led to better exit conditions for venture capitalists, and these will be examined further on.

It is not necessary for these specialized markets to be located in the same country as the venture capital investment, but it is essential for there to be the possibility of access to an appropriate external market. In the case of the Israeli venture capital industry, access to NASDAQ played a key role as an exit mechanism. The greater regulatory requirements resulting from application of the Sarbanes-Oxley Act in the United States have now led to the London AIM gaining in importance as a market for emerging company share offerings.

IV

Obstacles affecting venture capital in the region

In a number of the region's countries, there has been an upsurge of interest in the establishment of venture capital as an instrument for supporting new ventures, particularly more innovative ones. In Argentina, Brazil, Chile, Colombia, Mexico and Peru some degree of progress has already been made with financing of this kind and in some cases an initial or intermediate phase of development has been reached. In most of the countries, however, it is embryonic and numerous obstacles will have to be overcome before it can prosper.

Different analyses of the conditions for creating venture capital in the region's countries⁴ have identified what are considered to be the most serious problems.

Where policies and institutions are concerned, the main difficulties stem from the following:

(i) *Inadequate development of support mechanisms for the precompetitive stage.* Few countries have the institutions and instruments needed to turn ideas and projects into marketable products, business plans and new enterprises. The number of business incubators is still small and networks of innovative entrepreneurs and seed capital investors are only beginning to take shape. With some exceptions, public programmes to support enterprise and innovation are of very recent date. As a result, the flow of new projects leading to demand for venture capital is still small.

(ii) *Inadequate corporate governance standards and practices that discourage the involvement of minority partners in new ventures.* Rules on disclosure, related party transactions, insider trading and the distribution of buyout or takeover premiums, among other things, do not do enough to safeguard the rights of minority shareholders, which is what venture capitalists usually are. This is compounded in some cases by provisions outlawing covenants

between shareholders or voting agreements and/or lack of provision in legislation for the legal vehicle (or corporate structure) normally used to organize VCPs. Furthermore, institutional mechanisms for resolving disputes between shareholders, or between these and the company, are slow and in many cases not equipped to cope with the highly technical nature of these disagreements.

(iii) *The difficulty of estimating expected project returns.* A lack of uniformity in accounting practices is compounded by incompatibility with international standards. There is uncertainty about the valuation of contingent liabilities (relating to tax, labour and the environment) because of the possibility of changes in rules and standards. In some cases, rulings on such liabilities by the supervisory authority are not even final and are subject to retroactive revision.

(iv) *Double taxation of fund revenues.* Because venture capital funds, both for risk control and absorption and for the administration of the projects they invest in, act as an intermediate vehicle between investors and entrepreneurs, the tax system needs to allow for the possibility of taxation pass-through. This is not always the case, so that income may be taxed both when received by the fund and when paid out to the final recipient.

(v) *Prohibitions and limitations on involvement in certain businesses.* The legacy of earlier experiences and the history of the countries have led in some cases to limitations on State involvement in the productive economy and in others to prohibitions and constraints on the involvement of foreigners in certain industries. While there are reasons for these restrictions, their consequences are manifested in a lessening of the availability of State support instruments, even though international experience indicates that these are important catalysts, and in restricted access to the know-how and market contacts offered by foreign investors, another factor that has been crucial to the success of venture capital outside the region.

(vi) *Regulations limiting banks' equity holdings.* Although banks are some of the main providers

⁴ See Charvel, Gonzales and Olivas (2006), Córdova (2005), Echeopar, Angelelli and others (2006), Jiménez (2006), Kappaz, O'Hare and McNeece (2003), Kappaz (2005), Morrison and Foerster (2000), Nacional Financiera (2005), Choce and Atienza (2006), Superintendencia de Valores y Seguros de Chile (2002), Wallack (2005) and Zervos (2004).

of financing, there are also constraints on their participation in venture capital. These are mainly due to the adoption of a specialized banking model that seeks to limit the risks and conflicts of interest which can arise when a bank is at the same time an owner and a creditor of a particular firm by prohibiting banks from holding direct ownership stakes in companies. This is not the case in countries where a universal banking model prevails, and where these problems are kept at bay by imposing limits on the percentage of firms' equity banks may hold and the amounts they may lend to them. It has been suggested that adopting measures of this kind might facilitate the involvement of specialized banks in venture capital.

Among the features of market structure that hold back the development of venture capital are the following:

(i) *Fledgling entrepreneurial culture and traditional corporate ownership structure.* Many entrepreneurs and small businesses with growth potential do not fully appreciate the contribution that could be made by a partner in terms of managerial expertise and access to new technologies and markets. They prefer not to open up the capital structure, either for reasons of family tradition or because they wish to retain 100% control and not share the running of their businesses with outside partners. On top of this, they appear to be reluctant to provide proper disclosure of the results of their businesses and their real financial and asset position (particularly where financial and tax liabilities are concerned). As already indicated, involvement in management and access to reliable information on the quality of a firm and its business plans are essential conditions for venture capital to work.

(ii) *Lack of venture capitalists and old-fashioned attitudes to risk.* Few people have developed the skills needed to identify, select and administer innovative high-risk ventures. Those with the resources available prefer safer investments. This could be due in part to a legal environment that punishes failure (bankruptcy laws, for example) and to an approach to financial activity that sees taking and administering risks as a spurious, almost illicit road to wealth rather than as a value-creating activity. This attitude is not confined to the private sector. By way of example, the use of modern risk control instruments (such as derivatives) by public-sector enterprises and institutions and the use of public resources in risky undertakings (like supporting new ventures) is generally resisted

by policymakers and legislators. Underlying this is an outlook that does not acknowledge the inherent uncertainty of economic activity and interprets an adverse result solely as the outcome of poor decision-making or fraud.

(iii) *Lack of involvement by institutional investors.* As reforms resulting in the creation of pension funds and other institutional saving mechanisms have produced their full effect, the potential of these institutions to finance investment has become apparent. For reasons peculiar to the transition from an unfunded regime to one of private saving, however, the range of eligible investments was initially restricted, with less risky ones being favoured. These restrictions have gradually been lifted, but the share of venture capital investment coming from pension funds is still low as a proportion of their accumulated resources, even if in certain cases it may be significant as a proportion of venture capital funds' total resources. Consequently, there is great potential to channel more resources into venture capital, but it is necessary for institutional investors to be better informed about the characteristics and risks of the asset class this capital represents. It is also necessary for legislators, regulators and the public at large to have a better understanding of risk management; in particular, they need to realize that the contribution made by a particular project to overall portfolio risk depends not just on its actual risk level, but ultimately on the way this correlates with the risk represented by the other assets in the portfolio.⁵

(iv) *Small size of the market for innovative ventures.* The scarcity of innovative new projects offering adequate returns translates, for investors, into reduced scope for risk diversification and, for VCPs, into difficulties in affording the administration costs of a small portfolio. Another factor here is the small size of some economies, which may mean less wealth and less complex production activities.

(v) *Underdeveloped capital markets and illiquid exit mechanisms for venture capitalists.* Underdeveloped capital markets provide less scope for exit strategies involving the stock market, owing to high issuance costs and a lack of liquidity mechanisms for smaller firms and/or those without a track record. At the same time, private equity

⁵ The strong growth in the proportion of venture capital financed by pension funds in the United States is put down to the efforts of their regulator to clarify this point.

markets are underdeveloped, which restricts the scope for realizing returns on venture capital investments and thus reduces the incentive to participate.

Lastly, economic growth is another of the ambient conditions that appear to influence the emergence of venture capital, which would be more likely to prosper if new businesses were constantly appearing—a situation that generally only arises under conditions of steady growth. Consequently, the repeated experience of slow and unstable growth

in the region can hardly have been conducive to the emergence of financing of this type.

Recognizing the impact of these factors and the importance of stimulating innovation and new business creation to boost economic growth and competitiveness, a number of countries have undertaken reforms to remove the obstacles to the development of venture capital. They include Brazil and Chile, whose progress in this area is reviewed in the following section.

V

Progress with venture capital for innovation financing in Brazil and Chile

According to a recent comparative study, Brazil and Chile are the two countries in the region today that have made the greatest progress in creating favourable conditions for this industry.⁶ That study analyses 13 aspects of critical importance for venture capital in 11 Latin American and Caribbean countries and compares them with findings for four countries outside the region where this system of financing is highly developed.⁷ Brazil and Chile score close to, and in some cases as well as, the benchmark countries in the five most important aspects. These are: (i) tax treatment, (ii) protection for minority shareholders' rights, (iii) the removal of restrictions on the participation of institutional investors, (iv) capital market development and the practicability of exit strategies and (v) corporate governance requirements.

1. Progress in Brazil

As noted earlier, a number of indicators show that Brazil is the country making the greatest innovation effort in the region. Three key aspects of the Brazilian

experience have been: the recent law on innovation,⁸ intended to encourage this and enhance public-private interaction; the support programmes operated by the National Bank for Economic and Social Development (BNDES) and the Finance Company for the Study of Programmes and Projects (FINEP), including one oriented towards venture capital; and the creation by the São Paulo Stock Exchange (BOVESPA) of favourable conditions for minority equity holdings. This last measure in itself represents an important innovation for the development of capital markets in the region, over and above the financing of innovative initiatives.

Brazil's innovation law foment commercial interaction between public- and private-sector innovation bodies. Thus, it allows public-sector science and technology institutions⁹ to establish strategic alliances and sign contracts with private-sector firms and non-profit organizations governed by private law to carry out R&D activities aimed at creating innovative products and processes. To the same end, it empowers the public sector and its authorized agencies to take minority equity stakes in private-sector firms whose specific purpose is to devise science and technology projects with a view to creating innovative products and processes.

⁶ This section is based on information and figures presented in detail in Jiménez (2007).

⁷ See Economist Intelligence Unit (2005). The countries from the region that were included were Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Jamaica, Mexico, Peru, Trinidad and Tobago and Uruguay. The economies taken as benchmarks were Israel, Spain, Taiwan Province of China and the United Kingdom.

⁸ Law 10973 of 2 December 2004, implemented in 2005.

⁹ The innovation law defines science and technology institutions as governmental bodies or organizations whose institutional mission includes the carrying out of basic and applied research of a scientific or technological character.

Intellectual property rights over the end product are proportional to the equity holding.

It also encourages the participation of science and technology institutions in the innovation process by means of provisions allowing these institutions and those of their staff who participate in innovation processes to receive some financial reward. Thus, public-sector science and technology institutions may enter into technology transfer and licensing rights for the technologies they create and may provide R&D services to private-sector firms.

As can be seen, the thinking behind this law is markedly at odds with approaches circumscribing the role of the State in the productive economy to one of regulation and supervision and the correction of static market failures.

For their part, BNDES and FINEP operate support programmes for innovative firms, particularly those of a technological character, using traditional instruments such as subsidies and preferential credit facilities, but also equity holdings in innovative firms through VCPs and incubation programmes for such companies.

Financing comes from their own resources and from budget revenues. The latter include those raised by specific taxes or royalties applied to different industries, giving rise to 16 sectoral funds whose implementing agency is FINEP. By 2006, almost US\$ 600 million

had been drawn down from these funds for science and technology investment. As of 2004, meanwhile, venture capital funds had committed US\$ 5.58 billion, mostly for start-ups. Over 50% of the firms in the portfolios of these funds belonged to sectors in which emerging companies are usually based on new technologies¹⁰ (table 2).

Since December 2000, the stock market has undergone radical changes which, while not explicitly designed to support venture capital investment, in practice have given them a boost which could have the effect of consolidating this method of financing innovation and entrepreneurship. The changes introduced are meant to address the main factors discouraging minority investors (particularly foreign ones) from holding equity in companies.

In December 2000, BOVESPA introduced three new company listing segments, with requirements to which firms can voluntarily conform. The first of these segments is the Novo Mercado, whose standards of governance, transparency and protection for minority partners are more demanding

¹⁰ The following are classed as high-technology sectors: information and communication technologies (ICTs), electronics, industrial products and services, telecommunications, biotechnology, medicine and health care.

TABLE 2

Brazil: distribution of firms in venture capital fund portfolios by industry, December 2004

Sector	Number	%	Sector	Number	%
1. Information and communication technologies (ICTs) and electronics	92	30	7. Biotechnology	10	3
Software	50	16	8. Financial services	10	3
Process outsourcing	14	5	9. Construction/real estate	9	3
Internet	8	3	10. Travel and leisure	9	3
Machinery and equipment	7	2	11. Agribusiness	8	3
2. Industrial products and services	41	13	12. Medicine and health care	8	3
Iron and steel	7	2	Pharmaceutical products	3	1
Machinery and equipment	7	2	Medical and hospital products	2	1
Basic industry	6	2	13. Energy	7	2
Industrial automation	4	1	14. Textiles	7	2
3. Telecommunications	28	9	15. Media	7	2
4. Retail	21	7	16. Distribution and logistics	7	2
5. Food, drink and tobacco	12	4			
6. Transport	11	4	Other sectors	19	6
Air	4	1			
Rail	4	1	<i>Total</i>	<i>306</i>	<i>100</i>

Source: Carvalho, Ribeiro and Furtado, 2006.

than those laid down in legislation and in the rules of the Securities and Exchange Commission (CVM) and are similar to those found in developed-country markets. The other two new market segments (Nível 2 and Nível 1) have less stringent requirements to help firms adapt gradually to the new rules. Subsequently, in the second half of 2006, another new market segment, BOVESPA MAIS, was set up with a view to making the Novo Mercado increasingly accessible to small and medium-sized enterprises.

The Novo Mercado listing rules strengthen the hand of minority shareholders, as they require all shares to carry voting rights and at least 20% of company directors to be independent.¹¹ They prevent controlling shareholdings from being used to extract value from the firm at the expense of minority investors, giving the latter the right to receive the same price for their shares as is raised by the sale of the controlling shareholder's (tag-along right). At the same time, they greatly increase disclosure requirements in relation to the presentation of financial statements, transactions with parties related to the controlling group and insider trading. To prevent the need for long, complex judicial proceedings to resolve shareholders' disputes with the firm or with each other, they require these to be resolved by an arbitration body specially created by BOVESPA. Lastly, they establish a stock market presence requirement to ensure share liquidity and continuous price quotations.¹²

The market's response to these innovations initially fell short of expectations, but the new stock market segments have gradually been increasing their weight, especially since 2004, so that by 2008 the shares quoted on them accounted for some 80% of stock market capitalization and over 60% of daily trading volumes. Furthermore, the indices published by BOVESPA show that price performance has been better in the new segments than in the rest of the market. Thus, the Special Corporate Governance Stock Index (IGC), the index representing the new market segments, rose by 34% more than the IBOVESPA and by as much as the IBrX50 in the period from mid-2001, when the IGC was created, to August 2008. It should be explained that the

IBOVESPA and the IBrX50 are, respectively, the index with the greatest coverage and the one representing the 50 most heavily traded and liquid shares in the market. The dynamism of the new market segments was also expressed in a substantial increase in new share offerings there: whereas only 12 companies used them to begin with, by mid-2008 the number had increased to 161.

Besides the large increase in new issues, the data available show the proportion of share offerings accounted for by firms backed by venture capital, probably via the private equity market method. These account for a significant proportion of all new issuances (table 3). This is a very important symptom, as it shows that the Brazilian system for financing innovation and new business creation has evolved to the point where it covers almost every link in the chain, from early support for seed capital to the development of market mechanisms that provide exit options for venture capitalists, who can thus recommence the cycle of investment and innovation.

Of course, this does not mean there are no failings to be overcome in the way innovative firms are financed. On the whole, the region's countries have not taken on board the lessons learned in developed countries from the failures of major conglomerates and external auditors as a result of laxness in the criteria governing the independence of auditors from the firms they audit. These continuing shortcomings could impair the quality of information about financial statements, thus discouraging minority participation in new ventures.

2. Progress in Chile

A number of indicators show Chile ranking second in the region in terms of innovation effort (figure 1). It lags well behind Brazil in some qualitative aspects, however, and this, combined with the relatively late start it made in providing support for innovation, has meant that it has performed somewhat less well in this area.

Chilean efforts in support of innovation have been divided among numerous public, private and mixed institutions, including universities and firms, which to a large extent have operated independently. Only in 2005 was the Council on Innovation for Competitiveness created as an advisory body reporting to the national presidency with a view to its helping to formulate a strategy. The functions and legal status of the Council have yet to be formally

¹¹ Under Novo Mercado rules, directors are deemed to be independent when they do not have business, family or blood ties with the controlling group or the managers of the firm.

¹² See BOVESPA (2006a, 2006b, 2006c and 2006d) and Santana (2007).

TABLE 3

BOVESPA: initial public offerings on the Novo Mercado, Nivel 1 and Nivel 2
(Millions of dollars and percentages)

	2004	2005	2006	2007 ^a
<i>Total offerings</i>				
Total value of primary and secondary offerings	1 531	2 232	7 052	6 063
Number of offerings	7	9	26	22
Average value of offerings	219	248	271	276
Participation of foreigners (%)	69	62	76	...
<i>Offerings supported by venture capital^b</i>				
Total value of primary and secondary offerings	649	527	1 711	...
Number of offerings	3	3	7	...
Average value of offerings	216	176	244	...
Participation of foreigners (%)	72	81	75	...

Source: prepared by the author from BOVESPA data.

^a Figures as of May 2007.

^b 2006, up to October only.

established by law, so that in practice the situation has not changed much.

More broadly, in Chile there are also public-sector institutions whose mission it is to support innovation, private-sector venture capital funds and an incipient equity market framework which should favour the financing of new ventures, particularly innovative ones. By contrast with the situation in Brazil, there are various obstacles to public-private interaction and some still unresolved deficiencies in the rules governing public companies (*sociedades anónimas*) that discourage minority equity holdings. By way of example, the national Constitution adopted during the military regime limited the powers of the Chilean State to create new companies, so that this requires case-by-case legal authorization from parliament. This makes it difficult for the public and private sectors to jointly found innovative ventures. Furthermore, the current rules for public companies do not give minority shareholders enough protection (over insider trading and related party transactions, for instance); during 2007 and 2008 this gave rise to well-publicized cases in which the supervisor succeeded in penalizing flagrant violations, even though in many cases there are still no penalties. Parliamentary bills designed to solve these problems have been strongly resisted by the private sector.

The Production Development Corporation (CORFO) is one of the main public agencies implementing policies to support innovation and business start-ups. Among other development programmes, it has two major lines of action.

First, its INNOVA CHILE committee administers non-reimbursable support programmes (subsidies) for the initial stages of company development, including the incubation stage. Subsidies are also provided for business start-ups. Under the Seed Capital Facility (Línea de Capital Semilla), subsidies are provided to companies without a track record at the creation, start-up and initial trading stages. At the same time, investor networks are supported with subsidies for the organization, formalization and operation of networks of "angel" investors with a view to reducing the costs involved in identifying and evaluating business start-up projects.

Second, CORFO operates a programme of quasi-equity financing (i.e., credits with special subordination clauses and cost calculation methods) to support the venture capital industry. As of 2006, these credit lines totalled some US\$ 160 million but the level of disbursement was very low, hardly exceeding a fifth of that amount.

Lastly, only recently (2006) was a law passed to allow CORFO to take temporary (up to seven years) minority equity stakes as a venture capital provider. Until then this was not possible, since the belief that the State should play only a subsidiary role in the economy had reduced State involvement in production activity.

Although a legal framework for business investment funds has existed since 1989, the number of such funds is still small, despite an increase in activity since 2003. According to the information available, a total of US\$ 340 million was committed

in 2006, but only half that amount was disbursed. Most venture capital funds are still at the formation and project identification stage. A review of the type of firms that received funding when these funds actually invested shows that resources have been used in the first place to finance expansion and in the second place to help businesses begin trading, rather than to fund the precompetitive phase. This is much as would be expected from a financial industry that is still in the process of formation and is cautious about assuming risk.

Most investment is going to consumer, agricultural and construction businesses (table 4). Although it is not possible to establish with certainty the innovation and technology content of the firms being invested in, it is immediately clear that they are not concentrated in sectors usually characterized by the introduction of new technologies. Interviews with investment fund executives and officials responsible for public programmes have revealed some factors that appear to be influencing the behaviour described.

First, it is argued that there are not enough innovative technology projects whose returns would defray the (follow-up and specialization) costs their financing would entail. For the same reason, the potential for diversifying risk by investing in projects of this kind is small, since too little is still known about the type of risks they involve. In short, a vicious circle seems to be in operation whereby growth in this market is being held back because it is too small to provide the necessary scale.

As regards the creation of exit mechanisms, the results are again mixed. In 2001, a new stock market segment known as Bolsa Emergente was created to meet the specific needs of firms wishing to open up their capital structure. Existing disclosure requirements were replaced by more flexible ones designed to permit prospective risk assessment; another novelty was the introduction of the role of sponsor, an agent whose task it is to prepare the information needed for a firm's economic and financial position and the quality of its business plans to be reliably established. For other aspects of corporate governance and disclosure, current rules governing public companies continue to apply.

To ensure that these new securities are sufficiently liquid and are regularly quoted on the market, the companies concerned will have to employ a market maker responsible for providing and maintaining liquidity in the shares issued by continually offering

TABLE 4

Chile: distribution of firms in venture capital fund portfolios by sector, June 2006

Sector	Number of firms	Amounts invested (millions of dollars)	Distribution (%)
Communications	3	3.07	1.8
Computer-related	1	1.00	0.6
Medicine and health care-related	1	1.47	0.9
Consumer-related	9	30.07	17.6
Industrial products and services	2	3.08	1.8
Chemical products and materials	1	2.67	1.6
Industrial automation	2	5.59	3.3
Other manufactures	5	18.52	10.8
Financial services	1	0.06	0.0
Other services	2	7.99	4.7
Agriculture	6	30.42	17.8
Construction	6	32.15	18.8
Other	11	34.65	20.3
<i>Total</i>	<i>50</i>	<i>170.75</i>	<i>100.0</i>

Source: prepared by the author using data from the Chilean Association for the Administration of Investment Funds (ACAFI).

prices at both ends of the market. In exchange, the shares issued will be exempt from capital gains tax for a set period of time, irrespective of their stock market presence. This benefit currently exists in Chile for shares with a strong stock market presence. The firms referred to have been given this special treatment because stock market presence is rated by trading volume and frequency parameters that the new shares would be unable to achieve in the short term.

As can be seen, the changes brought in are not on the scale of those adopted in Brazil by BOVESPA, nor do they address the failings of Chilean corporate governance legislation as regards insider trading, related party transactions, the presence of outside directors, disclosure standards and quality and independence requirements for external auditors, among other matters. These failings discourage minority equity ownership, especially in the case of new and innovative firms.¹³

The results obtained so far have been mixed, depending on the viewpoint taken. Considering that the number of companies listed on the stock

¹³ Aware of these shortcomings in the rules currently governing public companies, and of their effects on the capital market, the Chilean Government sent a bill to parliament in 2005. The proposals that were adopted voluntarily by BOVESPA have met with strong resistance from the private sector in Chile.

exchange had been falling consistently since 1997, this new market segment undoubtedly helped to moderate and to some extent halt this downward trend in 2005 and 2006. In 1997, 294 companies were listed, after which the number fell to a low of 238. From the creation of this new market segment to late 2007 there were 14 new listings, of which 12 were carried out under the new rules. From that standpoint, the outcome has been positive.

From another point of view, it must be recognized that the companies listing on the Bolsa Emergente are far from being emerging enterprises or new ventures

with a large innovation or technology content, the only exception being one large information technology company with a long-standing presence in the market.

However, that does not make the establishment of this exit mechanism less important or useful. For one thing, earlier experience in a number of countries shows that markets of this type take a long time and require favourable conditions to mature. For another, the existence of an exit mechanism stimulates interest among potential participants in the prior phase of innovation financing, i.e., venture capital.

VI

Conclusion

Although the impulse to innovate derives from various sources, financing for innovative initiatives is an essential enabling condition if they are to bear fruit in the form of new products, processes or firms. The analysis conducted in this article highlights the need for a system whose various links can cover the different financing needs that arise at each phase by employing instruments which serve to overcome the deficiencies holding back support for innovation in each case.

This system is necessary because one of the driving forces of innovation is the search for competitive advantages that translate into higher returns. Consequently, the incentive to innovate will be greater if appropriate support is forthcoming right along a route that begins at the earliest phases, perhaps in the laboratory or in direct production experience, and ends at some market where the rewards of innovation can be realized and captured.

This article has reviewed a variety of instruments that are employed along this financing path, placing the emphasis on venture capital because this is a relatively new resource in the region, but one that has been successfully applied by some of the more innovative countries. It is obviously not the only instrument. Furthermore, its application must take account of the realities of the different financial systems. The cases of Chile (which has the greatest financial depth in the region) and Brazil (which, with Mexico, has the region's largest financial system in absolute terms)

may not be applicable to countries with less financial depth and/or with financial systems that are small in absolute terms, as in these circumstances it is difficult or unviable to develop capital markets generally, let alone the segment for innovative firms.

In cases where it is difficult to develop the private-sector components of the precompetitive and venture capital phases of this system, public-sector action, probably through banks or development agencies, should be at the core of innovation financing.

Again, when it is not realistic to expect significant near-term progress in the capital market, particularly the segment oriented towards new firms, it will be necessary to find other exit mechanisms. The response in some cases has been to create tie-ups between venture capital partnerships and foreign investors, and thence with financial market segments in more advanced countries (Avnimelech and Teubal, 2004).

There is no one right solution for innovation financing. The essential elements, from the financing point of view, are as follows: (i) how instruments (venture capital, for instance) serve to overcome obstacles which increase the level of risk (externalities and the intangibility of results, information asymmetries, moral hazard), (ii) how the incentive for investors (the prospect of returns) can be retained, and (iii) how private and public interest groups can be prevented from capturing the system.

(Original: Spanish)

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