Technology and technical efficiency heterogeneity: the case of national development banks in Latin America.

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Abstract:

This article explores the question of the heterogeneous rationales underpinning public intervention in the financial systems. Based on an analysis of the National Development Banks, this paper provides estimates of technical efficiency and technology differences among these institutions. It brings three innovative perspectives to empirical banking and finance literature.
First, long the subject of study, these banks have been paid very little interest since the 1980s as a focus of analysis in contemporary economic literature. However, actual economic context has brought back development banks in the debate on financial regulation. We begin by reviewing the main debate concerning the efficiency of these institutions before updating the issue in light of the current economic and management context.
Secondly, we examine the efficiency of the 29 Latin American national development banks from 11 countries, for which we have created a new database offering a conceptual framework analysed from the standpoint of the heterogeneous nature of these institutions (history, size, instruments, means of intervention, ownership structure, sectorial specialisation, etc.).
Finally, this question will be examined using an empirical latent class distance function model. In a first stage, Latent Class allows to estimate heterogeneous technology classes. In a second stage, we estimate a Stochastic Frontier for each technological regime and derive net measures of technical efficiency. Finally, we explore the determinants of technical efficiencies within each identified class. We have evidence for two technological classes for the sampled banks (61 % belonging to Class 1 and 39% to Class 2). Each class is characterized by a specific profile: Class 2 is defined by increasing return to scale and higher levels of efficiency. We also compare our results with those obtained by a common frontier model.

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Introduction.

National development banks (NDBs) are public or mixed economy financial institutions with the general objectives of promoting economic and social development, in particular through financial instruments, and providing direct and indirect solutions to market failures. While some international financial institutions display objectives which are similar to a certain extent, we have chosen to focus this work on national institutions only.
It should be noted that the role of NDBs in the national economies was continually redefined throughout the 20th century. In particular, the major structural transformations determined the changing nature of this type of institution. For example, development banks were often the driving force behind the industrialisation policies and the policies of massive investment in infrastructure witnessed until the 1970s. Throughout this period, they often played a role in transforming national (or even nationalist) policy ideas into economic projects. The 1980s saw numerous criticisms directed at these institutions, deeply impacting their nature both quantitatively and qualitatively. An analysis of the changes experienced by this type of institution highlights the central issue of their efficiency levels. Quite reasonably, the analysis of NDBs as an instrument of public policy largely crystallised the debate concerning state intervention, in particular during the 70s, 80s and 90s. Often accused of promoting corruption and bureaucracy, these banks were heavily criticised for being inefficient. The combination of structural economic transformations and profound changes, to which NDBs have been subjected since the mid-1980s, has nevertheless introduced a degree of heterogeneity into their objectives, instruments of intervention and characteristics. This would suggest that the debate on the validity and efficiency of these NDBs has been updated.

The geographical framework of the present study is limited to the region of Latin America. We can put forward two main arguments to justify selecting this region as the subject of the analysis. First, all the countries in Latin America have national development banks which occupy an important place in their financial systems. Second, these institutions play an important role in implementing tangible political, economic and social projects. In Brazil for example, development banks are used to implement projects aimed at combating famine while in Bolivia they serve to encourage the activities of the indigenous communities. Finally, these NDBs are organised into an association (ALIDE) which centralises their organisational and accounting data and aims to promote their activity.

The first part of this chapter reviews the roots of the question of efficiency of national development banks. These historical elements will provide a better understanding of the origins of the changes experienced by these institutions. The results of these changes then enable us to lay the foundations of an "updated" empirical strategy which we will present in the second part of the chapter. This will involve introducing an analysis of the current level of efficiency of the NDBs by taking account of their degree of heterogeneity. The question of efficiency and its determinants is examined in the third part of the chapter in relation to the results of a new database covering 29 Latin American national development banks for the period 1997-2005.

1. The origins of the question of efficiency of national development banks (NDBs).

The notion of efficiency must be considered here in the broadest sense of the word: examining the results in light of the means used. This notion is employed with a view to understanding the main imbalances both inside and outside the NDBs. We will define NDB efficiency more precisely in the empirical section.

1.1. The traditional role of NDBs in the economy

The role of the state in the Latin American financial system has changed continually since the 19th century, mirroring the construction of national and republican ideas. Numerous countries (Mexico, Chile, Bolivia, Argentina, etc.) witnessed nationalist revolutions echoing the limits of the independence movements of roughly a century before. This national idea asserted itself during the first half of the 20th century, marking a major break in countries which had until then been simple exporters of minerals (silver, copper, gold, etc.) or of raw materials (for example rubber). The idea was to implement institutional mechanisms capable of generate genuine economic development, thereby guaranteeing the autonomy of the Latin American nations. Consequently, the governments were to create an entire institutional system based on the prevailing system in European societies (beginning with legal institutions then followed by economic institutions and finally social institutions), thereby acknowledging that these institutions are a precursor of any development dynamics. The creation of national monetary and financial entities (central banks, public banks and even private national banks) is therefore a decisive step in asserting the identity of burgeoning nation states.
It was in this context that the first public banks and national development banks were created (Banco de la Nacion Argentina, Banco Nacional de Costa Rica, etc.).

The crisis of the 1930s was to play a decisive role in the creation of new public financial institutions supporting development. The limits of the single-exporter model characteristic of the Latin American economies were to become all too clear: a high level of dependence on certain export sectors and world prices, a high level of dependence on certain imports, a very limited redistribution of incomes, a low level of diversification in the production system, etc. The 1930s and 40s would therefore see the development of myriad new institutions: "BNDES" in Brazil, "NAFINSA" and "BANOBRAS" in Mexico, "CORFO" and "Banco del Estado" in Chile, "Banco de la Provincia de Buenos Aires" (nationalised in 1942) in Argentina, etc. They were to play a major role in the construction of the new economic model founded on the promotion of strategic sectors and the strategy of import substitution (Lopez, 2009). These institutions became veritable public investment banks with a clear, three-fold objective: the development of strategic sectors in industry and agriculture; poverty reduction; and the reduction of regional disparities. The means employed essentially involved granting long-term loans and participating in the capital of certain strategic groups (this was notably the case of *Nafinsa* in Mexico, *Corfo* in Chile and *Bndes* in Brazil).
At the same time as this second wave of financial institutions was springing to life, the neutrality characterising the central banks at that time was gradually being abandoned. Instead, these banks would henceforth use various means to encourage the emergence of national development institutions (development banks, public

banks, *fondos de fomento*, etc.), including money creation, more favourable regulations, direct financial participation in certain institutions, etc. (Canavese and Montuschi, 1985; Chandavarkar, 1987). The cases of Brazil, Colombia and Argentina clearly illustrate examples of central banks with a wide range of objectives stretching far beyond mere monetary regulation. The consequence of this bias would be an increased specialisation of the financial institutions in development. Thus the 1940s and 50s saw the emergence of the famous "*fondos de fomento*", veritable catalysts of strategic sectors. A sector-based approached was increasingly targeted, specific to a certain sector of production. Similarly, the first "regional" institutions appeared specialising in certain geographical areas seen as targets of a specific development programme (in particular rural areas). Finally, the intervention instruments also became specialised, with credits, long-term loans, collection of savings, subsidies, participation in the capital of certain firms, etc.

The 1940s and 50s also gave birth to the "*Corporaciones Financieras*", veritable financial and industrial conglomerates which were in particular responsible for the creation of a broad panel of public firms (air transport, railways, hydrocarbons, etc.) in numerous countries (Bolivia, Chile and Brazil among others). The result of this broad quantitative expansion and the specialisation of these different financial institutions can be seen in the fact that in 1967 there were 130 institutions of this type in Latin America. At the dawning of the 1970s, they accounted for the majority of public subsidies in Latin American states.

Finally, following the financial crises of the 1970s and 80s, public credit banks were created. They would either be independent or attached to financial development institutions. The aim of these public banks was to distribute credits and to control a large part of the banking market. In the mid-1980s, this type of public institution was responsible for 67% of all credits distributed in Brazil; 58% in Argentina, 75% in Colombia and 22% in Chile (Montenegro, 1995).

The extent and conditions of intervention through which this type of institution coordinated the entire production and financial sector were to make the banks the main operators in the economies. This leading position would nevertheless lead to the crystallisation of political objectives which would be decisive to the subsequent structural reforms. The combination of crises relating to indebtedness and hyperinflation during the 1980s would highlight the issue of the responsibility of this type of institution in the advent of these economic imbalances.

1.2. A largely contested efficiency

The question of the efficiency of national or public development institutions was to be decisive in altering the economic paradigm adopted in the 1980s. Criticisms were directed at these institutions insofar as they encouraged sectorial, monetary and commercial imbalances (while themselves proving to be unbalanced, demonstrating a dependence on public subsidies, management inefficiency, etc.). This dual destabilising mechanism would be largely responsible for the global economic imbalances affecting the majority of Latin American economies.

An in-depth historical analysis of the efficiency of these institutions is therefore necessary in order to understand the importance of the question.

a) NDBs as creators of imbalances[2].

The creation of imbalances resulted from several factors. We can distinguish macroeconomic imbalances from sectorial imbalances.
At the sectorial level, the massive public financial intervention in the industrial and agricultural sectors proved less than convincing in that these sectors did not become any more dynamic, in particular in technological terms. Industry for example (supposed to promote import substitution) performed poorly, despite support from the NDBs. The majority of the work carried out on the role of NDBs in Latin American economies identifies a negligible and often negative impact on industry and agriculture (Vogel and Larson, 1984; Jaramillo, Schiantarelli and Weiss, 1993; Lagos and Diaz, 1995). Some exceptions were noted by Gleizer (1995) who observed a positive effect on agriculture and the export sector. Finally, and somewhat indirectly, the public firms largely subsidised by the NDBs faced widespread problems of corruption and inefficiency themselves.
At the macroeconomic level, these institutions were accused of having created distortions in the financial markets (in particular by practising highly subsidised interest rates and raising the rates of mandatory contributions), encouraged inflation through the creation of money, implemented financial repression, made the private banking system weak and curbed the development of the stock markets (Ing, 1991; Gleizer, 1995; Edwards, 1995; Montenegro, 1997). To these accusations can be added the criticism, often raised, that they caused productivity and growth to slow (Lagos and Diaz, 1995; Barth et al., 2001; La Porta et al., 2002). Finally, economies according an important role to public banks would be more at risk to financial instability and crises in the banking system (Barth et al. 2001; La Porta et al., 2002; Caprio and Martinez Peria, 2002).

b) NDBs as imbalanced structures

NDBs would appear as inefficiently managed structures characterised by populism, rent-seeking behaviour and corruption. These considerations are also echoed in the theories of "public choice" which highlight the effective distance between the announced social objectives and the political objectives actually applied within public institutions (Jones, 1985; Donahue, 1989; Kikeri et al., 1992; Li and Xu, 2004; World Bank, 2005). Empirically speaking, public banks are almost universally more inefficient (in the general sense of the word) than private banks (Isik and Hassan, 2002; La Porta et al., 2002; Clarke, Cull and Shirley, 2005; Ariff and Can, 2008). A World Bank report (World Bank, 1979) demonstrates that, on average, 50% of the funds allocated to agriculture by this type of institution were misappropriated in Latin America. Populism is an "almost natural" phenomenon in this type of structure, tending to create strong non-egalitarian tensions benefitting the production sectors most in phase with the political considerations (Adams and Graham, 1981; Gonzales-Vega, 1984; Adams, 1987; Fry, 1991; Hostings, 1993). Finally, these institutions experience considerable difficulty in implementing an independent management system in relation to the public authorities, thereby

[2] It should nevertheless be noted that these results cannot be generalised for all financial development institutions around the world. A heterogeneous dimension in the efficiency analysis of NDBs is important, as shown by the works concerning Asia (Vittas and Kawaura, 1995; Vittas and Yoon Je Cho, 1995; Calomiris and Himmelberg, 1995; Staking, 1997).

exacerbating the limitations listed above (Diaz et al, 2006). Nevertheless, the most recent and up-to-date studies on India (Sathye, 2003) and Brazil (Staub, Souza and Tabak, 2010) show that certain public banks can be more efficient than private banks.

c) The impact of structural reforms and privatisation on the efficiency of public banks.

These different theoretical, historical and empirical analyses would accompany the emergence of structural reforms during the 1980s and 90s. The issue here is to identify the impact of these reforms on the efficiency of public banks. Once again, a consensus would seem to exist concerning the positive effects of privatising public banks, not only on their own efficiency levels but also on the global efficiency of the financial system (Clarke, Cull and Shirley, 2005). The privatisation movements concerning public banks increased the efficiency of these organisations (Baer and Nazmi, 2000; Beck et al., 2005), even more so as the residual public sphere after the institutional reform was small (Bonin and Wachtel, 2000, 2003; Bonin et al., 2005; Cull et al., 2002), in particular in Brazil (Beck, Crivelli and Summerhill, 2005; Nakane and Weintraub, 2005). At the same time, by encouraging competition within financial systems, these reforms increased the efficiency of the structures (Chen, Li and Moshirian, 2005; Otchere, 2005). Finally, certain empirical works showed the positive impact of privatising NDBs on public finances (Clarke, Cull and Shirley, 2005), in particular in Argentina (Clarke and Cull, 1999).

2. The changing NDBs and their role today.

As we have just seen, the debate on the role of the state in Latin American economies focussed largely on the efficiency of NDBs. The wave of criticism caused these financial structures to undergo a process of change, and it is this dynamic of change which is of particular interest to us here. We will attempt to understand the interest in studying NDBs today against a backdrop of this rationale of institutional change.
Two main arguments justify the theoretical and empirical study of national development banks today. First, even if their relative weight in the financial systems has changed (very often falling) over the past 40 years, these banks continue to weigh heavily on national economies. Second, these banks have experienced major institutional and organisational change which has drastically altered their place and their means of intervening in economic systems.

The first argument lies in the fact that these financial institutions play a major role in national economies. Their volume of activity, their level of institutionalisation and the change observed at present clearly show that they are still important economic operators. The number of national development banks around the world is currently estimated at 520. Developing countries boast an average of three such institutions. The region with the greatest concentration of this type of financial institution is Latin America (including the Caribbean), accounting for almost 30% of all such banks (153) (Bruck, 2005). Data collected in 1995 concerning public banks throughout the world indicated that these institutions (including public NDBs and mixed economy NDBs) controlled 41.57% of global financial assets in the banking system.
Examining the data for Latin America, we observe that the share held by public banks (including national development banks) fell between 1970 and 1995 as a direct result of the privatisation and financial disintermediation policies.

Table 1: Share of public banks in the financial system (% assets)

Pays	1970	1995
Argentina	71.94	60.50
Bolivia	53.14	18.48
Brazil	70.80	31.70
Chile	91.49	19.72
Colombia	57.67	53.92
Costa Rica	100	90.92
Dominican Republic	70.08	38.93
Ecuador	100	40.61
El Salvador	100	26.43
Guatemala	32.1	22.20
Honduras	49.2	29.90
Mexico	82.66	35.62
Nicaragua	90.44	63.96
Panama	17.93	17.08
Paraguay	55	48.02
Peru	87.38	26.46
Uruguay	42.29	69.79
Venezuela	82.88	57.98

Source: La Porta et al. (2002)

However, more recent accounting data show that the share of assets in banks of which the state is a shareholder remains high, even if we observe a significant level of heterogeneity between countries.

Table 2: Share of public banks in the financial system (% assets).			
Country	**1998**	**2000**	**2002**
Argentina	29.22	25.70	NA
Bolivia	0	0	0
Brazil	49.56	46.57	42.71
Chile	10.61	9.49	10.34
Colombia	16.32	21.10	19.39
Costa Rica	76.71	73.23	68.02
Guatemala	3.84	3.78	3.22
Honduras	3.23	2.28	1.78
Nicaragua	13.23	0.46	NA
El Salvador	6.99	5.73	4.28

Source: Levi-Yeyati et al. (2004)

Furthermore, in order to measure the financial importance of the national development banks, the latter can be compared to the financial weight of international development banks. We took a sample of 9 Latin American national development banks and compared their financial assets to those of the two most active multilateral development banks in the region (World Bank and Inter-American Development Bank).

Table 3: Financial assets (millions of USD).	
World Bank	**222,008**
BanObras (Mexico)	140,426
Bndes (Brazil)	76,753
IADB	**65,382**
NAFIN (Mexico)	21,328
World Bank portfolio for Latin America	**5,166**
BANDES (Venezuela)	4,352
CORFO (Chile)	4,036
Banco Nacional (Costa Rica)	3,703
Banco de la Ciudad de Buenos Aires (Argentina)	2,984
BANCOLDEX (Colombia)	1,616
COFIDE (Peru)	1,060

Source: author's calculations based on financial balance sheets for 2005

The second argument therefore concerns more qualitative aspects relating to the institutional change experienced by these institutions over the past 20 years.
At the root of these changes, and resulting from the limitations indicated earlier, several structural reforms were to impact the financial institutional landscape in the countries of Latin America. First, several central banks regained their independence, as was the case in Chile and Brazil in 1986, Colombia, Argentina and Venezuela in 1991 and Mexico in 1993. Reforms were then introduced to promote financial depth by enabling private institutions to diversify their ranges of financial services. This

policy can be illustrated by the case of Bolivia in 1995. Furthermore, deregulation policies were to become widespread throughout Latin America with interest rates no longer strictly controlled by the state and the public stranglehold on credit eliminated (Montenegro, 1997).
Moreover, the very activity of public financial institutions was deeply impacted. The volume of credits was drastically reduced and numerous branches were closed in "non-profitable" sites, i.e. the rural provinces, leading to regional credit rationing problems (Landivar, 2011), vast merger/acquisition phenomena and finally privatisations. The number of employees, an emblem of the criticisms relating to the inefficiency of public structures, was reduced. Finally, new strategic orientations were introduced with the aim of revolutionising the management practices of these institutions, or what was left of them (Diaz et al. 2006). These new strategic orientations were to transform the architecture of the NDBs which entered a new era, requiring that the question of the efficiency of these organisations be brought up to date.

One of the main effects of these upheavals was to be the introduction of management and steering committees enjoying greater independence from the public authorities. This increased independence was reflected in several significant changes aimed at rationalising financial operations, displaying less ambitious objectives and most importantly ensuring increased specialisation with regard to the objectives (program targets) or financial instruments (Diaz and Landivar, 2006; Baudoin et al., 2006). Several institutions were to restrict their action to specific sectors such as "micro-enterprises and SMEs", small-scale farming or exporters. Similarly, certain institutions were to content themselves with channelling loans to existing institutions, referred to here as "first-floor banks" (in Spanish "*Bancos de Segundo Piso*") while others specialised in larger, long-term financial instruments (banks financing infrastructure such as BanObras in Mexico), etc.
Thus the increasing specialisation of these institutions was to have a dual impact. First, it would demarcate the spheres of activity and second it would necessitate a continual search for innovative financial instruments. With this in mind, it should be noted that a vast majority of the financial innovations in favour of development were created and tested within the Latin American NDBs (ALIDE, 2006), in particular in the fields of financing agricultural insurance systems, new technologies applied to financial services, financing local communities and stock market innovations.

The historical review provided earlier demonstrates that there is an important breaking point which separates two management systems adopted by financial institutions in favour of development. Before the traditional models of NDBs were virulently called into question, they functioned as catalysts of production and played a dominant role in executing public policies. They positioned themselves above the markets and their objectives and areas of intervention were relatively homogenous: the promotion of strategic sectors and public enterprises, financing for public infrastructures and direct intervention on the credit market ("directed credit").
As the structural reforms were implemented, the limitations of public action were revealed and many economists tried to offer a relatively stable rationale for public intervention. This framework served as a rational corpus legitimising occasional state intervention which itself depended on market failures. The market and these institutions found themselves on the same level, the same plane of analysis. The heterogeneity of market failures was matched by the heterogeneity of scopes of

intervention by the NDBs. Finally the heterogeneous scopes of intervention were accompanied by heterogeneous instruments of intervention.
This structural change in the strategic orientations of NDBs must be correlated with the emerging economic literature of the 1980s, which examined problems of market failure with a particular emphasis on the analysis of financial systems. In this context, the works of Stiglitz on the justifications for state intervention in the financial systems would clarify the positioning of NDBs in the 1990s and at the beginning of the new millennium.
These different justifications, combined with the changes experienced by the NDBs, help to understand how these organisations became heterogeneous bodies with different objectives and means of intervention.

It is interesting to note the relative correspondence in table 4 between the theoretical justifications for state intervention in the financial systems put forward by Stiglitz (1994) and the specific objectives of the NDBs.

Table 4 : A comparison between market failures and main objectives of modern LA National Development Banks.

7 main market failures justifying a government intervention in financial systems (Stiglitz, 1994)	**Main objectives of Modern LA National Development Banks (Diaz and Landivar, 2006)**
Externalities due to monitoring, selection and loans	To fight against credit rationing
	To fight against regional credit rationing
Missing or Incomplete Markets	To promote strategic sectors (Exports, Public Infrastructure, Agriculture) or the financial access of vulnerable populations
Paretian Inefficiency of competing markets	To finance long term projects
Negative externalities due to financial crisis	To promote counter cyclical policies
Imperfect competition	To promote competition in financial markets
Investors not or bad informed	To encourage transparent and cheap information
The monitoring is a public good	To promote guarantees systems and funds

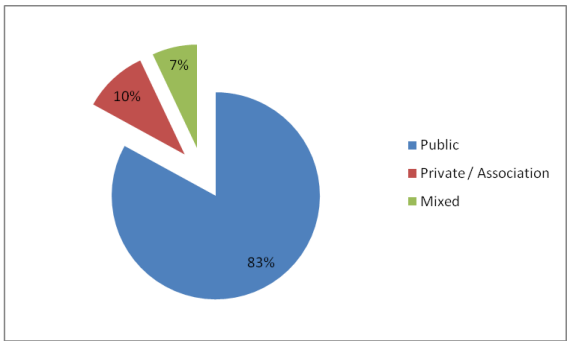
3. The heterogeneity of NDBs in facts: descriptive statistics of 29 Latin-American NDBs.

Our sample includes 29 national development banks for which we provide a number of aggregate descriptive statistics.

3.1. A large diversity in NDBs' ownership systems.

As mentioned above, NDBs were traditionally assimilated to Public banks. Today, new kind of governance's schemes are emerging with the apperance of Private NDBs (with an "Association" status) or Hybrid "Public/Private" banks. In our sample, we have 83% of public banks.

Figure 5: Ownership systems of Latin American NDBs

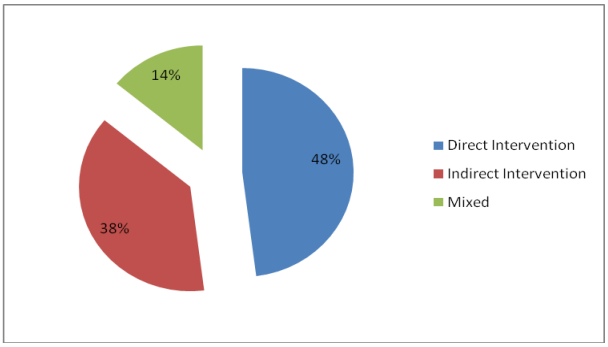


3.2. Heterogeneity in intervention mechanisms: position, sector, instrument.

The increasing specialisation of the NDBs can be examined effectively through the intervention mechanisms.
The mechanisms through which modern NDBs operate can be distinguished according to three vectors of specialisation, namely the position in the market, the target sector(s) and the instruments used.

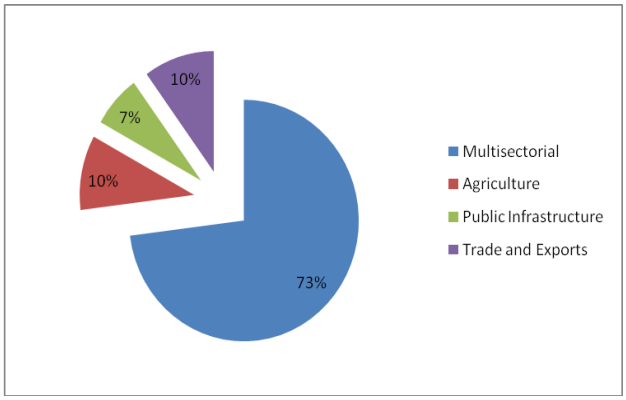
- The position corresponds to the choice of intervening either **directly** on the financial markets (in particular by means of directed credit) through in-house operational branches in direct contact with the customers ("*Banco de Primer Piso*" or "ground-floor bank"), or **indirectly** by financing partner structures upstream (commercial banks, micro-credit institutions) responsible for channelling flows towards the beneficiaries ("*Bancos de Segundo Piso*" or "first-floor banks"). Finally, some NDBs chose to intervene through a **mixed** model.

  Figure 6: Means of intervention of Latin American NDBs



- The sectorial choice corresponds to the choice of position in relation to the target productive sectors. Two types of organisation must be identified. First, **multi-sector NDBs**: these develop their range of services according to the size or type of enterprise without any sectorial specialisation, for example the "*Banco Multisectorial de Inversiones*" in El Salvador and the "*Banco del Estado*" in Chile among others. Second, **NDBs specialising in a single sector**: these include "FINAGRO" in Colombia specialising in agriculture; "BANOBRAS" in Mexico specialising in financing for infrastructures; and "BANCOLDEX" in Colombia working in the field of exports.

Figure 7: Sectorial specialisation of Latin American NDBs



- The choice of instruments is the third vector which highlights the heterogeneity of the intervention mechanisms through which NDBs operate. As we have just seen, the increasing specialisation of NDBs required a high rate of financial and instrumental innovation. We can nevertheless list the NDBs' main instruments of intervention:

- **Long-term credit**
- **Short-term credit**
- **Participation in the capital of certain firms**
- **Investment on the stock markets**
- **Administration of trust funds**
- **Participation in venture capital companies**
- **Guarantee systems and funds**
- **Leasing**
- **Co-financing and co-investment.**

- **Underwriting**
- **Technical assistance, technological services and training**
- **Financial information platforms**
- **Specific sectorial development programmes**
- **Others**

3.3. A large heterogeneity in their role into financial systems.

Even if some banks are true giants of the national banking systems, their place in the financial systems is relatively heterogeneous, as shown in table 5 for the 29 NDBs in the sample.

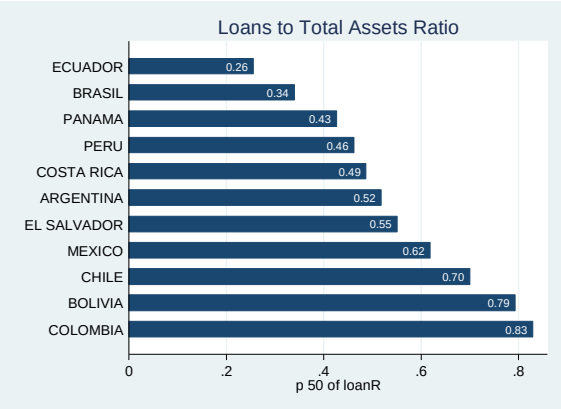
Table 8: Share of 29 Latin-American National Development Banks in the financial system (% Assets).

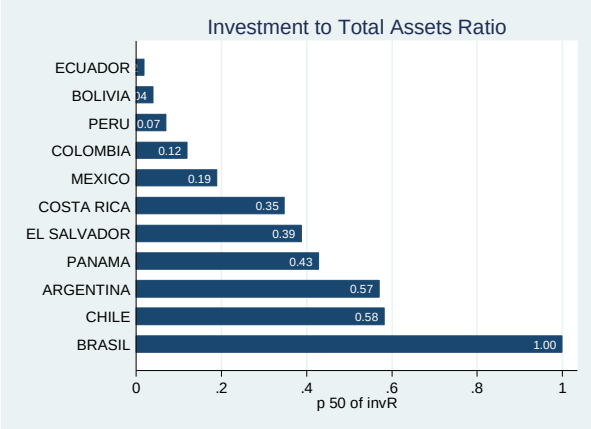
Country	Bank	2005
Argentina	Banco de Inversión y Comercio Exterior S.A. (BICE)	0,48
Argentina	Banco de la Provincia de Buenos Aires (BAPRO)	3,28
Argentina	Banco Cooperativo Limitado (BCL)	1,11
Argentina	Banco Ciudad de Buenos Aires (BCBA)	2,73
Argentina	Banco de la Nación Argentina (BNA)	6,75
Bolivia	Banco Solidario S.A.(BSOL)	2,50
Bolivia	Nacional Financiera Boliviana S.A.M. (NAFIBO)	3,98
Brasil	Banco da Amazonía S.A. (BASA)	0,22
Brasil	Banco do Brasil S.A. (BB)	14,51
Brasil	Caixa Federal (CAIXA)	5,64
Brasil	Banco do Nordeste do Brasil (BNB)	0,59
Brasil	Banco Nacional de Desarrollo Económico y Social (BNDES)	21,01
Colombia	Financiera Energetica Nacional.(FINERG)	0,49
Colombia	Fondo Nacional de Proyectos de Desarrollo (FONADE)	0,01
Colombia	Financiera de Desarrollo Territorial (FINDETER)	1,89
Colombia	Fondo para el financiamiento del sector Agropecuario (FINAGRO)	2,78
Colombia	Banco Cafetero (BANCAFE)	2,77
Colombia	Banco de Comercio Exterior de Colombia S.A. (BANCOLDEX)	3,01
Chile	Banco del Estado de Chile (BEC)	15,08
Chile	Banco del Desarrollo S.A.(BDC)	4,17
Costa Rica	Banco Nacional de Costa Rica (BNCR)	22,14
Costa Rica	Banco de Costa Rica (BCR)	25,73
Ecuador	Corporación Financiera Nacional (COFIN)	1,03
El Salvador	Banco Multisectorial de Inversiones (BMI)	2,51
Mexico	Banco Nacional de Comercio Exterior S.N.C. (BANCOMEXT)	3,54
Mexico	Banco Nacional de Obras y Servicios Públicos S.N.C. (BANOBRAS)	7,54
Mexico	Nacional Financiera S.N.C. (NAFIN)	4,38
Panama	Banco Nacional de Panama (BNP)	13,32
Peru	Corporación Financiera de Desarrollo S.A. (COFIDE)	1,70

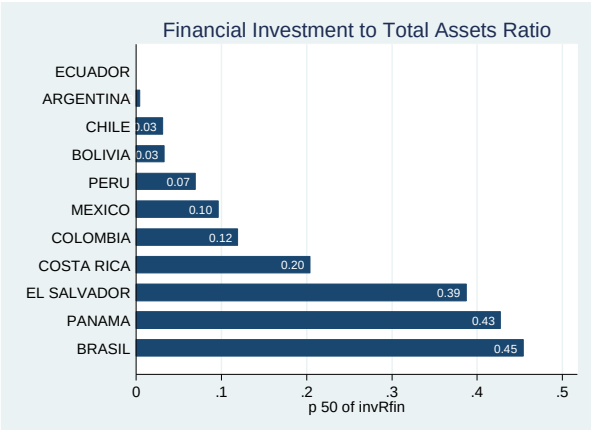
Source: Author and WDI (2005).

The next tables confirms a large heterogeneity in business models across Banks and countries. In fact, we have computed several ratios on Total Assest (TA) : Loans to TA Ratios , Investment to TA Ratios (Investments realized by the bank in public infrastructure, social policies, strategical economic projects,…) and Financial Investments to TA Ratios (Investments realized by the bank in financial markets in order to optimize ressource allocations). Each ratio represents a modern objective pursued by NDBs.

Figure 9 : Loans to TA Ratio,Investment to TA Ratio and Financial Investment to TA Ratio.

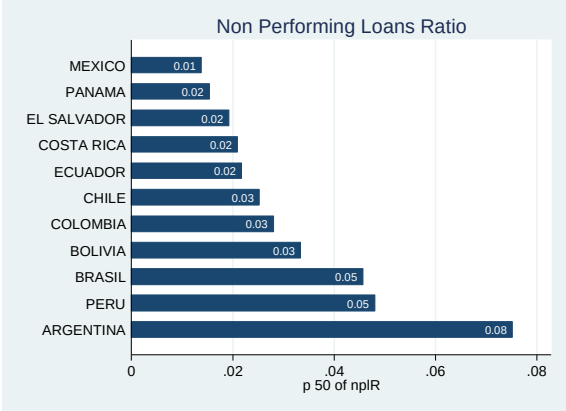


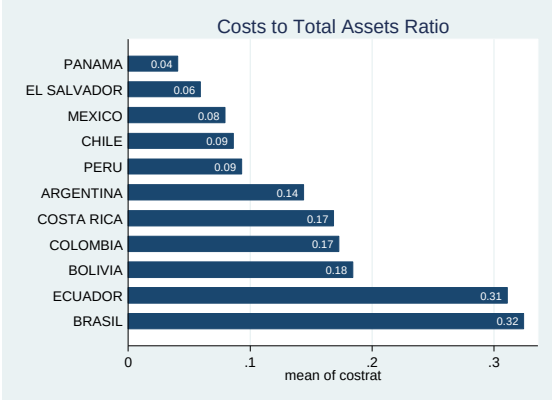


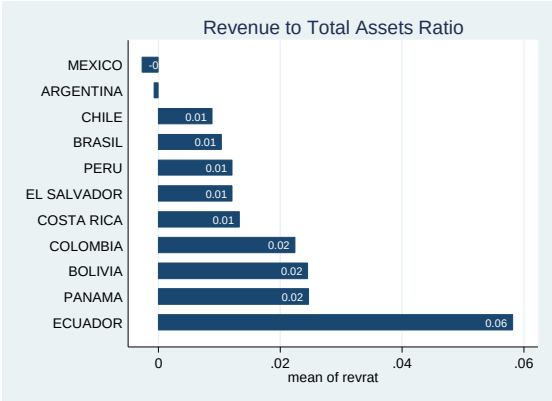


Moreover, we have computed descriptive statistics on the current activity of NDBs : Non Performing Loans Ratio, Costs to TA Ratio and Revenue to TA Ratio.

Figure 10 : Non Performing Loans Ratio, Costs to TA Ratio and Revenue to TA Ratio.







These Figures confirms the diversity of situations accross NDBs. In short, the role of "modern" NDBs must be analysed from the standpoint of heterogeneity. As we have seen, this characteristic was the result of a major institutional restructuring of the financial organisations in favour of development. The most obvious consequence was that this type of institution endeavoured to better respond to and match the failures of the financial markets. An updated debate on the efficiency of this type of institution must therefore take account of these different elements.

4. The current efficiency levels of Latin American NDBs.

4.1. The analytical framework

In order to compare the efficiency and the technology used by the development banks under study, we need to represent the technology using a parametric model. The most commonly used approach in the empirical is to consider a cost frontier model. Unfortunately we found difficulties to construct a cost function because of the lack of good measures for input prices. Most of the input variables information's are on quantities. For this reason we have a dual representation, the input distance function. This model can be equivalently used and allows to obtain information on the technology (or the technologies) used and also on return to scale, factor elasticities of substitution and efficiency. Another advantage of this model with respect to our study on development banks, compared to the cost function is that we do not need to impose a strong assumption on the behavior of the bankers concerning the cost minimization.

Another important issue discussed in this study is the unobservable heterogeneity of the technology. We have a sample of 29 banks observed across ?? countries. Some of them are much more specialized in providing loans while other are much more concerned with investments. So it is too complicated to consider groups of likely homogeneous banks based on some determinants. A much recent methodology on frontier modeling concerns this topic called the latent class frontier models (LCFM), proposed by (Greene 2005, and Kubhakar and Orea(??)) can be applied. The data set in use is very limited, (29 banks), the LCFM is highly parameterized; we mean the likelihood function incorporates variables on the technology, others which explain the inefficiency and other variables explaining the probability membership within each technology class. For our limited sample data set, the likelihood function of the standard LCFM fail to converge most of the time. For this reason we have simplified the standard model by applying latent class procedure in a first step ignoring the asymmetry of the error distribution in the model i.e. which equivalent to assume that all the banks are efficient. In a second step, a bank being classified with respect to their most likely used technology group, a standard stochastic frontier model is applied in order to derive the efficiency banks score.

The input distance function.

The parametric input distance function provides input oriented efficiency estimates. It measures by how much the inputs used could be reduced at maximum while producing a given vector of outputs. Among the output bundle considered we retain two desirable outputs (loans and investments) and one undesirable output (bad loans). It has been demonstrated in some banking studies, that measuring bank efficiency while ignoring bad loans provide biased measures of the efficiency. NPL ratio of the studied banks varies between ?? and ??? , which suggests heterogeneity vis a vis to risk of the studied banks, which may have implications on the technology used.

The input directional distance function is defined by:

$$\mathrm{D_i}(Y,X) = \sup_{\delta}\left\{\delta > 0, (Y, \frac{X}{\delta}) \in T(Y)\right\} \quad (1)$$

$T(Y)$ is the production possibilities set, Y=(Y_1, Y_2, Y_3) represent the output vector, the first two components are the desirable outputs (loans, investments) and the third component Y_3, is the undesirable output (NPL, non performing loans) and X the input vector used (labor, financial and capital). The distance function permits to represent a multi outputs multi input technology, and provide a direct measure of bank technical efficiency. The input distance function should verify some regularity conditions, non decreasing in inputs, non decreasing in undesirable output and non increasing in desirable outputs. These properties suggests that the total efficiency of a bank decreases (increases) where one of the inputs or the undesirable (output) increases. The distance function should also be homogeneous and linear with respect to the inputs. The translog input distance function normalized with respect to the first input is:

$$1 = D_i(Y, b, X)e^{v-u} \quad (\mathrm{u} = 0, \text{banks are technical ly efficient})$$

$$\left(\frac{1}{\mathrm{x}_1}\right) = D_i(\frac{\mathrm{Y}}{\mathrm{x}_1}, X)e^{v-u}$$

$$-Log(\mathrm{x}_1) = a_0 + \sum_{j=1}^{3} bjLog(y_j) + \frac{1}{2}\sum_{j=1}^{3}\sum_{j'=1}^{3} bjj'Log(y_j)Log(y_{j'}) + \quad (2)$$

$$+\sum_{i=2}^{3} a_i Log(x_i / x_1) + \frac{1}{2}\sum_{i=2}^{3}\sum_{i'=2}^{3} a_{ii'}Log(x_i / x_1)Log(x_{i'} / x_1) +$$

$$\sum_{j=1}^{3}\sum_{i=2}^{3} c_{ji}Log(y_j)Log(x_i / x_1) + v - u$$

v represents the Gaussian random shocks while $u \geq 0$ represents the asymmetric error term which capture technical inefficiency.

The return to scale RTS are derived following Fare and Primont (1995) using the following expression:

$$RTS = -\sum_{j=1}^{3} \frac{\partial Log(D_i(Y, X)}{\partial Log(y_j)} \quad (3)$$

Estimating equation (2) using standard frontier models, whatever the assumption used for the inefficiency distribution provide measures of the technical efficiency. It is important to mention that this measure will ignore banks heterogeneity since the model assumes that all the banks share a common technology represented by the distance function (2).

Technology heterogeneity and the Latent Class Model

In order to capture the unobservable heterogeneity of the technology of the development banks we assume that technology banks efficient population is a mixture of two subgroups technology classes in proportions π_1 and (1-π_1). Under

the assumption that the banks are efficient, u=0[3], the mixture density for a given observation

$$\ln L = \pi_1(\delta_{it}) \ln g_1(v_{1it}\big|_{j=1}) + (1-\pi_1(\delta_{it})) \ln g_2(v_{2it}\big|_{j=2}) \quad (4)$$

The probability class technology membership π_1 could either be considered as a constant proportion or could be conditioned on some technology variables called covariates. According to our simplification of the likelihood function in (4) the results are stable concerning this proportion either by introducing the covariates in the model or not. This constitutes an empirical advantage of our specification compared to the LCSF model.

Technology class membership is determined by a multinomial logit. $W_{it} = (1, LoanR, \text{InvestR})$, the two variables loans to total assets ratio (LoanR), and investments to total assets ratio (InvestR) have been retained as the covariates of the technology class membership.

$$P_1(\delta_{it}) = \frac{\exp(\delta' W_{it})}{\sum_{j=1}^{J} \exp(\delta' W_{it})} \quad (5)$$

Equation (5) is replaced in the likelihood function (4) which is maximized by a non linear procedure.

Once the LCM has been estimated, the posterior probability class membership is obtained using Bayes theorem. Conditional on the technology covariates, this probability is derived by the following expression:

$$Pc1 = P(yi \in Class\,1) = \frac{g_1(v_{1it}\big|_{j=1})}{\pi_1(\delta_{it}) g_1(v_{1it}\big|_{j=1}) + (1-\pi_1(\delta_{it})) g_2(v_{2it}\big|_{j=2})} \quad (6)$$

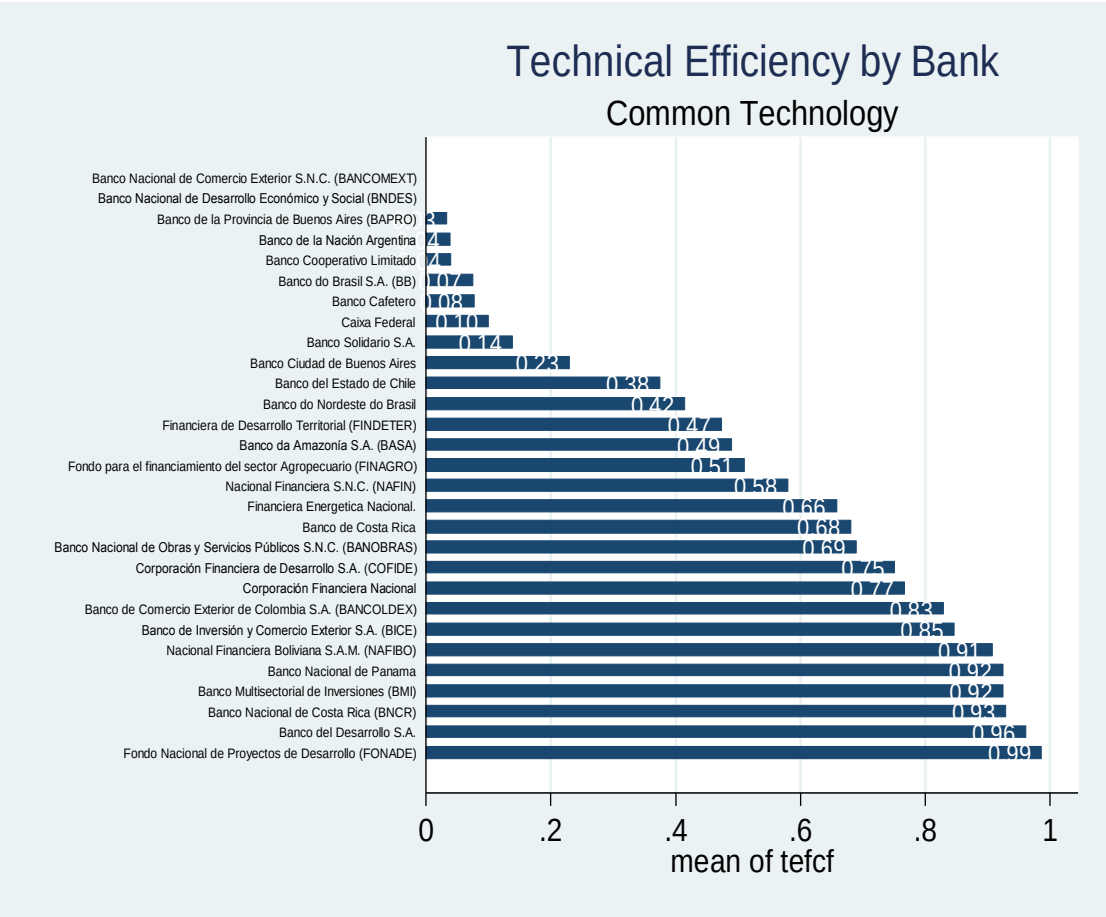
Using these probabilities, sampled banks are decomposed into two groups, the group one where the Pc1>50% (pc1>(pc2=1-pc1)). Within each identified technology class, we run a standard stochastic frontier model in order to derive the efficiency score. These efficiency scores are then regressed in a second step on some inefficiency covariates. Efficiencies are net measures of inefficiency, in the sense that they are derived with respect a specific technology obtained from the LC model. The distance with respect to the frontier is mainly explained by differences in technical inefficiency across banks using a common technology. Tobit model is used since the efficiency scores belong to the interval [0,1].

[3] This assumption could be relaxed, the likelihood is much more complicated to maximize according to our limited sample data set. Moreover, relaxing this assumption will generate the LCSFM.

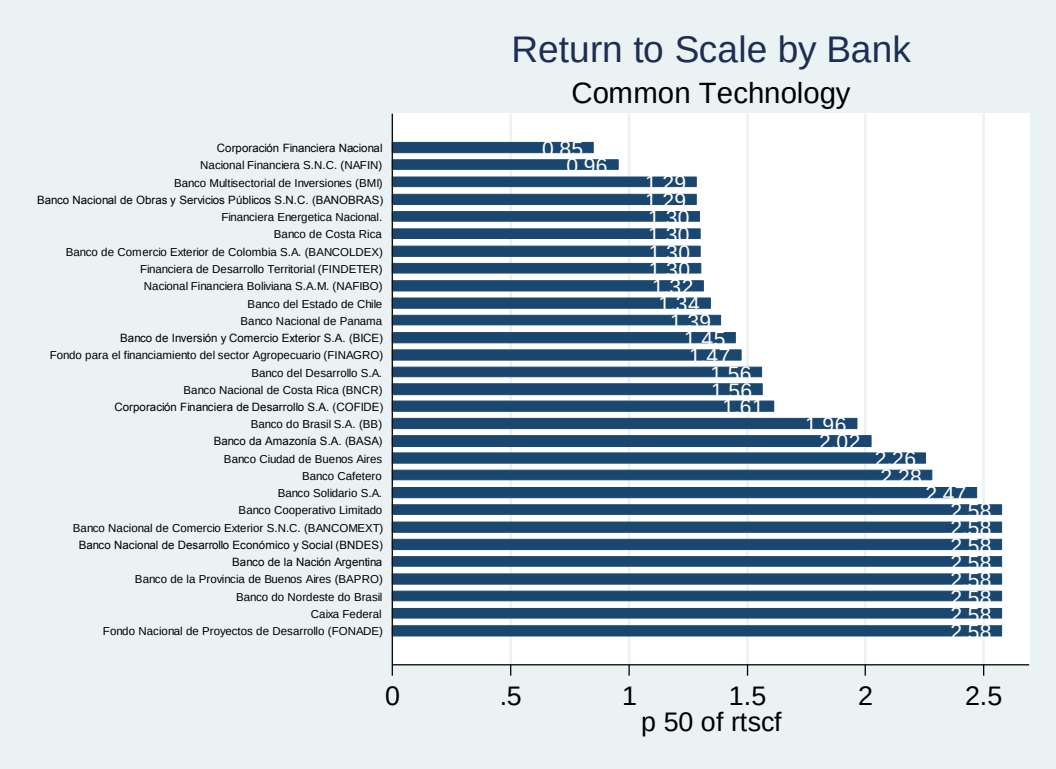
4.2. Results: the efficiency of NDBs.

4.2.1. Efficiencies scores with a common technological frontier.

In this section we examine the efficiency levels of NDBs. First, we have computed these efficiencies through a standard Stochastic Frontier model where we assume that NDBs share the same technology i.e. they produce their services through a common technological pattern.



We can observe that efficiency scores by banks vary from very low levels (Bndes, Bancomext, Bapro,...) to very high levels (Fonade, BDSa, BNCR,...). These results suggest that a large technological heterogeneity is not considered by the standard stochastic frontier model, especially in light to the arguments exposed in the descriptive section above. These results are confirmed by return to scale indexes that we have calculated too, observing strong differences among banks.



Both arguments (large levels of heterogeneity in technical efficiencies and in return to scales) asks for models that allow a better control for technological heterogeneity.

4.2.2. Efficiencies controlling for technological heterogeneity: a Latent Class Distance Function Model.

The model used for this section is inspired, as mentioned before, by recent developments in Latent Class Stochastic Frontier models. In our model, we suppose that some variables, here Investment to Assets ratio (IAR) and Loans to Assets ratio (LAR), can be used in order to discriminate the technological class probability of each bank. For our sample, we have found two technological classes with a partition of 61% of banks belonging to Class 1 and 49% of banks sharing the technology of Class 2. The results of this Latent Class Distance model are in appendix.

4.2.3. National Development Banks Profiles by technological class.

Table 12 : Efficiencies and instruments of intervention : a Tobit Regression.

Variable	Class 1	Class 2
Direct intervention	-0.3562	0.3836
	-4.13	3.31
Mixed intervention	0.1374	0.5982
	1.78	3.91
Public Bank	-0.0494	-0.1352
	-0.86	-2.48
Mixed Economy Bank	0.2771	-0.1362
	1.99	-1.60
Sectorial Specialization	0.0612	-0.0707
	1.15	-1.40
Direct Investment in companies	0.2477	0.1970
	4.32	4.11
Investment in financial markets	-0.1477	-0.2977
	-1.47	-3.60
Administration of trust funds	-0.0106	-0.1960
	-0.12	-2.57
Venture Capital	-0.3688	0.0627
	-8.10	1.51
Guarantee funds	0.0919	0.0226
	2.29	0.66
Leasing	-0.5611	-0.2236
	-12.49	-2.96
Cofinancing instruments	-0.4097	-0.0516
	-9.73	-1.36
Underwritting	0.1855	0.1095
	4.36	2.07
Services to companies	-0.3698	-0.1865
	-6.80	-3.21
Technical asistance or support	0.0561	0.2897
	0.47	2.39
Information systems for financial markets	-0.2030	-0.3100
	-2.39	-2.96
Specific support to development programs	0.2824	-0.0064
	4.09	-0.11
Size	-0.0650	0.0526
	-4.22	3.01
Age	0.0750	0.0426
	4.12	2.01
Constant	1.0199	0.6451

	5.94	3.30
Sigma		
Cst	0.1258	0.1097
	16.97	13.71
AIC	-146.3533	-108.7886

Numbers under coefs are t stats.

The results of this model enable us to measure the correlation between the efficiency scores and the categories of variables supposed to capture the heterogeneity of the national development banks' management models. With regard to the general characteristics, we observe that NDBs belonging to Class 2 which intervene directly on the credit market are relatively less efficient than those which adopt a more indirect means of intervention (i.e. by intervening upstream, above, on the "first floor" of the traditional or micro-finance banking system, corresponding to a financing activity of "ground-floor" partner financial institutions). Furthermore, NDBs of Class 1 adopting a mixed intervention approach display higher efficiency scores than the others.
With regard to the ownership system, we observe that public NDBs of Class 1 are less efficient than "private" NDBs (understood as associative, cooperative institutions). Furthermore, the longer the history of an NDB, the greater its efficiency – possibly indicating the existence of a learning dynamic. Within the framework of the NDBs, this may indirectly confirm the beneficial effect of the different waves of criticism directed at these institutions over a number of decades (within the framework of our analysis, this is only valid for the NDBs which "survived" these waves of criticism). For Class 1 NDBs the higher is the volume of activity, the lower is its efficiency, suggesting that big developments banks (in assets) are less efficient.

As for the variables allowing us to model the heterogeneity of the financial instruments adopted by the NDBs to intervene in the financial systems, we can distinguish the following elements.

- For NDBs belonging to technological Class 1:

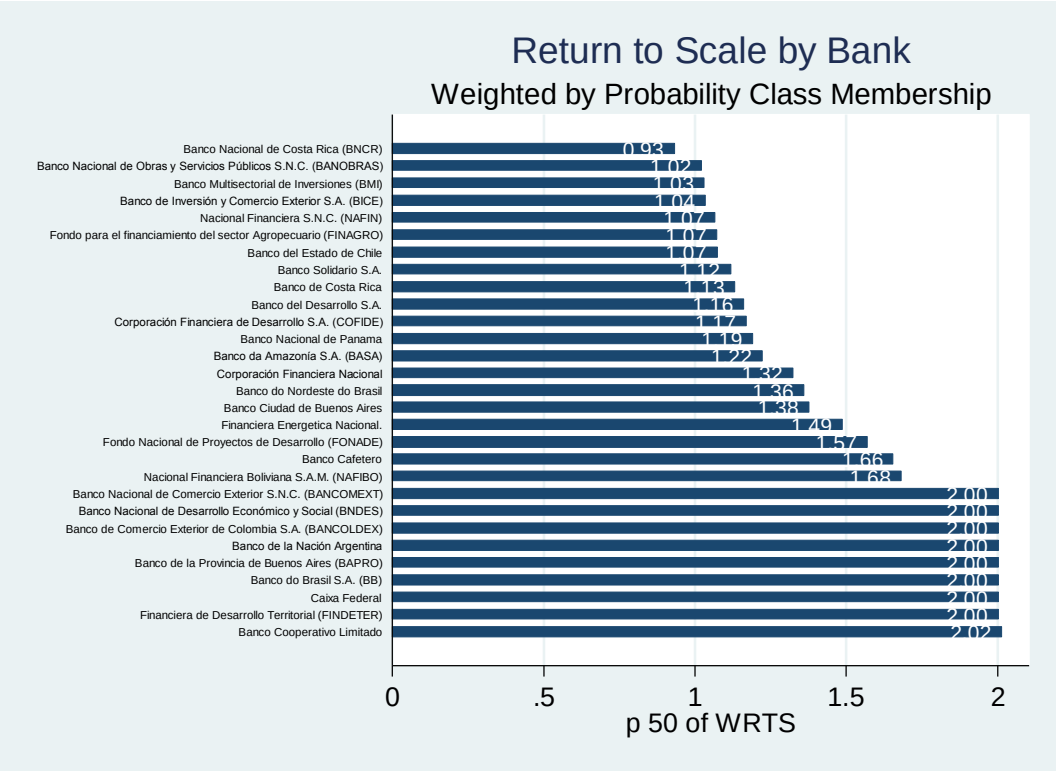
For banks which administrate Trust Funds and employ Venture Capital instruments for certain development projects or Leasing instruments are the least efficient. However, NDBs investing directly in the capital of certain companies (strategic companies often identified by the national development programmes, the main strategic framework guiding NDBs in Latin America), which finance specific sectorial development programmes in their entirety are potentially the most efficient NDBs.

- For NDBs belonging to technological Class 2:

For banks which employ Underwrtitting instruments for certain development projects or, again Venture Capital instruments are the least efficient. NDBs which invest funds in financial markets in order to optimize public funds for example, are

the least efficient too. However, NDBs specialising in particular sectors (Agriculture, Trade or Public Infrastructure,...) are relatively more inefficient that multi-sector NDBs.

Finally, we have computed Returns to Scale for each bank, weighting for probability class membership, according to recent literature on Latent Class Stochastic Frontier Models.



Conclusion

This work has enabled us to control for the heterogeneity of intervention rationales underpinning National Development Banks in Latin America.
We can draw some directions that seem relevant in regard to our results. First, NDBs are not standard banks and their business models are very heterogeneous. As a consequence, an analysis of their efficiency needs to control for their heterogeneity. Our latent class framework tries to control for this, especially for different technological regimes. The results are relevant in order to have a more precise idea on the determinants of efficiency, with a main distinction across technological classes, and controlling for different instruments and means of intervention managed by NDBs. This empirical approach draws the profiles of efficient NDBs.
Around the world, NDBs are paying a lot of increasing attention as possible ways of public intervention in financial markets.
We feel that this approach is relevant in that it enables us to refine the analysis of NDB efficiency, in particular to improve the evaluation of these institutions.

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Appendix.

Table A : Latent Class Model Results.

Variable	Class 1	Class 2
lx2sx1	1.0389	0.9639
	8.95	8.48
lx3sx1	0.2283	0.1463
	5.21	2.26
lx4sx1	-0.2051	0.0879
	-5.90	1.68
ly1	-0.2659	-0.3794
	-4.02	-4.24
ly2	-0.3122	-0.5831
	-5.55	-7.51
lx2sx1s	-0.2570	0.1779
	-3.08	1.77
lx3sx1s	0.0986	0.0554
	5.68	1.25
lx4sx1s	-0.0820	-0.0245
	-2.85	-0.72
lx2x3	-0.0151	0.0212
	-0.46	0.51
lx2x4	-0.0361	0.0480
	-0.82	1.02

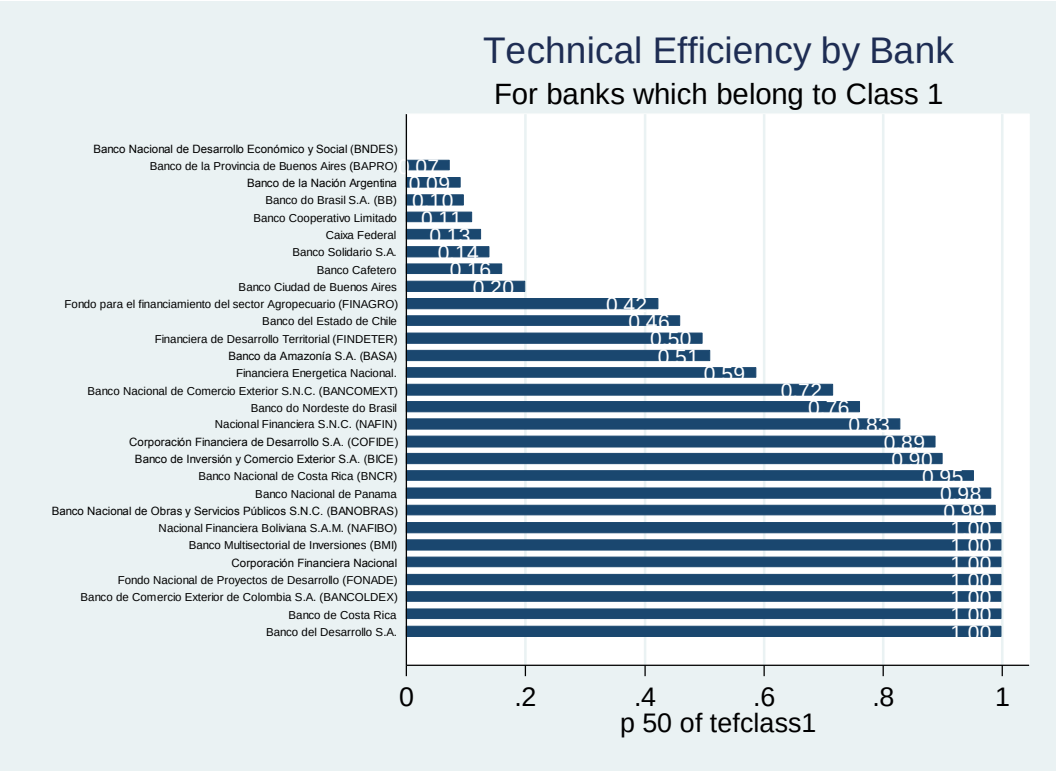
ly1x2	0.0850	-0.0851
	1.58	-1.06
ly1x3	-0.0828	-0.0753
	-3.59	-1.96
ly1x4	0.0877	0.1330
	2.92	2.39
ly2x2	-0.0638	0.1052
	-3.07	2.56
ly2x3	0.0335	0.0590
	2.13	4.13
ly2x4	-0.0259	-0.0293
	-1.39	-1.33
ly1s	-0.1209	0.1488
	-1.94	1.48
ly2s	-0.0985	0.0302
	-4.57	1.17
ly1y2	0.1086	-0.2028
	3.89	-5.76
Constant	0.1004	1.8358
	0.99	14.67
Country dummies	Yes	
Time dummies	Yes	
AIC	153.8101	

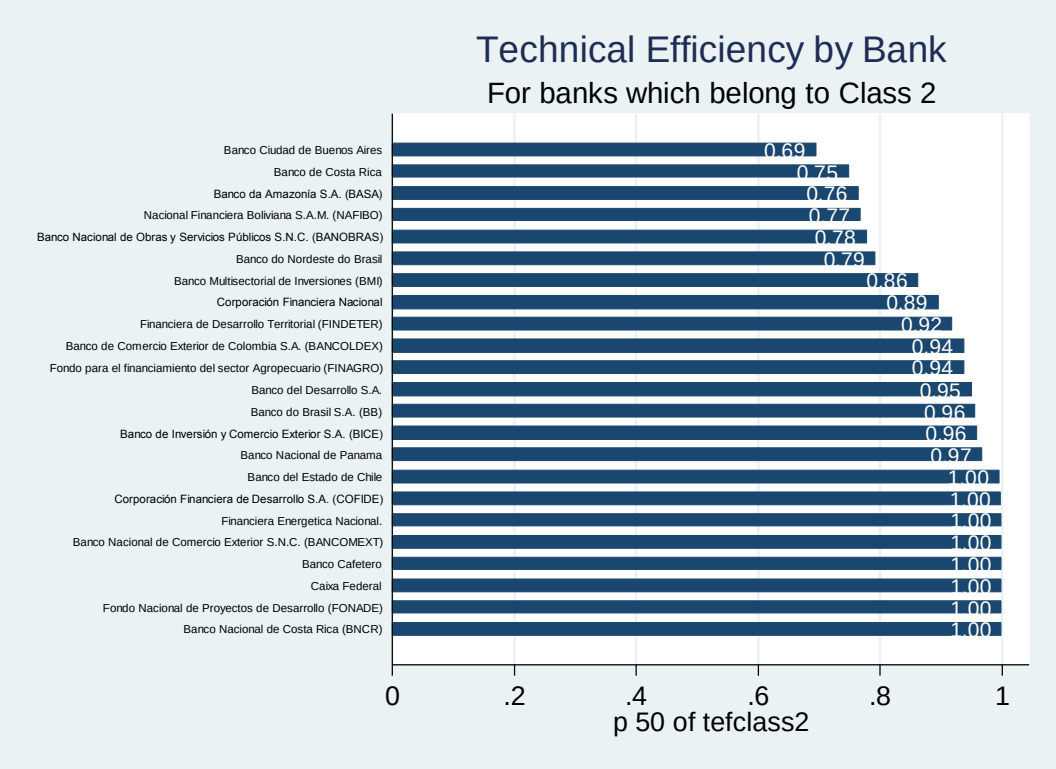
Numbers under coefs are t stats.

Probability Class	
LAR	-5.7293
	-5.77
IAR	-1.8887
	-2.61
Constant	4.6191
	5.55
LnSigma1	
Constant	-1.7346
	-26.75

LnSigma2	
Constant	-2.0595
	-25.50

Table B : Efficiencies by bank.




Technical Efficiency by Bank
For banks which belong to Class 2
Banco Ciudad de Buenos Aires
Banco de Costa Rica
Banco da Amazonía S.A. (BASA)
Nacional Financiera Boliviana S.A.M. (NAFIBO)
Banco Nacional de Obras y Servicios Públicos S.N.C. (BANOBRAS)
Banco do Nordeste do Brasil
Banco Multisectorial de Inversiones (BMI)
Corporación Financiera Nacional
Financiera de Desarrollo Territorial (FINDETER)
Banco de Comercio Exterior de Colombia S.A. (BANCOLDEX)
Fondo para el financiamiento del sector Agropecuario (FINAGRO)
Banco del Desarrollo S.A.
Banco do Brasil S.A. (BB)
Banco de Inversión y Comercio Exterior S.A. (BICE)
Banco Nacional de Panama
Banco del Estado de Chile
Corporación Financiera de Desarrollo S.A. (COFIDE)
Financiera Energetica Nacional.
Banco Nacional de Comercio Exterior S.N.C. (BANCOMEXT)
Banco Cafetero
Caixa Federal
Fondo Nacional de Proyectos de Desarrollo (FONADE)
Banco Nacional de Costa Rica (BNCR)
0.69
0.75
0.76
0.77
0.78
0.79
0.86
0.89
0.92
0.94
0.94
0.95
0.96
0.96
0.97
1.00
1.00
1.00
1.00
1.00
1.00
1.00
1.00
0
.2
.4
.6
.8
1
p 50 of tefclass2