

**CIRPÉE**

Centre interuniversitaire sur le risque, les politiques économiques et l'emploi

Cahier de recherche/Working Paper **03-34**

## **Theory and Test on the Corporate Governance of Financial Cooperative Systems: Merger vs. Networks**

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Septembre/September 2003

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Financial support from the International Development Research Center (IDRC) and Développement International Desjardins (DID) is gratefully acknowledged. The usual disclaimer applies. This work is part of a larger research program that operates under the title of "Microfinance: a market approach". The authors are grateful to André Leclerc for his devoted collaboration in the elaboration of the data base on Québec's cooperatives. We also thank Benoit Tremblay and participants of the *Third National Conference on Financial Sector Research-2003* and the *Mapping Cooperative Studies in the New Millennium, 2003 Conference* for useful comments; and to the Desjardins Movement for the enthusiastic support offered in the collection of the data used in the research.

**Abstract:** This paper presents a study of the economic organization of systems of financial cooperatives (FC). The first part presents a theoretical framework rooted in principles of *transaction cost economics* (TCE) that seeks to explain empirical regularities observable in systems of FC worldwide. The second part is an empirical study that compares X-efficiency between members of the Quebec *Desjardins* movement (DM) and the United States Credit Union system (USCU), the first organized as a tight network of institutions and the second composed largely by independent institutions with few ties. The fundamental proposition is that networks, are a superior form of governance mechanism (over markets and mergers) for relatively wide and relevant ranges of contractual hazard and size of the institutions. Further, that networks provide substitute, hierarchy based, control mechanisms when size of the institution dilutes internal governance mechanisms, discouraging subgoal pursuits and expense preferences by agents, both occurring in large FC. The theory allows us to generate a set of testable hypothesis of which we highlight three: i) For small FC, differences in efficiency will be relatively small, if any. ii) Large institutions should display systematically lower efficiency than similar sized FC members of strategic networks. iii) Networks should display lower variance in the size as well as in performance indicators. Throughout, empirical results are consistent with our central theoretical proposition.

**Résumé:** Cet article présente une étude de l'organisation économique de systèmes de coopératives financières. La première section présente un cadre théorique basé sur la *théorie des coûts de transactions* qui tente d'expliquer des récurrences empiriques observables dans les systèmes de coopératives financières dans le monde. La deuxième section est une étude empirique qui compare l'efficacité des coopératives financières du Mouvement *Desjardins* du Québec et des "credit unions" Américaines. Le premier réseau est fortement intégré, alors que le second est composé principalement d'institutions indépendantes reliées seulement par quelques liens. La proposition fondamentale est qu'une intégration accrue permet d'atteindre une forme supérieure de gouvernance (en comparaison avec le marché ou les fusions) pour une gamme relativement large de risque contractuel et de taille des institutions. De plus, les réseaux constituent un substitut, basé sur la hiérarchie, aux mécanismes de contrôle lorsque la taille de l'institution affaiblit les mécanismes de gouvernance interne, décourageant la poursuite des objectifs secondaires et la préférence pour certaines dépenses des agents, deux phénomènes observés dans les grandes coopératives financières. La théorie nous permet de générer un ensemble d'hypothèses vérifiables. Nous en soulignons trois: i) Pour les petites coopératives financières, les différences d'efficacité seront relativement petites. ii) Les grandes institutions *indépendantes* devraient présenter une efficacité moindre que les institutions de taille comparable membres d'un réseau stratégique. iii) Les institutions membres d'un réseaux devraient présenter une moindre variance en taille et en efficacité. Nos résultats empiriques confirment notre proposition théorique centrale.

**Keywords:** Transaction cost economics, financial cooperatives, credit unions, networks, corporate governance, technical efficiency, X-efficiency

**Mots clés:** Théorie des coûts de transactions, coopératives financières, unions de crédit, réseaux, gouvernance corporative, efficacité technique, efficacité en dotations

**JEL Classification:** G2, G3

# 1 Introduction

This paper presents a study of the economic organization of systems of financial cooperatives (FC). It consists of two parts. The first, presents a theoretical framework rooted in principles of *transaction cost economics* (TCE). There, we seek to explain empirical regularities observable in systems of FC worldwide. In particular, explain integration of large numbers of FC into *networks* that present specific features common in several countries. The second, consists of an empirical study that compares two particular systems of FC, the United States Credit Union (USCU) system and the Quebec *Desjardins* movement (DM). The first organized as a loose arrangement with very low level of integration and the second integrated into a tightly organized (strategic) network.<sup>12</sup>

Elsewhere ([Fischer, 2000], [Fischer, 2002]) it was argued, based on an analysis of 18 cases of "mature" FC systems, that there exist two dominant models of "macro" governance of FC systems. The models present certain constant characteristics in terms of governance across groups of countries. The systems of FC operating as *networks* appear to display either equal or superior (but not inferior) performance that those operating under a looser organization (*non-network*). As measures of performance, variables such as market penetration in terms of population and financial assets, stability of the system, level of services provided to members, were used. As could be expected, the *network* did not outperform the *non-network* in every measure, but under no measure was the result reversed. The difference of performance does not appear to be attributable to cultural, religious, or political factors, as was argued elsewhere [MacPherson, 1998]. Rather, the difference in performance appears to be related to governance. In this paper we focus on networks of depository type of mutual intermediaries (financial co-operatives), however, structures of similar characteristics and complexity exist among mutuals in other industries such as insurance (e.g. Promutuel in Quebec); health management (e.g. Statutory Health Insurance mutuals in Germany); community banks (Cajas in Spain and Sparkasse in Germany, the largest institution, taken as networks, in their respective countries) to mention just a few. Thus, the interest of understanding these structures transcends vastly the field of FC. Among these latter, most networks are in place well over half a century, with origins tracing back to the second half of the XIX century, in Germany. With minor institutional variations, they have been implemented in cultural, legal and economic settings as varied as those of Germany, Australia, Japan, Quebec, Brazil and Korea to mention a few.

In the empirical portion of the work we compare two systems of FC that choose alternative organization paths that differ by the complexity and functionality of the hierarchical governance structure they adopt—the USCU movement as a non-network and the DM as a network. We do this by focusing on X-efficiency (EFF) based on a Stochastic Frontier Approach (SFA) and on the estimation of expense preferences behavior. The central proposition we test is whether governance structures that result from adopting one or the other approach of organization, matters in terms of performance measured as EFF. In this sense, this study is similar to earlier works ([Ingham, 1992], [Armour and Teece, 1978] and [Steer and Cable, 1978]) that test the hypothesis that the organizational structure of hierarchical firms—the U-form vs. M-form [Williamson, 1975]—matters in terms of performance. Two important differences between those studies and the present are the following: i) There, the focus is on hierarchical firms of consolidated joint-stock ownership that adopt alternative governance structure for the purpose of economizing on transaction costs; we study systems of independently owned cooperative firms that choose to enter or not into long-term network relations, also for the purpose of economizing on transaction costs;<sup>3</sup> ii) We use measures of efficiency that reflect modern

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<sup>1</sup>Throughout the text we will use TCE based standard terminology with only scant or no explanation of its meaning. The reader is referred to the latest compilation in terms of methodology and advances made using the approach [Williamson, 1996] for definitions and examples of uses of the terms. However, to facilitate the reading by individuals acquainted with cooperative studies likely to be interested in the study but that are unfamiliar with TCE, we explain through footnotes the meaning of some key concepts on which the theory is built.

<sup>2</sup>The DM is, in fact, a "strategic network" with a hierarchical structure of two layers with central nodes playing, among others, the role of "hub nodes" with clear responsibility for strategic decision making, and the base units focusing on operational aspects. In this sense, DM approaches closely an M-form organization [Williamson, 1975] but in which the "divisions" keep their legal independence and the central hub-nodes, despite its strategic functions, is an agent of the base units. The analysis of different forms of networks is a subject on itself that will not be covered here. For this reason we will use the expression "network" when referring to the DM, suppressing the qualifier "strategic." The USCU system, on the other hand presents a few network features. Detailed description of the differences between the two systems is beyond the scope of the paper and unnecessary to achieve our purpose of explaining and testing the efficiency of alternative organization models for systems of FC.

<sup>3</sup>In TCE terminology these are hybrids, organizations that display "various forms of long-term contracting, reciprocal trading,

performance analysis of financial intermediaries.<sup>4</sup> Throughout the paper we will denote both credit unions and *caisses populaires* simply as financial cooperatives (FC).

## 2 A TCE based theory of cooperative networks

In this section we will develop the model of networks of FC, providing an explanation of why networks appear to be a preferred choice of governance—rather than remaining isolated or merge into large organizations—and appear to present a considerable success. We will do this by first, summarizing some key concepts on contractual law and the way they affect inter-firm relations. Then, we present a few key stylized facts about FC on which we build the model. This is followed by an exposition of why appropriability hazard (one of three critical dimensions of inter-firm relationships) is the prevailing form of contractual hazard in inter-FC relations and why expense preferences is a key shift parameter that influences the way FC may optimally govern these relations. In the last part of the section we focus on two special issues in networks: the role of mergers *within* networks, and the role of the so-called “subsidiarity principle,” often used in networks of FC to reinforce high-powered autonomous incentives. We close by collecting the refutable propositions that can be extracted from the theoretical arguments.

### 2.1 Networks as a discrete organizational choice of economic organization

One important aspect of network structures, is its discreteness as an organizational form.<sup>5</sup> Networks are one among a limited number of generic forms of organizing economic activity that includes also markets and hierarchies on both sides of the spectrum.<sup>6</sup> Institutional—or governance—choices are discrete rather than on a continuous line because discrete contract law differences provide crucial support for and serve to define each generic form of governance ([Williamson, 1991] pp. 270.) and each generic form is supported and defined by a distinctive contract law. Under market, the applicable contract law is the classical, that emphasizes discreteness of transaction, presentation of benefits to the parties and that its enforcement is assured by the courts.<sup>7</sup> This emphasis on discreteness and presentation of classical contract law is in full agreement with the nature of the transactions that in economics are understood under markets (as opposed to hierarchies). Hierarchies, on the other hand, are supported by the contract law of forbearance (or relational contract law). The third form, hybrids, are not a loose amalgam of markets and hierarchies. They possess their own disciplined rationale; in networks—and hybrids in general—contracting is supported by neoclassical contract law.<sup>8</sup> Neoclassical contract law provides support for long term relationships with two key characteristics: i) gaps in the planning of responses expected from the contracting parties<sup>9</sup>; and ii)

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regulation, franchising and the like” ([Williamson, 1996], pp.104).

<sup>4</sup>The works cited above use the rate of return on stockholder’s equity as measure of performance. This measure would be inadequate for FC and out of line with measures of financial intermediary performance standard in the literature. This literature will be reviewed later on.

<sup>5</sup>Discreteness of organizations has been studied elsewhere ([Simon, 1978], [Williamson, 1985] and [Arregle, Cauvin, Ghertman, Grand and Rousseau, 2000] (Ch. 2) and citation therein) under the name of “discrete structural analysis.”

<sup>6</sup>Markets is a form of economic organization in which individual buyers and sellers bear no dependency relation to each other. If contracts are renewed period per period, that is only because current suppliers are continuously meeting bids in the spot market. Hierarchies appear when transactions are internalized into an enterprise (the classical buy versus make options). The reader will note that we use the expression hierarchy in the very restricted sense defined by transaction costs economics given above. *Networks* are also hierarchies when the term is used in a wider sense as multilayered organizations.

<sup>7</sup>A discrete transaction is one that is entirely separated not only from all other present relations but also from all past and future relations as well. Presentation refers to the effort of identifying explicitly the current value for the parties of all consequences implied by the exchange supported by the contract. A good example of presentation is the case of an insurance contract. In a classical contract framework a purchaser of an insurance contract “is deemed to have consented not only to the terms in the policy which they did not read and could not have understood if they had, but also to all the interpretations the law would make of those terms” [Macneil, 1978].

<sup>8</sup>Neoclassical contract law and excuse doctrine apply to contracts in which the parties to the transaction maintain autonomy but are bilaterally dependent to a nontrivial degree. As noted by Macneil [Macneil, 1978], “the long-term economic relations in question are between firms rather than within a firm”. Interpreting the contractual arrangement that exists between firms in a network as an interfirm rather than an intra-firm contract is in line with the (often fiercely defended) independent character and local ownership of individual FC in a network.

<sup>9</sup>The existence of these gaps becomes more important the longer the relationship and the diversity of situations that must be covered by the contract. In a network of FC, the relationship has, by definition, an undefined duration and covers a complex set of business activities. Such contracts are bound to have considerable gaps in the planning of responses required from the

a range of processes and techniques used by contract planners to create flexibility and avoid leaving gaps or build in inflexibility ([Macneil, 1978], pp. 865). The parties to such contract maintain autonomy, but the contract is mediated by an elastic contracting mechanism that is supported by governance structures that will serve to fill the planning gaps and solve potential conflicts when need arises. These contracting mechanisms includes arbitration, take-or-pay procurement, tied sales, agreement to agree, reciprocity, standards and regulation among others ([Williamson, 1991], pp. 269, [Macneil, 1978], pp. 866-873). Reciprocity and regulation are two of the contracting mechanism used in networks of FC and that appear to play a key role in the working of these organizations. These mechanisms will be describe later on. Thus, the principal difference between markets and networks is the duration of the contractual relationship and the supporting contractual law (classical vs. neoclassical respectively) while both forms are similar in that agents conserve autonomy. Similarly, the principal difference between hierarchies and hybrids/networks is the autonomy of the agents (being lost in one and conserved in the other) and the supporting contract law (forbearance and neoclassical respectively), while the similarity is that governance structures become necessary.<sup>10</sup>

Institutional forms supported by one or other form of contracting laws do not appear in a continuum. Neither should it be expected that there is an infinite variation of possible generic institutional forms that will operate with similar level of efficiency, although many *local* –i.e. relatively minor–institutional variations are likely to exist. The importance of this notion in our analysis of networks (of FC) is double: i) it serves to explain that many different experiments of institutional innovation at the international level, related or independent, converge to generic structures, where the relationships between agents are governed by similar mechanisms; ii) changes in the legal and judiciary context may create highly consequential disturbances that may impede or facilitate the establishment of a particular generic form or a particular implementation, or make the implementation of such structures particularly fragile or robust.<sup>11</sup> It is known that hybrid economic relations are used in situation where:

- Mergers may be too risky in view of the uncertainties of the project. In these cases networking allows to engage in reversible commitments (in this sense networks create valuable real-type options). Ex. Joint mining or technology development projects.
- Exploitation of economies of scale and scope in the production of inputs while conserving independence of the contracting parties (protection of residual property rights) is desired. Ex. Printing, banking, biotechnology.
- Providers of complementary services join in a long-term relationship to provide customers expanded value through coordination in the provision of the services. Ex. Passenger airline industry (e.g. Star and Skyteam alliances) and software.<sup>12</sup>
- Providers and users of a service that implies investment in highly specific assets (e.g. the classical case of the contractual relation between a utility producer and the distributor of the service).

In each of these case a TCE rationale can be found at the root of the formation of the network/hybrid economic relationship. The second application is the one pioneered by FC with a huge success, measured by the enormous scale and complexity of some of the European networks.

## 2.2 Stylized facts

To analyze the economic rationale for the creation of networks of FC we must first establish a few stylized facts about FC and the networks they often form:

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parties.

<sup>10</sup>The sociology literature also recognizes the existence of three fundamental types of interfaces between economic agents: relationship (hierarchy), transactions (markets) and hybrids, with attributes similar to those provided by TCE theorists [Baker, 1990].

<sup>11</sup>In the case of systems of FC, several examples could be provided (e.g. Argentina, Belgium, Mexico, Uruguay) of legal disturbances that caused significant shifts in the governance of the systems.

<sup>12</sup>An example of this latter type of arrangement is the E-4 Security alliance formed during 2003. It consist of four leading firms in Internet security software: Trend Micro, Nokia, Check Point and Internet Security Systems that cover complementary software to protect servers from virus, hackers' and crackers' attacks.

1. In contrast to the analysis of buy vs. make usually performed in the context of TCE, the contractual arrangements we are focusing on do not imply a vertical relationship of provision of an input from a supplier to a buyer. In the case of FC it is a mutual lateral (horizontal) dependency that develops between the parties (individual FC: first-tier nodes). Specifically, the mutual lateral dependency arises from a pure production-economics imperative. This, consists of the need to join forces to exploit economies of scale and to reduce the uncertainty in the acquisition of inputs and the management of infrastructure required to perform the intermediation process. This feature does not invalidate the analytical framework provided by TCE, but takes us away from the analysis traditionally performed using this framework. The same type of motivation appears to be at the root of the other networks we have made reference to in the previous section. Technological alliances have been object to a similar analysis [Oxley, 1997]. As in those alliances, the mutual lateral dependency between first-tier nodes arises from cooperative efforts to exploit jointly technologies, marketing, cross licencing, production and infrastructure management through: equity joint ventures, franchise arrangements and other multilateral contractual agreements.
2. Pursue of economies of scale is one reason to engage in lateral contractual relations between first-tier nodes, but is not the only. In fact, uncertainty is at least an equal, and perhaps a more important agglomerating factor. Creating joint mechanisms to reduce uncertainty in the acquisition of inputs can be a powerful incentive to engage in lateral contracts. In fact, circumstantial evidence suggests that networks that today have reached an impressive level of development, were often formed to better manage uncertainty facing individual FC through organs that represented them jointly.<sup>13</sup>
3. Therefore, while TCE provides the tools to analyze the choice of governance structure (among discrete forms: market, hybrids and hierarchies), the initial motivation of establishing a relationship between units is not one of transaction cost economizing, but one that results from production economics imperatives to exploit economies of scale and reduce uncertainty in the acquisition of inputs. However, to achieve this goal, individual FC could choose either mergers that would establish a hierarchy-like organization supported by relational contracts. Or they can choose a hybrid type of relationships supported by neoclassical contracts in which the parties to the transaction maintain autonomy but are bilaterally dependent to a nontrivial degree. As noted before, these contracts provide support for long term relationships with two key characteristics: i) the existence of gaps in the planning of responses by the contracting parties; and ii) the presence of a range of processes and techniques used by contract planners to create flexibility ([Macneil, 1978], pp. 865). The units that participate in such contract maintain autonomy, but the contract is mediated by the elastic contracting mechanism. In this choice, *merger vs. network*, the arguments that play the central role are transaction costs economizing ones. It may perhaps appear to the reader unfamiliar with TCE that the choice in terms of efficiency of the contractual relationship is rather obvious (in favor of mergers).<sup>14</sup> This intuition derives from the fact –addressed below– that a hierarchy-like organization is likely to lead to lower production and coordination costs. However, we will have the opportunity to present arguments supporting the notion that this choice is likely *not* the best. Rather, for transaction economizing arguments networks are likely to be a better choice.
4. A comprehensive understanding of these types of organizations requires thus a two-step analysis. The first is the purely production economics part of the analysis that deals with the issue of achieving gains in the cost of acquisition of inputs. The second is the organization economics analysis that focuses on the type of contractual relationship that will be established between the units (the *discriminating*

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<sup>13</sup>FC face relatively low output oriented uncertainty with owner/members being also the clients usually belonging to a clearly defined community. However, they face considerable levels of uncertainty on the inputs they require to provide their members with desired financial services. The very root of networks of FC, the Raiffeisen Regional Cooperative Bank (*DG Bank*), created in 1865 to manage member liquidity, is one excellent example.

<sup>14</sup>In fact the policy oriented literature of promotion of FC is choke-full of well intended but ill informed recommendations to do precisely that: merger to achieve economies of scale. It often does a great disservice to the FC they want to help exposing them to considerable risks of other nature. As we will see below, mergers is likely not the optimal governance choice at all when economies of scale in the acquisition on inputs and infrastructure management is the motivation for engaging in lateral contracting.

*alignment*).<sup>15</sup> <sup>16</sup> The collective contract that establishes the conditions of adherence to the network by the first-tier nodes, to which the collective is tied and that defines the rights and obligations of the collective will be called the *network subscription agreement (NSA)*.<sup>17</sup> In this work we will ignore the production economics problem and focus on the governance issue. This latter will be treated using TCE arguments.

5. While the two problems, the production economics and the governance economics can be treated separately and using different analysis tools, they are not independent of each other. In fact, as shown elsewhere ([Riordan and Williamson, 1985], pp. 106) they are most likely negatively related. When individual units choose to establish lateral dependency relationships, they do this with the goal of reducing production costs (through economies of scale in input acquisition and infrastructure management). But they will do this at increasing governance cost required to manage the relation. In traditional TCE analysis, the next step, hybrids, provides middle of the road savings in production costs and middle of the road increases in governance costs; hierarchy, on the other hand will provide maximum gains in production costs but maximum governance costs. FC wanting to engage in a NSA to gain economies of scale will unambiguously face increased governance costs. The challenge we face is to demonstrate which choice of combination in production and governance costs is the optimal for FC.

### 2.3 Contractual hazards in cooperative organizations

In the archetypal problem of vertical integration the focus of transaction cost analysis is on mitigation of hold-up problems associated with investment in specific assets.<sup>18</sup> However, asset specificity is only one among three critical dimensions; the other two usually identified are frequency of transactions and uncertainty of transaction. Just as asset specificity accepts many distinctions –site, physical, human-asset, etc. (see [Williamson, 1996], pp.105), within the dimension of transaction uncertainty it is possible to accept a number of sources of uncertainty. While less has been said about the different forms this critical dimension may take, one particular form of contractual hazard that has received increased attention in the literature is *appropriability hazard*. This hazard arises in situations of interfirm alliances that involve technology transfers and common production of goods and services in the presence of weak property rights ([Hagedoorn, 1993], [Oxley, 1997]). Appropriability hazard (AH) can be traced to difficulties in adequately specifying payoff-relevant activities under conditions of bounded rationality, monitoring the execution of prescribed activities, and/or enforcing contracts through the courts to control opportunism [Oxley, 1997].

When FC join, either through networks or mergers, to undertake the joint production of a designated segment of goods, member/owners of the first-tier nodes entering into the arrangement give up control of the distribution of payoffs of the joint activity. In doing so they incur in AH.<sup>19</sup> However, protection of these property rights through the court is near impossible given the difficulties of third-party verification. That is,

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<sup>15</sup>There is yet another transaction economizing problem that arises. It is the one that must be solved to optimize the relationship between the (joint) acquirers of inputs—the hierarchy or the network—and the supplier of those inputs. This is a secondary problem that we will also ignore. In practice, in the decision buy vs. make, networks of FC often choose to acquire many of the suppliers of inputs.

<sup>16</sup>From a methodological point of view, the first step could perhaps be approached using the theory of the club. This is so because a *network* can be viewed as a *private collective (of enterprises) deriving mutual benefits from procuring and sharing common (or network) services characterized by excludable benefits, by establishing an organization with a representation governance that is empowered by the members to procure designated segments of common services*. The parallel of this definition with that of a club is rather obvious. Club theory can potentially provide the mathematical instruments and theorems necessary to explain the decision to join the club (the Samuelson condition), the choice of designated segment of common services and inputs, the optimal size of the network in terms of members, the size of the network facility and other second order economizing problems. This theory will however not solve the first order economizing problem of the choice of economic organization that must be adopted to govern the relationship between the contracting parties.

<sup>17</sup>In most networks of FC this NSA does not exist. Rather, the talk is of statutes and by-laws of a federation. since they play exactly the same role as a NSA, for the purpose of our analysis these are semantic differences. Interestingly, in the case of Promutuel of Quebec—a network of insurance cooperatives—a NSA exists explicitly.

<sup>18</sup>The specificity of an asset generally makes reference to the "degree to which that asset can be deployed to an alternative use without sacrifice of productive value" (e.g. [Williamson, 1996], pp. 59).

<sup>19</sup>We do not exclude the possibility that asset specificity may also be an issue. However appropriability hazard provides a more straightforward explanation of the type of risk facing parties that engage in a multilateral contract designed for joint production, acquisition and management of inputs.

when FC enter into a NSA or into a merger the protection of the property rights to the subscribing parties falls out of the competence of the courts.<sup>20</sup> This protection can only be achieved through mechanisms built into the network governance institutions. The loss of control over the distribution of payoffs increases with the intensity of the delegation of decision powers towards the alliance integration structures. In fact, it reaches its highest point when a full merger of all activities is the choice of governance structure. In this case, the property rights of individual members are fully diluted into those of the new institution. One should expect that contracting parties will be reticent to engage in such arrangements unless a reasonable guarantee exists that the parties' property rights will indeed be protected. In the context of cooperative governance structures this is difficult to do. Given the one-member-one-vote principle, all that is needed to accomplish expropriation of individual property rights of members of a FC entering into a merger, is that the partner FC has a larger membership.

It has been argued [Oxley, 1997] that AH increases when i) the alliance involves product or process designs—rather than when only production or marketing activities are undertaken; ii) the range of products increases; iii) a wider geographical area is covered by the alliance; iv) more firms are involved. These are all factors that play a role in networks of FC: they typically engage in product design and production, they can cover an enormous range of products and huge geographical areas—often the entire country—and involve hundreds or thousands of institutions. In the context of FC, another factor to consider is that AH will be a positive function of the size of the institution. Small FC typically provide a narrow range of relatively low technology financial products and services. In consequence, when entering any lateral contract arrangement, they will be subject to a relatively low level of AH. As the institution grows in size it is likely to offer a wider range of products with increasingly complex technology incorporated into them. Further, if they merge in order to gain in economies of scale or engage in limited purpose—CUSOS<sup>21</sup>—or general purpose networks with the aim procuring and sharing common (or network) services the technology component of the products and services offered is also likely to increase.

As proposed elsewhere ([Williamson, 1996], pp. 107) let governance costs be defined as a family of function  $G_J = G_J(k, \theta)$  of AH,  $k$ , some shift parameters,  $\theta$ , and  $J = \{M, N, H\}$  where  $M$  stands for market type contractual relationships supported by neoclassical contractual relations,  $N$  stands for hybrid relationships (alliances, networks, etc.) supported by neo-classical contractual relationships, and  $H$  stands for hierarchical (merger) relationships supported by relational contracts. It is also standard to assume that  $G_M(0) < G_N(0) < G_H(0)$  and that  $G'_M > G'_N > G'_H$ . This, of course, reflect the decreasing power of incentives of increasingly complex organizations setup to govern the relationship. The default low-cost governance,  $M$ , is a simple spot contract supported by classical contract law. Any other governance structure, such as an alliance or a network,  $N$ , or a full merger of partners,  $H$ , implies larger governance costs even in the absence of any contractual hazard ( $G_J(0)$ ), justifying the first set of inequalities. In a graph with horizontal axe representing contractual hazard,  $k$ , and vertical axe governance costs,  $G_J$ , the curve corresponding to  $M$  would cross the intercept at the lowest point with  $N$  and  $H$  displaying higher intercepts.<sup>22</sup>

## 2.4 The role of expense preferences

Shift parameters usually play little role in TCE analysis. However, one shift parameter that appears to us to be of particular importance in the analysis of mutual financial intermediaries is *expense preference* (EP) behavior by managers. It is an established fact that managers are not neutral when it comes to the allocation of resources into different inputs used by the firm they control.<sup>23</sup> Rather, like any individual with bounded rationality and opportunist behavior, they are likely to engage in subgoal pursuit if given the opportunity. Among the opportunities of subgoal pursuit, engaging in certain expenses such as personnel and fixed assets

<sup>20</sup>A continuous appeal to the courts to settle differences within a network of tens, hundreds or thousands of firms—as is the case in these FC networks—would render it hopelessly cumbersome and unresponsive to disturbances. The whole purpose of the network would thus be defeated.

<sup>21</sup>CUSOS (Credit Union Service Organizations, common in the United States). We explain these organizations later on.

<sup>22</sup>Traditionally the graph has been used to represent on the horizontal axe asset specificity. In our analysis we have not encountered any contradiction in extending the use of the graph to AH. The analysis is in effect simplified when using AH. As in the analysis of asset specificity,  $\Delta G = G_H - G_N \lesseqgtr 0$  depending upon the level of AH, while changes in production costs (excluding governance costs) as a result of exploiting economies of joint acquisition (purchase or production)  $\Delta C = C_H - C_N < 0$ , unambiguously. This is not the case of asset specificity in which case  $\Delta C$  is a convex function asymptotic to the asset specificity axe [Riordan and Williamson, 1985].

<sup>23</sup>Incidentally, this is an analysis that was also formalized by Williamson ([Williamson, December 1963]).



are likely to be favored. Further, this type of subgoal pursuit can be expected to be accentuated with diffusion of ownership [Nicols, 1967] which, in the case of cooperative institutions, is positively correlated with the size of the institution. Thus, *ceteris paribus*, larger institutions can be expected to display increasing deviations from the cost minimizing optimum. This is due to the cooperative principle of one-member one-vote and the free riding of monitoring phenomenon. These central propositions have been adapted to the context of mutual financial intermediaries and have found unambiguous support in empirical studies ([Gropner and Beard, 1995], [Akella and Greenbaum, 1988]).<sup>24</sup> Three key features of mutuals makes governance less efficient and thus more prone to be beset by EP problems:

1. The one-member one-vote bars the possibility that single shareholders may take important or dominating positions that will encourage monitoring. Every member is limited, by the very nature of the cooperative form, to a control of one over the number of members in the mutual;
2. Shares are not traded in secondary markets at floating prices, all shares are bought from and sold to the mutual at book value.<sup>25</sup> This prevents markets from incorporating into prices investor appreciation about the quality of management, which in turn would affect the cost of financing of the enterprise;<sup>26</sup>
3. There is no market for corporate control. Control of a mutual cannot be obtained by bidding for shares in either hostile or friendly takeover.

The absence of these disciplining mechanisms in FC encourages entrenchment and provides conditions for severe EP behavior. Thus governance in all forms of mutuals –including FC–is considerably weaker than in joint stock firms. As a result, in mutuals, EP of managers is always an issue of significant consequences and governance is typically problematic. In fact, one manifestation of EPs is that managers tend to overdimension the organizations they lead beyond the optimum economic size. We will not enter into details of these propositions and their empirical support since they are well documented, but will use the results directly in our analysis. The central idea is that the deviation of cost minimizing behavior manifested as EP increases with the size of the institution. The implication is that size of institution associated to the different governance forms has consequential impact on that choice. In all those governance forms that imply the existence of large institutions, be they the form  $M$ ,  $N$  or  $H$ , higher governance costs can be expected as a result of managers’s EPs.

In traditional TCE analysis, as contractual hazard in the form of asset specificity increases, the optimal organizational choice changes discretely from market to hybrid to hierarchy as each of these governance forms dominates along a governance costs economizing frontier. We propose that in the case of FC, EP, viewed as a shift parameter, plays a determinant role in governance costs and choices, increasing significantly  $G'_H$ .<sup>27</sup> As institutions grow in size due to mergers, EP will accentuate. Thus, FC that face the need, due to production economic imperatives, to engage in lateral contracts, must decide among three choices: i) remain tied up in spot contractual relations increasingly unsuitable for the long-term nature of the relationship and for the level of contractual hazard; ii) lock themselves up into merger operations where AH of member residual property rights are high, complicated by EP hazard associated with the dilution of ownership; or iii) engage themselves into alliances with improved protection against AH and where the exercise of EPs is limited. Accentuated governance costs associated with  $H$  due to EP in turn implies that hybrids –networks– will be the governance mechanism of choice over a wide range of level of appropriability hazard–the “swollen middle” [Hennart, 1993]. As a result, systems of FC that seek to increase services to their members through pooling of resources will either adapt by adopting efficient governance mechanisms thus remaining on the governance cost economizing frontier, or pay the price of lack of adaptation with inefficient governance mechanisms.

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<sup>24</sup>The effect was also found in the United States Savings and Loans sector ( [Mester, 1991], [Mester, 1989], [Verbrugge and Goldstein, 1981a], [Verbrugge and Goldstein, Spring, 1981b], [Verbrugge and Jahera, 1981]) and in other industries ([Oswald and Gardiner, 1994], [Awh and Primeaux, 1985], [Rhoades, 1980]) and in mutual property liability insurance firms [Cummins, Weiss and Zi, 1999]. Further, there is an extensive empirical literature of the role of “agency conflicts” –a parallel concept that describes manager-owner relations from a different theoretical perspective [Jensen and Meckling, 1976]–in firm performance. Most studies support a negative relation between ownership diffusion and performance (e.g. [Lins, 2000], [Su, 2000]).

<sup>25</sup>Except, of course, in the once in a lifetime cases of those cooperatives that choose to demutualize.

<sup>26</sup>Residual market discipline remains, with deposits that can be, and often are, priced to reflect management quality.

<sup>27</sup>In fact, it is likely that the northwest shift occurs in both  $G'_H$  and  $G'_N$ . However, it suffices that  $\Delta G'_H > \Delta G'_N$  for the analysis to hold. As we will see below, this can easily be justified.

Given the established understanding about the role of EPs in organization in general, and in mutual financial intermediaries in particular, it is easy to see that they will have an impact on governance costs in the case of FC that become large by means of mergers ( $H$ ), accompanied by an increase in contractual hazard. But why should networks be useful in restraining EPs? The argument is similar to that used to explain the superiority, under certain conditions, of the M-form organization when compared with the U-form organization, a proposition that also counts with empirical support. There are two reasons why networks will tend to curb EP. They are:

1. Networks, by establishing lateral partnerships supported by neoclassical contracts, implies that individual institutions remain small, however large the network –in terms of number of members– may be. Indeed, the Quebec *Desjardins* network has over 1000 member institutions with a total of over 5.0 million shareholder/clients. In Europe, the German *Raiffeisen-Volksbank* networks is composed of over 2000 individual FC that service almost 14 million member clients (and another 16 million non-member clients). The largest individual United States credit union is much larger than the largest individual *Desjardins caisse populaire*. Similarly, the largest Ontario credit union is larger than the largest *Desjardins caisse populaire*, although the DM taken together is several times the Ontario credit union movement, in an economy that is considerably smaller.
2. In networks a separation is made between strategic decision making and tactical or operational decision making. A central node is responsible for proposing or taking strategic decisions –often subject to approval by the membership through representative governance bodies– with first-tier nodes being responsible for day-to-day operations and performance of the members of the network and the contact with the shareholder/client. The situation is thus similar to the one that justifies the existence–and superiority under specific circumstances– of the M-form organization ([Williamson, 1996], [Ingham, 1992], [Armour and Teece, 1978] and [Steer and Cable, 1978]).<sup>28</sup>

Managers of first-tier nodes are responsible before the second tier nodes –charged with strategic planning and performance appraisal– for the performance of the node they administer in terms of the satisfaction of strategic objectives and performance standards. Conversely, managers of second tier nodes are accountable to the first-tier organizations for strategic management of the network. In fact, systems of FC have adopted the strategy proposed for franchisers (e.g. [Williamson, 1996], pp 64-65 and [Klein and Leffler, 1981]) in which these engage the services of an agent to police performance of member institutions. Given that the banking licence held by individual FC, and its charter value, depends on the performance of each individual unit and the network as a whole, the policing agent becomes in effect a supervisor, often adopting the standards of the state regulatory authority.<sup>29</sup> As a result, managers of individual FC are now subject to two controls: the one emanating from the membership through the governance bodies (Board of Directors and Supervision/auditing Committees) and the one emanating from the strategic second tier bodies. In practice, *every* major system of FC that adopted the network model of organization in the developed and developing world, engages de services of a policing agent responsible for market practices and prudential supervision of the first-tier nodes. Thus, (self)regulation is one of the key contracting mechanisms that supports the stability of networks of FC. What varies between networks is the degree of independence between the strategic nodes and these supervisory bodies. This independence is relatively high in the case of the German *Raiffeisen-Volksbank* network and almost non-existent in the Brazilian *Sicredi* or the Korean *NACF* (National Agricultural Cooperatives Federation, which, despite its name, is a network of mostly FC) networks. The upshot is, networks of FC –in the way they have been implemented almost universally– provide explicitly mechanisms to reinforce the governance of individual units and thus curb EP.<sup>30</sup> Thus,

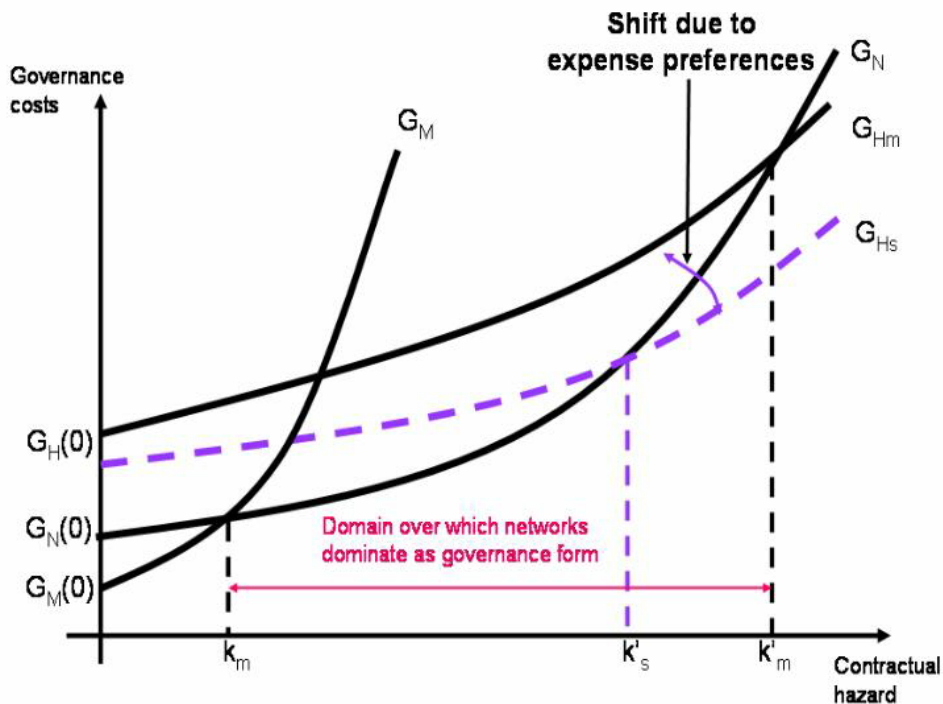
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<sup>28</sup>We cannot ignore the possibility that for a network to function adequately, the first-tier nodes must achieve a minimum size below which they may be unsuitable partners for the alliance. One of the reasons why this could be the case is that by being a member of the network, the range of products offered to its members may increase dramatically. Very small nodes would find it difficult to deliver to its members this vast array of products. This is perhaps the reason that is compelling some of the networks (*Desjardins* and the German *Raiffeisen-Volksbanks* systems among others) to encourage mergers of smaller nodes when practically feasible from the geographical point of view. We will return on this question later on.

<sup>29</sup>In effect, in networks of FC the action by the policing agent has become auxiliary of state banking regulation, in which the latter "delegates" the supervision of individual units to the network policing agent. The specific institutional setup of this policing agent varies from system to system, but the function is identical.

<sup>30</sup>This feature, like several other remarkable regularities present in networks of FC, appear to have been developed more or less independently in different parts of the world. In other words, systems of FC, when they negotiate the mechanisms that will

Figure 1: Expense preference and network dominance in financial cooperatives



other things equal, FC members of networks should display lower exposure to EP. One prediction that can be drawn from this analysis is that, *ceteris paribus* networks should display lower variance in the size as well as in performance indicators of FC operating in a particular market.

Figure 1 illustrates this reasoning. The curves  $G_M$ ,  $G_N$ , and  $G_H$  correspond to the governance cost function for markets, networks and hierarchies respectively. In the figure we have represented two functions for those corresponding to hierarchies ( $G_{H_s}$  and  $G_{H_m}$ ) with  $G_{H_s}(0) < G_{H_m}(0)$  and  $G'_{H_m} > G'_{H_s}$ . This illustrates the fact that those forms of enterprises –say joint stock firms,  $s$ – in which governance is more efficient than mutuals,  $m$ , a less rapid increase in governance costs will be observed as contractual hazard (and firm size) increases. The shift may be just parallel and equal to  $G_{H_m}(0) - G_{H_s}(0)$ , but it may also vary according to AH. In fact, the case could be made that this shift may increase with AH as increase in this will provide managers increased possibilities to exercise EP. The result of this shift results in a range of contractual hazards ( $k_s$  to  $k'_s$ ) for joint stock firms over which hybrids is the preferred governance form that is considerably narrower than that corresponding to mutuals ( $k_m$  to  $k'_m$ ). No doubt, EP are also an issue in networks, however for reasons exposed above it is less so than in the other two forms of corporate governance. How important this shift may be, is of course an empirical question. The shift does not have to be very large to produce the effect just described. It just needs to be sufficiently large to span the relevant range of contractual hazards under which most FC operate. Also, whether  $G_{H_m}$  and  $G_N$  cross at all, or whether the reduction of costs of ex-post haggling between partners more than compensates for the increase in EP that may result in mergers to insure that  $G'_N(k_i) > G'_{H_m}(k_i)$  for each  $i$ , are both open questions worth investigating. An interesting observation is that strategic networks –i.e. networks where the separation of strategic and operational decision making is accomplished– are neighbors of the M-form organizations, the

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govern the partnership, arrive independently to mechanisms that may differ slightly in their institutional setup, but play the same role. While there is indeed evidence that some networks have copied certain features from a predecessor, in other cases all circumstances suggest repeated independent development with the same result. Clearly, the use of regulation is a discriminating alignment that has demonstrated its usefulness in repeated and independent situations.

first placed just to the left of  $k'_j$  –the point of switch of dominance of  $G_{Nj}$  over  $G_{Hj}$  to the opposite– and the second just to the right ([Williamson, 1996], pp. 109)

Based on this analysis, we can predict with very reasonable confidence that over ranges of contractual hazard that are very small – i.e. FC that are relatively small and unsophisticated in the services they provide to their members and do not wish to expand those services– one can expect to see institutions that remain independent or tied up in only very loose arrangement. This is the typical situation of many developing countries in which FC is an incipient sector offering only very basic financial services. This is, anyway, often all the community they serve needs. The picture on the other end is less clear. However, we adventure to posit that either:

- the gains to be made in costs due to reduced ex-post haggling is insufficient to compensate for more severe EP that result from mergers, thus resulting in  $G'_N(k_i) \not> G'_{Hm}(k_i)$  for every  $i$ , which may result in  $G_{Hm}$  and  $G_N$  not crossing at all.
- contractual hazard has not been large enough to justify the step of merging networks into consolidated organizations.

The basis for making this assertion is the following. First, the reasoning, if correct, implies that over relatively large regions of contractual hazard one should observe FC joining into networks. Only as contractual hazard increase in importance should one observe that outright mergers may become a dominant choice in terms of governance cost economizing. This is a statement that is valid only for the case of FC. It is easy to describe situations that apply to other types of institutions in which the hybrid option does not dominate over any range of contractual hazard. In fact, such a situation will occur if the frequency of disturbances is large enough ([Williamson, 1996], pp. 116-117). Other scenarios can easily be identified that would create the same result. Thus, the more or less obligatory *passage* through the form  $N$  before moving on to  $H$  is –as the dichotomy buy vs. make reveals– by no means universal. In the case of FC it is the important role of EP that makes this passage more or less obligatory. In the same vein, it might be interesting to investigate if particular systems of FC might be exposed to situations that would justify skipping  $N$  and moving on directly to  $H$ . Given the relative uniformity of the services provided by FC everywhere–with those organized around networks invariably providing the widest and more sophisticated range of financial services and thus being exposed to highest contractual hazard–we do not believe that this is the case. We do not know of any system of FC that has performed this transition as a system:  $M$  to  $N$  to  $H$ . That is, we do not know of any system of FC that was once organized as a network and has chosen to consolidate operations into a single organization in which contractual support has moved from neo-classical contract law to a purely relational contractual environment with consolidation of ownership into a single entity.

Second, often FC merge into larger organizations, sometimes quite large ones. There are two possible explanations to this phenomenon. i) They are the result of pure EP behavior by aggressive managers that seek to do exactly what EP suggests, create oversized and suboptimal organizations.<sup>31</sup> ii) Under the cover of an apparent legally consolidated organization they have introduced rule of governance that are designed to protect members from AH vis a vis the rest of the system and that mimic neoclassical contract law. These are just networks with a gloss of hierarchy.<sup>32</sup> This allows us to provide a refutable hypothesis: in the case of organizations that resulted from the exercise of EP, they should present governance –and overall–costs, for equal level of contractual hazard, that are superior than those operating in a network regime. The alternative hypothesis is that mergers lead to economies of scale and asset diversification that makes them more, not less, efficient. This hypothesis will be tested.

From a practical point of view it is of course unlikely that the choices of governance structure were made by this reasoning. Rather, different systems chose alternative approaches, that lead to structures that today

<sup>31</sup>We could cite several cases of FC in developing countries, particularly in Latin America, that would be likely to be the result of this. With a huge social cost, most of these institutions defaulted when their cost structure exceeded their means and have since exited the market [Desrochers and Fischer, 2002].

<sup>32</sup>Again, we could cite examples of such organizations in Latin America. Two of the most prominent ones are *Caja Popular Mexicana* and *Banco Credicoop* (Argentina). These institutions evolved into these structures as an adaptation to a regulatory environment that was hostile to networks of FC and thus were forced into organizational engineering that would conserve the attributes of networks while presenting an appearance of a consolidated organizations. Interestingly, these organizations could easily be “demerged” without changing fundamentally their governance structure and decision making practices. The reverse, merger, implies dramatic changes in the way decisions are made upsetting completely the balance of power between the first-tier and the central nodes.

display differing levels of performance or whose historical lack of performance has led to their extinction either by reorganization or by exit. In some countries, different groups of FC have sometimes taken different institutional approaches resulting in the coexistence of more than one organizational form. Indeed, reality is more complex than what a parsimonious model of that reality would suggest. The merger vs. network dichotomy we propose here may become entangled. This is, for example, the case in our two case studies (United States and Quebec). In the United States, FC have favored growth either by internal means or through mergers. In Quebec, over the last 50 years, FC (now unified under the *Desjardins* banner) have become highly integrated into a network. However, in the United States FC increasingly join in limited purpose networks –in contrast to all purpose networks such as *Desjardins* and others– known as CUSOs (Credit Union Service Organizations).<sup>33</sup> On the other hand, *Desjardins* –and other networks of FC– have, in the last few years engaged in a considerable consolidation of its structure encouraging merger activity, specially among the smallest members of the network.<sup>34</sup> We will address explicitly this issue below. Yet, care has been taken to discourage formation of very large FC, to seek a balance in the size of member units and to encourage a deepening of the division of labor between member FC and the network second-tier nodes. That is, the merger activity was designed to strengthen the ties and increase efficiency within the networks. These processes result in two clearly distinguishable models of cooperative organization and governance. The United States credit union system, with a loose level of integration with some very large institutions that result from mergers and internal growth on one hand. On the other, the Quebec *Desjardins* movement built a strategic network where central nodes provide a wide range of inputs, infrastructure management services, strategic leadership and monitoring functions.

## 2.5 Mergers in networks

While in network based system hybrid contractual arrangements dominate, as we noted earlier, mergers among network members are not uncommon. This suggests that, given certain circumstances, in multilateral hybrid systems merging and networking may not always be mutually exclusive contractual arrangements. That is, subset of units, while controlling much of contractual hazard resulting of lateral relations through network arrangements, may still benefit from mergers among them. This is a somewhat unusual setting in the context of TCE where hybrids and mergers are seen as mutually exclusive mechanisms.

We will exclude those kind of mergers that may be exclusively the result of managers subgoal pursuit, and to which we made reference earlier. Making use of TCE analytical tools, it is possible to conceive situations where, despite the existence of a network governance structure, local mergers may be desirable. A solution to the puzzle has been provided by Williamson (e.g. [Williamson, 1996]) by explaining the role of another critical dimension in contractual relations, frequency of transactions. To see the role of frequency of transactions in the context presented thus far, imagine the following scenario. A multilateral networks as the one described in previous section exists. This network was created to govern the joint venture relationships designed solve the pure production-economics type of imperative to exploit economies of scale and to reduce the uncertainty in the acquisition of inputs and the management of infrastructure required to complete the intermediation process. However, for a subsets of network members *local* imperatives develop. The situation can most easily be seen in, say two, neighboring FC. There:

1. The membership/clientele engages in multiple and frequent crossed transactions that involve resources of both institutions. Examples of these transactions may be the use of each others ATM resulting in continuous settling of balances between the parties. Under these conditions, merging the institution to internalize transactions presents operational cost advantages that more than compensate increased governance costs –due to EP–that may result from a merger, and that are generally controlled by the regulatory bodies of the network.
2. These two institutions, due to territorial commonality of their membership, may benefit from pooling infrastructure which cannot be furnished advantageously by the network (e.g. buildings, ATM).

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<sup>33</sup>These are joint ventures of a limited number of FC in which some specific resources are pooled and jointly used by the members of the CUSO. They are hybrid/network organizations in the sense given to the word in TCE. Examples of resources pooled under CUSO are ATMs and Common service branches. However, U.S. FC have not reached the level of network integration that characterizes *Desjardins*, where every FC in the system participates in a vast club of common resources and pooling of risk coupled with a sophisticated governance structure. In fact, most U.S. based FC have not joined any CUSO.

<sup>34</sup>Leaders of the *Desjardins* movement have set the target of reducing the number of FC from over 1200 to below 800.

3. Finally, and most importantly, owner-members of both institutions may perceive that the protection of their residual rights may not be in peril in a merger since the commonality of interests is sufficient to prevent expropriation by either partners. Further, the network structure provide adequate compensatory control over management subgoal pursuit despite dilution of direct control by the membership.

Under these conditions, despite the existence of a network arrangement, certain local merger activity may be justified, although the overall network structure dominates at the macro level.<sup>35</sup> This suggests that the analysis of networks of FC is in reality a multi-layered exercise in which a particular dimension (e.g. appropriability hazard) plays a dominant role and another dimension (e.g. frequency of transactions) plays a role under the shadow of the first. The outcome of one or the other action depends upon which dimension dominates. For example, a merger that may be the optimal cost economizing alignments when performed within a network—with the benefits in terms of economizing on bounded rationality—may not be so in absence of one.

## 2.6 Subsidiarity

A concept often used by networks of FC to regulate governance mechanisms—and that to our knowledge has no parallel in the TCE literature nor in writings about hybrids—is the *subsidiarity principle*. The interest of analyzing this concept is that its function is to *increase the power of autonomous incentives* within organizations. The importance of autonomous incentives in encouraging adjustment to consequential disturbances is amply discussed in the TCE literature and needs not be repeated here. In addition to reinforce higher-powered incentives the subsidiarity principle also has the effect of decentralizing the search of policy solutions and decision making whenever relevant. Recent models [Kollman, Miller and Page, 2000] reveal the advantage of this decentralization in federated organizations since they exploit and combine the mutual information discovered by the subunits to reveal even better solutions.

A dictionary based definition of the term subsidiarity, articulated for political structures, suggests that it is a concept that opposes centralization, that delimits the function of second tier nodes to that of supporting and complementing auto-determination of first-tier units.<sup>36</sup> In the Collins Concise Dictionary, the word subsidiarity is defined as the principle of devolving political decisions to the lowest practical level. The application of the principle of subsidiarity encourages *decentralization* of functions in the network yielding as a result that the maximum amount possible of task are organized around first-tier nodes. According to some observers of cooperative movements [Heinke, 1993] the *only* fact that justifies a second tier node to assumes a particular political or business function is that the first-tier node(s) is (are) incapable of performing locally the functions necessary for the delivery of services to their members.<sup>37</sup>

The central ideas behind the principle of subsidiarity are thus the following:

- The second (and higher) tier nodes have the function of assisting or functioning in a supplementary capacity only, and this only by first-tier nodes' choice.
- Under no circumstances are higher tier organizations to carry out activities that may compete with the lower tier nodes.<sup>38</sup>

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<sup>35</sup>Mergers may also occur in networks due to corrective actions. In the case that a particular FC may underperform or become non-viable as individual unit, merger may be the most logical solution. However, in this case merger cannot be viewed as a strategy of radial growth although the acquiring institution will in fact become larger.

<sup>36</sup>The word "subsidiarity" derives from "subsidium" or "subsidiium" that in military science refers to reserve troops, that engage only in those occasions in which combating troops are insufficient. The principle of subsidiarity finds ideological roots in the catholic social philosophy, with an explicit formulation in the 1931 Social Encyclica *Quadragesimo Anno*.

<sup>37</sup>This principle is a key feature also for political structures in which long-term alliances are formed that imply complex governance and institutional structures while the first tier units (in this case provinces and states) wish to conserve the level of autonomy that the protection of the interests of their constituency requires while promoting overall efficiency of the system. For example, the subsidiarity principle plays a central role in the European Maastricht Accord. This Accord also extends the concept of subsidiarity. There, it is specified that the second tier nodes (EEC bodies) should engage in functions that *are not of their competence* only in those cases in which the overall goals of the system cannot be achieved otherwise. This extension appears reasonable for networks such as those created by FC, to the extent that recalcitrant individual first-tier nodes could otherwise hold the entire network hostage of achieving desirable goals. However, this extension of the concept also opens the door to arbitrary centralization of power by second-tier nodes.

<sup>38</sup>A simple but illustrating example of application of this principle is the case of the Reinsurance company owned by *Promutuel* of Quebec. This, while specialized in reinsurance of casualty insurance liabilities, is allowed to retail casualty insurance directly

- The maximum amount possible of task are organized around the first-tier nodes.
- Second tier organs provide only services that cannot be provided by the first-tier nodes and that require economies of scale or can be produced only by the higher tier nodes.

Some particularly important examples of application of the principle of subsidiarity are the following: the abstention of second tier nodes to accept membership of—or to accept deposits from or provide credit to—natural persons; the abstention of second tier nodes to open branches or points of services that compete with the activities of the first-tier units; the abstention of second tier nodes to execute business transactions with members that are within the sphere of activities of the first-tier units.

The use of principle of subsidiarity is perhaps one of the least evident features of networks of FC. While a definition of the principle and notes about the necessity of its use are relatively easy to find, particularly in the German literature on networks of FC and *Sparkassen*,<sup>39</sup> much less is said about its specific economic role. However its consistent application can easily be explained in terms of TCE. We may attribute to the principle of subsidiarity precise economic functions:

1. *Increases the overall efficiency of the network.* As in the M-form, the subsidiarity principle promotes the separation of competence of first and second tier nodes with each one assuming only the function in which they are most efficient or present comparative advantages.
2. *Reduces the impact of errors on the network.* By keeping decision and activities at the lower levels when economies of scale or comparative advantage do not justify unambiguously their transfer to second tier nodes, errors committed in the exercise of the business activity will tend to have a local impact only, keeping the rest of the network shielded and facilitating learning.
3. *Introduces an environment of competition in the network.* Preventing unnecessary centralization and favoring initiatives at the local level. An environment of experimentation and competition is thus created that facilitates the rapid transmission of tried and efficient solutions across the network.
4. *Limits the uncontrolled growth of second tier nodes and insures governability of the network.* The principle of subsidiarity establishes a relatively clear criteria for the separation of functions between first and second tier nodes and reaffirms the accessory role of the second with respect to the first. In this context it is interesting to note the definition of subsidiarity provided by S. Battisti and cited by Reibert [Reibert, 1994]<sup>40</sup> According to Battisti, subsidiarity is a rule of competence attribution and construction for associations and federations that serves as guide for questions of design. Subsidiarity thus provides a criteria that delimits the growth of second tier organizations encouraging their expansion when important economies can be achieved by transferring functions from first to second tier nodes or putting a break on their expansion when the subsidiarity principle is being transgressed.<sup>41</sup>

Clearly, the principle of subsidiarity used and invoked so often by networks of FC has clearly the role to strengthen autonomous adaptation mechanisms within the network. As often emphasized, autonomous adaptations by economic units constitute one of the market's most powerful attributes to force economic efficiency. Thus, networks FC clearly seek explicitly to exploit in a balanced fashion both *Hayek's autonomous adaptation* and *Barnard's cooperative adaptation mechanisms* [Williamson, 1996].

## 2.7 Summary of refutable propositions

With the purpose of providing an overview of the refutable propositions that can be drawn from the framework presented above, we now present a brief summary of hypotheses that might be tested to verify or reject the propositions. Of these hypotheses, some require data to which we do not have access. For this reason we

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to the public only in those territories where members of the Promutuel federation have no installed selling capacity, particularly the "open territories" of Montreal and Quebec City.

<sup>39</sup>e.g. [Arzbach, 2000], [Bonus, Greve, Kring and Polster, 1999], [Reibert, 1994] and [Heinke, 1993].

<sup>40</sup>The citation is from the book by Battisti, *The Historical Intellectual Roots of the Subsidiarity Principle*.

<sup>41</sup>Some authors [Heinke, 1993] also define what they call the "active subsidiarity." Under this concept reference is made to activities second tier nodes engage to cover "seamlessly" all aspects of the market in which competition is occurring and in which first-tier units are not active or have not the competence to become active.

will focus on those that can be tested with the data available. We will also present the approach that will be used for testing these predictions. The summary of predictions articulated in previous pages is, *ceteris paribus*:

1. **H1: Over ranges of low AH non integration is optimal.** Over ranges of contractual hazard that are very small one can expect to see institutions that remain independent or tied up in only very loose arrangement while conserving a relatively high level of efficiency. This is the typical situation of many developing countries in which FC is an incipient sector offering only very basic financial services, which is often all the community they serve needs.
2. **H2: As AH increases network organizations dominate:** For higher levels of contractual hazard, networks become the optimal form of organization. Thus, for similar level of contractual hazard FC operating in networks should display higher levels of X-efficiency and lower variance in the size of institutions than FC not members of networks. This is so because FC members of networks:
  - (a) Solve the economies of scale imperative through joint productions;
  - (b) Adopt a cost efficient governance structure;
  - (c) Avoid the use of sub-optimal merger based growth strategies.
3. **H3: EP increases with the size of the institution but less so in networks.** Since risk of EP is positively related to size of the institution (due to limits on governance and lack of separation of functions), over a range of large FC, differences in X-efficiency and EP between members and non-members of networks will be relatively large.
4. **H4: Mergers may increase EP:** Under both growth strategies (merger or network based) FC created by mergers that resulted from the exercise of EP should present lower X-efficiency and higher EP.

In formulating H3 we have not excluded the possibility of employing either radial growth or network arrangement (such as CUSOS) in either system as *secondary* mechanism. What matters is the primary mechanism of growth.

We note two aspects of the testing procedures we will use:

- Much of the empirical tests will be based on measures of efficiency (X-efficiency) and EP standard in analysis of performance of financial intermediaries. X-efficiency is a measure of performance particularly suited to the analysis at hand. In TCE the analysis centers on cost economizing governance mechanisms, however, what matters (as noted by [Riordan and Williamson, 1985]) is the cumulative cost of production *and* governance costs. The optimal choice is that which minimizes the total cost of production and governance. X-efficiency measures exactly this costs. Similarly, well established statistical measures of EP—often used to compare joint-stock and mutual type of intermediaries—will allow us to test some of the central propositions of the theory.
- We face the difficult task of finding a suitable proxy of contractual hazard. This is a common problem to empirical research that uses TCE as the framework of analysis. However, throughout the presentation we have argued that contractual hazard and size of institution are positively –albeit imperfectly–correlated. For this reason we will use size as a proxy of contractual hazard.

### 3 The statistical model

We propose to verify whether belonging to a network –an alternative mechanism of transaction governance– changes the portrait of X-efficiency of individual FC as they grow in size. This measure of performance is based on a single standard translog cost function. We propose also to verify whether EP differ in networks and non-network systems. Since our goal is to test the hypothesis that governance matters, rather than to innovate in the technique of efficiency measure, we use a well established approach to measure efficiency and EP.



### 3.1 X-efficiency

Specifically, we use the intermediation approach, considering the amount of loans as outputs, as in [Mitchell and Onvural, 1996], except for a few modifications that we present below and justify as we go. The value of deposits, capital and the number of employees are the inputs. In addition to operational costs, the approach also includes interest costs on the right hand side. The model is based on the work of [Sealey and Lindley, 1977]. Since homogeneity of input prices ( $A_{ij} = 0$ ) was not verified, we include cross-terms. More specifically, our model is inspired from the adaptation for financial intermediaries of the work of Sealey [Mitchell and Onvural, 1996]. The modifications are:

- Instead of using cross-sectional estimations, we adopt a distribution-free approach (DFA), a methodology used in previous studies ([Berger, 1993], [Berger and Mester, 1997], [Altunbas, Gardener, Molyneux and Moore, 2001]).
- We include various dummy variables to form adequate categories, an approach sometimes favored [Westley and Shaffer, 1999]. Following established practice ([Fried, Lovell and Eeckaut, 1993], [Hugues and Mester, 1993], [Rezvanian, Mehdian and Elyasiani, Spring 1996] and [Berger and Mester, 1997]) we discriminate among five size categories.
- Since we use panel data, we decide upon the estimation procedure (fixed effect or random effect estimators) by performing a Hausman test [Hausman, 1978]. This test is essential when using panel to verify whether parameters should be drawn from a fixed effect estimator (unbiased but inefficient) or a random effect estimator (efficient but potentially biased if  $E[X | \epsilon.] \neq 0$ , that is, if the X matrix of covariates is not independent of individual factors  $\epsilon$ ).<sup>42</sup>
- We include a technical efficiency catch-all factor estimated by a trend variable and its cross-terms with inputs prices and quantities. The approach has become standard in the literature ([Gallant, 1981], [Lang and Welzel, 1996b], [Altunbas, Gardener, Molyneux and Moore, 2001] and [Kumbhakar, Lozano-Vivas, Lovell and Hassan, 2001]).
- We do not include cost share equations, to reflect the fact that FC are not assumed to minimize their costs as a joint stock bank would. This is consistent with the study of German cooperative banks [Lang and Welzel, 1996b].<sup>43</sup>
- The model is defined as follows:

$$LnC = \alpha_0 + \mathbf{b}'\mathbf{x} + \frac{1}{2}\mathbf{x}'\mathbf{A}\mathbf{x} + \mathbf{F}\mathbf{F} + \epsilon + \varepsilon \quad (1)$$

Where:

$LnC$  = natural logarithm of costs;

$\alpha_0$  = a constant;

$\mathbf{b}$  = a vector of coefficients;

$\mathbf{x}$  = a matrix of variables including 3 non-scaled log-input prices, 1 non-scaled log-output quantity, 1 trend variable to reflect technological changes, log of credit risk, log of capitalization, and a dummy for acquiring institutions. As noted, we also include nine dummy variables to separate into five size groups for each country, with the smallest Quebec FC representing the intercept. Table III presents the definition and basic characteristics of the variables. Note that  $CRR$ ,  $CAP$ , and  $ACQ$  variables are not included in cross analyses. Fourier Flexible terms require scaled variables comprised within  $[0, 2\pi]$  range. Table IV presents

<sup>42</sup>If independence is verified, the appropriate estimation procedure is one of random effect, and if it is not, the use of fixed effect estimation procedures becomes imperative to avoid bias in the key coefficients. This procedure was apparently not followed by some earlier research that made use of the random effect procedure ([Altunbas, Gardener, Molyneux and Moore, 2001]). Others [Lang and Welzel, 1996a] present results for both fixed and random effect estimators but do not indicate which is the unbiased vector. As shown by [Hausman, 1978], only one set of estimators is adequate for a specific sample, with one of them either inefficient, or biased.

<sup>43</sup>We note however that various authors imposed cost minimization for non-profit financial intermediaries ([Murray J.D., 1983], [Rezvanian, Mehdian and Elyasiani, Spring 1996] and [Westley and Shaffer, 1999]).

the basic characteristics of our scaled variables and scaling factors. The scaling process is consistent with earlier work [Mitchell and Onvural, 1996].

$\mathbf{A} = [A_{w1}, A_{w2}, A_{w3}, A_{x1}, A_{x2}, A_{x3}, A_y, A_T, GR1, \dots, GR9]$ , a matrix of 90 coefficients most of which are related to cross terms;

$\mathbf{FF}$  = a series of Fourier transform terms to be defined later;

$\epsilon$  = individual efficiency component of error;

$\varepsilon$  = random error;

The usual constraints to insure homogeneity in input prices and symmetry of second-order coefficients are imposed:  $\sum_{i=1}^4 b_{wi} = 1, \sum A_{ij} = 0$ . Besides these restrictions we also assure that trigonometric terms including input prices respect the condition  $\sum k_h = 0$  ([Gallant, 1982], [Mitchell and Onvural, 1996]).

As detailed in Table III, the dependent variable is total costs, including both operational expenses and interest expenses. The independent variables include three inputs and their respective prices : interest rate on deposits, cost of personnel, and cost of fixed capital. We include only one output, the quantity of loans. All these variables are unscaled. We also integrate an ex post risk measure: the proportion of bad loans over net loans and the amount of capital over assets. This variable control for heteroskedasticity and potential differences between well and poorly capitalized FC. In effect, strong evidence ([Hugues and Mester, 1993], [Mester, 1993], [Hugues, Lang, Mester and Moon, 1996], and [Berger and Mester, 1997]) support inclusion of capital into cost efficiency. A small cooperative does not have access to the same amount of deposits due to a lesser capital. Larger FC have more possibilities to generate profits because they already accumulated some reserves over time that give them more flexibility in their asset-management. A study with a data set consisting of 441 bank holding companies demonstrated that inclusion of capital structure and risk-taking into efficiency measurement improves the estimated coefficients [Hugues, Mester and Moon, 2000], two variables also included elsewhere [Hugues and Mester, 1993].

We use an unbalanced panel data set over the years 1996-2000 (described below) including merging institutions in Quebec. We consider both pre-merger institutions as independent FC, and post-merger institution as a different institution. We use a different U.S. paired-FC after merger, and include a dummy variable taking a value of 1 when the merger occurs. This approach follows established practice ([Lang and Welzel, 1996b],[Lang and Welzel, 1999]). Then we include a set of dummy variables to distinguish among various groups of FC. We divided the sample into five size groups in terms of asset values: less than 5.0 millions; 5-10 millions; 10-25 millions; 25-50 millions and, last group, more than 50 millions. Thus, the intercept represents U.S. FC with assets <5.0 millions, the first dummy includes U.S. FC with real assets between 5 and 10 millions, the second one between 10 and 25 millions, the third between 25 and 50 millions, while the fourth includes the ones above 50 millions. The fifth to ninth dummies includes Canadian FC whose assets are distributed among similar size groups. More precisely, the fifth includes Canadian FC whose assets are below 5 millions, while the ninth group includes Canadian FC whose assets are above 50 millions. The groups were recomposed each year to control for migration due to natural growth or merger. Through the use of size and country dummies we have estimated unrestricted models that are specific to each country and group size.

The last section of our model (presented by expression  $FF$ ) is related to Fourier transform terms. They are trigonometric modifications of scaled variables included in the function (3 inputs, 3 input prices, and 1 output). This process enables the cost function to better fit data than the Translog cost function eliminating some of the assumptions of parametric models, as we will discuss in the following section. Next sections present some aspects of performance measurement, the FF terms and error decomposition, respectively.

The error term is divided into an inefficiency ( $\epsilon$ ) and a random ( $\varepsilon$ ) component. The first component is the core (or individual mean) inefficiency, estimated as the time average of each FC's residual, while the second component is the purely random component.

### 3.1.1 Measures of Performance

We consider X-efficiency as an indicator of performance. Our definition of efficiency [Berger and Mester, 1997] is:

$$EFF = \frac{\epsilon_i^{Min}}{\epsilon_i} \quad (2)$$

Where  $\epsilon_i^{Min}$  is the minimal cost associated to the most efficient CU, approximated by the 1% fractile of

our sample in order to avoid extreme observations. The interpretation of the ratio is that it represents the proportion of costs that is efficiently used. For example, if  $\epsilon_i^{Min}$  is representing 70% of  $\epsilon_i$ , 70% of costs of this FC is used efficiently, and 30% is wasted inefficiently. All FC having a cost below the 1% fractile receive a 100% efficiency score.

### 3.1.2 Fourier Flexible Functional Form

In order to be coherent with some recent critics of the translog cost function for efficiency measurement ([Mitchell and Onvural, 1996], [Berger and Mester, 1997]), we decide to estimate a model that integrates trigonometric independent variables. The translog specification imposes a U-shaped cost function that might not be the adequate form of the cost structure. Fourier Flexible (FF) functional form permits to estimate the bias introduced by traditional translog cost function [Mitchell and Onvural, 1996]. In effect, assuming that the true cost function of the credit unions follows a translog function might introduce a bias if this is not actually the case. The superiority of the FF functional form has been demonstrated ([Gallant, 1981], [Gallant, 1982], [Mitchell and Onvural, 1996], [Berger, Leusner and Mingo, 1997]) by performing exclusion tests on the FF terms. Efficiency ranking is not much affected by the inclusion of FF terms, though each coefficient taken separately was significant [Berger and DeYoung, 1997]. Some authors found that inefficiencies were twice as big when excluding the FF terms [Berger and DeYoung, 1997]. The choice of trigonometric terms was inspired from earlier studies ([Mitchell and Onvural, 1996] and [Altunbas, Gardener, Molyneux and Moore, 2001]). Like previous works ([Mitchell and Onvural, 1996], [Berger and Mester, 1997]) we test the impact of adding FF terms by estimating the significance of their associated coefficients. We also perform additional exclusion tests as done in previous studies mentioned above. The set of trigonometric terms selected and exclusion tests are presented in Table IV.

## 3.2 Expense preference

To test presence of EP we use the approach most favored in the empirical literature [Mester, 1989] (Mester).<sup>44</sup> Mester (and other that followed her methodology) compare two groups of enterprises, one of joint-stock and the other of mutual intermediaries, under the assumption that the production technology of both groups is not the same-case in which the simple test of intercept becomes invalid. In particular, we use the separable expense parameter  $z_i$  and the joint expense parameter  $\rho_i$  tests that correspond to separable and joint decision models respectively.<sup>45</sup> The major difference between X-efficiency and EP tests is that the latter concentrates on the quantity of specific inputs used, while the prior also considers the effect of input prices and output quantities. That is, the EP tests focus on the decision of managers to suboptimally use some specific inputs, excluding the other effects. Our interest is to know whether larger FC present higher EP than smaller ones (see H3 above). Since our sample is constituted of mutuals only, we cannot adopt the usual definition of the two groups (mutuals being considered as expensers, and joint stock institutions as profit maximizers). Instead assume that larger FC favor a suboptimal utilization of inputs (the expensers), while smaller FC make a judicious use of their inputs (the cost minimizers). Thus, for each system we divide the sample into two groups by size of membership. The separating criteria is the median. From there on the test applied is that proposed by Mester in equations 10 and 11 ([Mester, 1989]. pp. 489). Thus the test consists of computing  $z_i$  and  $\rho_i$  for the groups of larger FC in each system and then compare the value these parameters take in each system. EP will be larger in the systems that presents the larger  $z_i$  and  $\rho_i$ . We focus on two types of expenses: labor and fixed assets. The assumption is that expensers will use more of these two inputs than the cost minimizing FC.

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<sup>44</sup>Other approaches exist (e.g. [Cummins, Weiss and Zi, 1999], [Mester, 1993]) but Mester is the most cited. It is also the approach subject to least restrictions on the properties of the underlying log cost function.

<sup>45</sup>Separable EP is defined as the utilization of excessive inputs, once costs have been minimized. It is thus the result of a two steps process: first, the manager of the FC tries to maximize profits (e.g. minimize costs), and second decides to use a greater quantity of some inputs. Price effect of input prices thus do not intervene in the process. Joint EP is the result of a one-step process that cannot be disentangled between profit maximization and overutilization of some inputs. More precisely, the managers do not try at first to minimize costs, but rather consume more of specific inputs (e.g. labor) than a profit maximizers.

### 3.3 Panel Data Set and Error Decomposition

A critical assumption associated to stochastic frontier approaches (SFA) models is that the error term can be decomposed into a random component, following a normal distribution, and an efficiency component, following a half-normal distribution. Many alternatives were proposed to avoid this critical assumption, as the hypothesis of half-normal distribution of the efficiency component received some critics recently ([Greene, 1990] and [Berger, 1993]). We concentrate on three alternatives: The first consists in eliminating the random component of the error term altogether, using a non-parametric model such as DEA or FDH. As we previously mentioned, DEA avoids the decomposition of errors between efficiency and randomness by assuming that the random component is simply not present and that differences in total costs are completely explained by differences in efficiency ([Aly, Grabowski, Pasurka and Rangan, 1990], [Ferrier and Lovell, 1990], [Elyasiani and Mehdiian, 1990]). The second alternative is to set an arbitrary limit between random error and efficiency, with a methodology such as the TFA [Lozano Vivas, 1997]. This methodology assumes that deviations from predicted costs within the lowest average-cost quartile are attributable to random error, while deviations in the remaining quartiles are attributable to efficiency. TFA only substitutes the assumption about the distribution of the error term with an equally arbitrary assumption about where the inefficiencies stop and the random errors begin [Berger, 1993]. Important divergences in the results were noted from one methodology to another. This inconsistency prompted some critics to both approaches:

Berger and Humphrey attribute the inconsistent ranking to the major sins of these two approaches - viz., too little account of random error by the non-parametric studies and too much structure imposed on the frontier by the parametric approaches.[Berger and Mester, 1997]

The third alternative is to consider a random error component, but to eliminate all the distributional constraints by introducing a panel data set. Several authors have noted the virtues of DFA estimates obtained with a panel data set ([Schmidt and Sickles, 1984], [Berger, 1993], [Berger and Mester, 1997], [Altunbas, Gardener, Molyneux and Moore, 2001]). A methodology was established to evaluate the most adequate number of years to consider, with data covering 618 U.S. commercial banks over eleven (11) years [DeYoung, 1997]. De Young found that a six (6) years period is the best compromise between too little (which introduces a large dispersion or residuals) and too much time periods (which is delicate if some tendency is included in the data).

Concretely, our method consists in estimating average individual inefficiency over the five year period. This constitutes the non-random component ( $\epsilon$ ) of error, or average inefficiency. This measure is compared to the level of inefficiency of most efficient FC over the five-years period, which eliminates short term randomness. As suggested in Hausman [Hausman, 1978], we test whether a random or a fixed effect model is more appropriate with a Chi-square test comparing the vector of coefficient estimated with both models.<sup>46</sup>

## 4 Data

We consider an unbalanced panel data set of 1 281 FC from Quebec and U.S. respectively, yielding a total of 11732 observations between 1996 and 2000. The characteristics of our samples are presented in Table I. As we have access to a larger U.S. sample, we associated one U.S. FC for each Quebec FC whose assets were most similar in value as of December 1996. In order to have a better size matching, we do not differentiate between U.S. FC types. In December 1996, we considered 778 (1188 in December 2000) federally chartered, federally insured FC, 483 (93 in December 2000) state chartered, federally insured FC, and 28 state chartered, non-insured FC (0 in December 2000).

We keep our initial matching until the U.S. FC disappears from the data base, in which case it is replaced by another U.S. FC whose value of assets is nearest to the value of the Canadian CU, at the date

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<sup>46</sup>More precisely, we estimate the  $m$  statistic, presented in Equation 5.1. of page 1268 [Hausman, 1978]. This statistic estimates the significance of the difference of parameters from random and fixed effect models. A significant difference means the null hypothesis of no fixed effect (Equation 3.4, page 1261) is rejected, so a random effect model would be biased. If the  $m$  statistic is not significant, then the alternative hypothesis (Equation 3.1, page 1261) is rejected, a fixed effect model is then inefficient but unbiased. We observe a very significant  $m$  statistic, so we reject the null hypothesis and conclude a random effect model would be biased. Again, we have strong doubts on the validity of results of previous studies that did not use the adequate set of coefficient.

of change. In other words, when a Canadian FC disappears we eliminate both the Canadian and its paired U.S. observations, but in case a U.S. FC disappears, we substitute with a new matching FC. Our pairs, once formed, remain constant. This means that the average size of the FC might increase differently in both countries. As expected, a test of difference of means (Z-test) demonstrated that the size of Quebec FC and their U.S. counterparts are not statistically different. More interestingly, a similar test showed that the size of U.S.-paired cooperatives is also comparable to the average size of the complete U.S. data base, containing more than 10 000 CU. *Thus, we can state with reasonable confidence that results reported for our sample are likely to apply to the complete U.S. sample.*

Our sample includes a rather heterogeneous set of FC. We assured for poolability of data first by controlling for time trend. Our second control for poolability consists in estimating Equation 1 excluding and then including  $GR1, \dots, GR9$  dummy variables and test for the importance of individual and time effect in error decomposition, a common approach with panel data. The inclusion of these dummy variables significantly reduced the F-statistics of both effects. We also verified if our sample is poolable among size groups and countries. To test for poolability, we use Chow tests that compare the sum of squared errors of our constrained model (defined in Equation 1) and alternative unconstrained models (estimating first five distinct models for each size category, and then two distinct models for each country). In order to better disaggregate the analysis we then run group-specific regressions and test for comparability of restricted and unrestricted models. F-statistic of Chow test suggest keeping size dummy variables in the restricted model.<sup>47</sup> We also perform separate estimations for each size group. We find differing coefficients but similar performance ratios, thus we continue reporting results obtained from the joint model.

## 5 Results

First some general observations on summary statistics. Table I shows that Quebec *caisses populaires* and size-paired U.S. credit unions have similar clienteles, i.e. have comparable median size of loans and deposits. Despite their almost identical size and similar clientele, Quebec FC manage a substantially greater amount of loans in proportion to administrative expenses. In effect, Quebec FC present a median ratio of loans over administrative costs between 34 and 46, while their U.S. counterparts present a median ratio between 24 and 27. Large U.S. FC do not perform appreciably better than their smaller counterparts: the ratio for largest FC is only 5% higher than for the smallest FC in the U.S., while the improvement in Quebec is 35%. *This suggests that EP that become more important with size is controlled by the regulatory mechanisms in the network.* This is consistent with the theory exposed in the first part of the paper. The ratio of deposits over loans, when it is greater than 100% is a measure of funds acquired from members that are not used for member-oriented financial intermediation. The ratio is substantially higher in U.S. than Quebec FC, which means that U.S. FC accept funds that are used in activities (e.g. purchase of fixed assets) other than to provide credit services to its members. Though we recognize that in the banking literature this ratio is a measure of credit risk exposure, in the context of FC it reflects often the use of member funds for unproductive purposes such as fixed asset (confirmed by the Fixed-to-Total Assets ratio).

The intermediation margin is, in the context of a FC, the ultimate measure of cost imposed to members including both production and transaction governance costs. The smaller this margin, the higher (lower) will be the rates that FC will pay (charge) to its net saver (borrower) members. This margin must cover all other expenses incurred by the FC. This intermediation margin is smaller for *caisses populaires* than for credit unions except for the largest group. What these differences suggest is that U.S. members-clients, while exposed to lower transaction costs tied to the governance structure in the network, may be exposed to higher production costs and/or to higher EP by managers than members of Quebec FC. Since the margin contains all costs related to production and governance, the Quebec system appears to perform better than the U.S. credit union system. Thus—and in contradiction to opponents of network structures—for the average member, the average cost of running the Quebec complex network is less than the cost of running a system

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<sup>47</sup>F-statistic of Chow test of Canadian versus U.S. observations (comparing a restricted model using both countries simultaneously and an unrestricted model estimating two separated regressions) is 126.37 and passes to 75.94 when including size dummies. Both statistics demonstrate data is not poolable at the 1% level. We then perform a similar test for size groups (Restricted model estimates all size groups simultaneously, while unrestricted model estimate five different regressions) and obtain F-statistics of 6.45 and 1.86 when excluding and including size dummies, respectively. Both statistics are significant at the 1% level.

of non-integrated FC over the whole range of sizes except the largest.<sup>48</sup> These preliminary observations are consistent with the main hypothesis of higher efficiency in FC members of a network, in particular on lower overall costs of intermediation and control of EP. We formalize the concepts of performance in terms of X-efficiency and EP below .

## 5.1 X-efficiency

We present results of estimation related to Equation 1 in Panels A and B of Table VI. A few comments on model estimation. Table V present three alternative models and diagnostics of including 47, 24 and 0 trigonometric terms respectively. We see that inclusion of trigonometric terms improves adjusted  $R$ -square marginally, passing from 96.0% to 96.5% (Panel B). The benefit of introducing FF terms is to impose more stringent tests on the significance of coefficients. In effect, a reduction of F-statistics related to exclusion tests is observed when FF terms are added into the model (Panel C). For example, usual homogeneity of input prices hypothesis ( $Aw_i = Ax_i = Ay = 0$ ) is rejected with a F-statistic of 329.9 if we do not include FF terms (H=0 column), but with a F-statistic of only 33.7 if we include 47 FF terms. All exclusion tests are rejected at the 1% level. While most of these tests are of marginal interest in this study we present them for comparability with previous studies and to provide technically minded readers the elements to judge the estimates. In particular, we note that the ratio of pass-due loans over net loans is also very significantly related to cost efficiency, confirming recent empirical results for joint stock banks. Our size dummies and FF terms are also very significant.

The residues of the model were subject to an ANOVA to determine whether latent individual or time effects remained. The analysis revealed that no individual effect remained with an F-test value of 0.879. We could not reject the hypothesis of no latent individual effects in the residues even after eliminating all group-size dummies and FF-terms. The high adjusted  $R$ -squared of even the simplest model, the reasonable DW and absence of multicollinearity suggests that the model explains very well the dependent variable. We did, however, find a very strong time effect with an F-test value of 596.6, despite the presence of a trend variable, suggesting that  $E[X | \tau.] \neq 0$ . Although somewhat unusual in panel data with many individuals and few time periods, the presence of latent time effect may be explained by the absence in the regression of any explanatory variable that may capture time-related shocks that are not monotonic –like the trend variable. Thus we were forced to adjust our data accordingly by deducting the average over all individuals for each period—a fixed effect adjustment. As noted before we also used a Hausman test to check whether a random or a fixed effect estimation procedure should be used. Rejection of the hypothesis of equality of parameters with a very high F-test (12389.9) suggested unambiguously the need to use a fixed effect approach. Thus the final model used to compute all results that follow is one estimate using a time-related fixed effect adjustment with adjustment for time effects and no adjustment for individual effects.<sup>49</sup> Finally, a few comments on the use of size-group dummies. In the presence of a sample that does not change with time and the need to use a individual related fixed-effect estimation procedure, such dummies would not be identified. We would then be unable to check whether the size-groups of FC display different cost functions. However, our sample is not constant in size with several units switching group throughout the period. Further, given that no correction for latent individual fixed effect was necessary, we are fully justified, from the statistical point of view, to use size group dummies.

Panel A of Table VI presents mean individual X-efficiency scores in their usual presentation. It is interesting to note that even after controlling for 161 parameters and ignoring shifts in the intercept that capture intrinsic differences between the groups (governance and size), Quebec FC are still marginally more efficient than their U.S. counterparts except for the two smallest groups. In order to replicate most studies that do not include size dummies (GR1,...,GR9), we add the impact of size group to our individual effect

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<sup>48</sup>Monopoly arguments cannot be invoked in this case. Both systems often operate where no other financial institution is available. On the contrary, U.S. FC are probably much more exposed to competition from small private local banks and mutual or private Savings and Loan Associations. In Quebec, competition by the six large banks can be felt only in urban centers. This also ignores the fact that the average Quebec *caisse populaire* offers to members a considerably larger range of financial services than a United States credit union.

<sup>49</sup>It may be added that the correction for time effect changed considerably results. Before this adjustment, EOS and X-efficiency displayed a clear trend—e.g. towards higher X-efficiency. This trend disappeared with the time effect adjustment, as results below will show.

error (presented in Panel A) and obtain a clearer image of the relative X-efficiency of Quebec and U.S. FC.<sup>50</sup> Quebec FC present X-efficiency scores between 83.73% and 92.59%, while U.S. FC show considerably lower ratios, between 78.66% and 86.14%. These results are presented in Panel B of Table VI. In Figures 2 and 3 we display first-order stochastic dominance diagrams. Diagrams in Figure 2 and 3 correspond to Panel A and B respectively. There, it can be seen that even for size-groups that display very close mean measures of X-efficiency –e.g. the group 5-10M– the Quebec FC stochastically dominate throughout the range. Results are consistent with H2. We also find support for H3, that differences in efficiency between member and non member FC will increase with the size of the institution.

## 5.2 Expense preference

Table VII presents results for the formal EP tests based on Mester for large FC. We performed tests 1 to 3 of [Mester, 1989] (pp. 486-488) to check whether both groups of institutions (small and large) in each system present different cost functions. Test 1 verifies whether linearity in input prices is verified for the group of profit maximizers (small FC in our case). As these institutions are assumed to be cost minimizers, we estimate cost share equations and find that linearity of input prices is not verified, i.e. that all cross coefficients related to  $w_i(Ln(w_i w_j))$  and  $Ln(y_i w_j)$  are significant at the level of 1% . We conclude that intercept is thus not valid.<sup>51</sup> As Test 1 refutes a cost function linear in input prices, we need not estimate Test 2.<sup>52</sup> Estimation of Test 3 (equivalent to test 2 but without the assumption of linearity of input prices) requires the estimation of the cost function for both groups and the estimation of the difference in costs between cost minimizing and expenser FC. Once this difference is obtained, it is regressed over the input quantities and prices, and output quantities. If both cost functions are similar, coefficients would be non-significant. We find that all parameters are significant at the 1% level, thus concluding that cost functions of both categories are not similar, and that one must use the Mester’s general tests for the presence of separable ( $z_i$ ) and joint ( $\rho_i$ ) EP. Both processes are evaluated with the estimation of a cost function for cost minimizers, and then estimation of the cost function of expensers with a unique shift parameter including all variables associated to EP (labor and fixed assets in our case). A shift parameter ( $\rho_i$ ) significantly different from 0 (1) in the case of separable (joint) EP, implies that *expensers effectively use more of the inputs than a cost minimizer*. We observe that the shift parameter  $z_i$  is positive and significantly different from zero for both inputs and both systems. We also observe that joint expense preference  $\rho_i$  is significantly different from one in both systems, but in one case (DM) it is below, and in the other (USCU) it is above one. In all four cases (for  $z_i$  and  $\rho_i$  and for labor and fixed assets) coefficients for the USCU are considerably larger than those for the DM. This is consistent with H3 that over a range of large FC, differences in EP between members and non-members of networks will be relatively large.

## 6 Conclusions

This paper presents a study of the economic organization of systems of financial cooperatives (FC). It consists of two parts. The first part presents a theoretical framework rooted in principles of *transaction cost economics* (TCE) that seeks to explain empirical regularities observable in systems of FC worldwide. In particular we seek to explain integration of large numbers of FC into large *networks* that present specific features common to many countries. The second part consists of an empirical study that compares two systems of FC, the United States credit unions system (USCU) and the Quebec *Desjardins* movement (DM).

<sup>50</sup>The pure error used usually for the estimation of X-efficiency (Panel B) is obtained after adjusting the regression for the size effect. It is clear that if the dummy is not included, these errors would be much larger—but the slope coefficients would be biased. If a particular size group would display larger positive (negative) error, the inclusion of the dummy will yield a coefficient that is positive (negative). Thus, when we correct for the dummy in the computation of the X-efficiency (Panel C) we are just adjusting for the reduction of the error forced through the inclusion of the dummy.

<sup>51</sup>The intercept test compares average cost of the two groups. One would say that a group is more cost-efficient if the intercept is significantly greater than the intercept of the other group. This test is valid only if one can demonstrate that both groups have statistically similar cost functions, i.e. that each coefficient is not significantly different between one group and the other, and that both groups show similar statistical characteristics (variance and covariance of variables).

<sup>52</sup>Despite the results of Test 1, we estimated equation 8 (p.488) of Mester (assuming linearity of costs in input prices) and found that all parameters are statistically different from 0 at the 1% level, invalidating the hypothesis of similar cost functions.

The fundamental proposition is that networks, particularly strategic networks, are a superior form of governance mechanism (over markets and mergers) for relatively wide and relevant ranges of contractual hazard and size of the institutions. Another central theoretical proposition generated by the analysis is that strategic networks provide a substitute, hierarchy based, control mechanisms when size of the institution dilutes internal governance mechanisms thus discouraging subgoal pursuits and expense preferences, and possibly economizing on bounded rationality both occurring in large FC. The theoretical portion allows us to generate a set of refutable propositions that can be formulated as follows: (i) Over ranges of contractual hazard that are very small one can expect to see institutions that remain independent or tied up in only very loose arrangement while conserving a relatively high level of efficiency. This is the typical situation of many developing countries in which FC is an incipient sector offering only very basic financial services, which is often all the community they serve needs. (ii) For higher levels of contractual hazard, networks become the optimal form of organization. Thus, for similar level of contractual hazard FC operating in networks should display higher levels of X-efficiency and lower variance in the size of institutions than FC not members of networks. This is so because FC members of networks solve the economies of scale imperative through joint productions and adopt a cost efficient governance structure. (iii) Since risk of EP is positively related to size of the institution (due to limits on governance and lack of separation of functions), over a range of large FC, differences in X-efficiency and EP between members and non-members of networks will be relatively large. (iv) Under both growth strategies (merger or network based) FC created by mergers that resulted from the exercise of EP should present lower X-efficiency and higher EP.

In the empirical portion of the paper we tested hypothesis (ii) and (iii). We find that DM based FC present overall higher efficiency than USCU. The difference in efficiency increases with the size of the institutions. Also, large USCU present considerably higher expense preference than equally sized DM FC. These results are consistent with our central theoretical proposition that strategic networks provide a substitute, hierarchy based, control mechanisms when size of the institution dilutes internal governance mechanisms thus discouraging subgoal pursuits and expense preferences, and possibly economizing on bounded rationality. Opponents to networks often argued that running the *Desjardins'* strategic network system is expensive. Thus that the benefits associated to the vast array of financial services offered to large sectors of the population and in particular to rural communities comes at a heavy price. The data suggest that, yes, the success of the DM is servicing its vast and rural clientele comes at a price. But, even paying that price, the evidence provided by the measures of X-efficiency and expense preference indicates that the DM outperforms the USCU system.

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**Table I**  
**Description of Data (1)**  
**Median Figures (1996-2000)**

**French Canadian Caisses Populaires**

	< 5M	5-10M	10-25M	25-50M	>50M	Total
N	875	1053	1647	1262	1029	5866
% of total	15%	18%	28%	22%	18%	100%
Total assets	3 184	7 294	16 434	33 841	68 755	17 936
Median deposit by employee	886	1 123	1 247	1 369	1 455	1 247
Median loan by employee	917	1 117	1 264	1 329	1 438	1 248
Loans/Administrative costs	34	38	42	43	46	41
Deposits/Loans	97,5%	99,8%	99,0%	103,2%	100,1%	100,1%
Fixed assets/Total assets	0,70%	1,20%	1,42%	1,40%	1,31%	1,30%
Real intermediation margin /Loans	4,81%	4,01%	3,75%	3,45%	3,35%	3,75%

**Size-Paired American Credit Unions**

	< 5M	5-10M	10-25M	25-50M	>50M	Total
N	815	964	1596	1299	1193	5867
% of total	14%	16%	27%	22%	20%	100%
Total assets	3 291	7 490	16 381	34 672	71 949	19 367
Median deposit by employee	1 104	1 382	1 557	1 590	1 711	1 498
Median loan by employee	851	1 011	1 129	1 191	1 266	1 118
Loans/Administrative costs	24	24	26	26	27	26
Deposits/Loans	126,1%	130,4%	133,6%	130,4%	130,6%	130,8%
Fixed assets/Total assets	0,33%	0,77%	1,48%	2,00%	2,22%	1,46%
Real intermediation margin /Loans	4,86%	4,24%	3,83%	3,63%	3,25%	3,81%

**Complete Sample of American Credit Unions**

	< 5M	5-10M	10-25M	25-50M	>50M	Total
N	26816	9561	10514	5853	7898	60642
% of total	44%	16%	17%	10%	13%	100%
Total assets	1 537	6 962	15 422	34 289	107 160	6 337
Median deposit by employee	889	1 389	1 534	1 562	1 760	1 307
Median loan by employee	681	1 018	1 138	1 172	1 341	986
Loans/Administrative costs	25	25	26	26	28	26
Deposits/Loans	128,5%	132,5%	132,3%	130,6%	129,6%	130,3%
Fixed assets/Total assets	0,17%	0,64%	1,53%	2,09%	2,09%	0,62%
Real intermediation margin /Loans	4,73%	4,12%	3,93%	3,87%	3,48%	4,13%

(1) December 31, 2001 dollars, All monetary units were divided by 1000 in the regressions,

Source: Confédération des Caisses Desjardins, National Credit Union Association,

**Table II**  
**Growth of Financial Cooperatives Through Time (1)**  
**Median Figures**  
**1996-2000**

**French Canadian Caisses Populaires**

	<b>&lt; 5M</b>		<b>5-10M</b>		<b>10-25M</b>		<b>25-50M</b>		<b>&gt;50M</b>		<b>Total</b>	
	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>
1996	208	3 100	238	7 409	370	16 372	269	33 539	197	65 891	1 282	16 570
1997	191	3 076	227	7 321	362	16 111	273	33 612	188	66 355	1 241	17 073
1998	185	3 296	210	7 066	363	16 286	259	33 393	200	67 535	1 217	17 536
1999	157	3 207	213	7 248	318	16 741	236	33 683	217	69 100	1 141	18 487
2000	134	3 306	165	7 367	234	16 841	225	35 210	227	74 637	985	21 626
1996-2000	875	3 184	1053	7 294	1647	16 434	1262	33 841	1029	68 755	5866	17 936

**Size-Paired American Credit Unions**

	<b>&lt; 5M</b>		<b>5-10M</b>		<b>10-25M</b>		<b>25-50M</b>		<b>&gt;50M</b>		<b>Total</b>	
	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>	<b>N</b>	<b>Median assets</b>
1996	192	3 280	221	7 586	363	16 424	279	33 814	227	67 571	1 282	17 978
1997	174	3 219	218	7 481	357	16 382	270	34 971	222	69 354	1 241	18 101
1998	165	3 291	198	7 378	337	16 365	269	35 299	249	72 731	1 218	19 313
1999	147	3 433	186	7 497	300	16 328	258	34 801	250	73 230	1141	20613
2000	137	3 390	141	7 501	239	16 257	223	35 350	245	75 035	985	22 308
1996-2000	815	3 291	964	7 490	1596	16 381	1299	34 672	1193	71 949	5867	19 367

(1) December 31, 2001 dollars. All monetary units were divided by 1000 in the regressions.

Source: Confédération des Caisses Desjardins, National Credit Union Association.

**Table III**  
**Definition of variables and their basic characteristics (1)**  
**1996-2000**

		Dependent Variable					United States				
Symbol	Definition	Canada					United States				
		Mean	Std Dev.	Minimum	Median	Maximum	Mean	Std Dev.	Minimum	Median	Maximum
C	Real total costs, in thousands US\$, deflated by the Consumer Price Index (CPI) with 1995 as the base year.	1 223	5 325	0	434	218 367	2 796	4 737	18	1 473	116 005

		Independent Variables - Input prices					United States				
Symbol	Definition	Canada					United States				
		Mean	Std Dev.	Minimum	Median	Maximum	Mean	Std Dev.	Minimum	Median	Maximum
W <sub>1</sub>	Real annual, ex post interest rate on deposits and dividend rate on shares, in percentage.	1,84%	1,97%	0,00%	0,92%	24,00%	4,48%	3,67%	0,00%	3,73%	24,00%
W <sub>2</sub>	Real wage rate, in US\$ by equivalent full-time employee and deflated by the CPI.	26 070	6 680	5 980	24 540	69 360	30 515	8 764	0	29 894	118 963
W <sub>3</sub>	Real occupancy expenses, defined as occupancy expenses divided by fixed assets, in percentage.	47,96%	237,95%	0,00%	24,07%	8491,60%	2920,76%	56122,22%	0,00%	50,15%	2252000,00%

		Independent Variables - Input quantities					United States				
Symbol	Definition	Canada					United States				
		Mean	Std Dev.	Minimum	Median	Maximum	Mean	Std Dev.	Minimum	Median	Maximum
X <sub>1</sub>	Deposits and shares, in thousands US\$, deflated by the CPI.	24 110	36 991	0	14 466	1 234 902	27 923	45 798	255	16 730	1 767 794
X <sub>2</sub>	In Québec, the number of equivalent full-time employees is defined by the total number of hours worked each week divided by 33,5 hours a week. In U.S. we rather used the sum of full-time employees and half the sum of part-time employees.	15	19	1	8	176	14	20	1	8	556
X <sub>3</sub>	Amount of fixed assets, in thousands US\$, deflated by the CPI.	406	573	0	244	15 038	676	1 143	0	264	31 661

		Independent Variables - Output quantities					United States				
Symbol	Definition	Canada					United States				
		Mean	Std Dev.	Minimum	Median	Maximum	Mean	Std Dev.	Minimum	Median	Maximum
Y	Loans, in thousands US\$, deflated by the CPI.	23 864	37 734	0	14 654	1 348 081	20 940	36 470	39	12 152	1 422 629

		Independent variables - Environmental factors					United States				
Symbol	Definition	Canada					United States				
		Mean	Std Dev.	Minimum	Median	Maximum	Mean	Std Dev.	Minimum	Median	Maximum
CRR	Total delinquent loans / Total loans	1,56%	3,15%	0,03%	1,30%	178,58%	1,46%	1,96%	0,00%	1,00%	63,11%
CAP	Total equity / Total assets	17,97%	8,87%	0,03%	15,34%	99,99%	13,02%	4,60%	-14,17%	12,28%	54,94%
ACQ	Dummy variable taking the value of 1 if the institution acquired another one, 0 elsewhere.	17,99%	8,94%	0,02%	15,35%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
GR <sub>1</sub>	American CU with real assets between 5 and 10 millions.	0,00%	0,00%	0,00%	0,00%	0,00%	14,65%	35,36%	0,00%	0,00%	100,00%
GR <sub>2</sub>	American CU with real assets between 10 and 25 millions.	0,00%	0,00%	0,00%	0,00%	0,00%	24,26%	42,87%	0,00%	0,00%	100,00%
GR <sub>3</sub>	American CU with real assets between 25 and 50 millions.	0,00%	0,00%	0,00%	0,00%	0,00%	19,74%	39,81%	0,00%	0,00%	100,00%
GR <sub>4</sub>	American CU with real assets above 50 millions.	0,00%	0,00%	0,00%	0,00%	0,00%	18,13%	38,53%	0,00%	0,00%	100,00%
GR <sub>5</sub>	Canadian CU	100,00%	0,00%	0,00%	100,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
GR <sub>6</sub>	Canadian CU with real assets between 5 and 10 millions.	16,00%	36,67%	0,00%	0,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
GR <sub>7</sub>	Canadian CU with real assets between 10 and 25 millions.	25,03%	43,32%	0,00%	0,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
GR <sub>8</sub>	Canadian CU with real assets between 25 and 50 millions.	19,18%	39,37%	0,00%	0,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%
GR <sub>9</sub>	Canadian CU with real assets above 50 millions.	15,64%	36,33%	0,00%	0,00%	100,00%	0,00%	0,00%	0,00%	0,00%	0,00%

(1) December 31, 2001 dollars. All monetary units were divided by 1000 in the regressions. To avoid extreme observations, we had to limit the interest rate on deposits at 24%, which is the usury rate in Canada.

Source: Confédération des Caisses Desjardins, National Credit Union Association.

**Table IV**  
**Scale factors and scaled variables for the Fourier flexible cost**  
**equations**  
**1996-2000**

Scale Factors		
$w^{\min}_i$ = sample minimum value of input price $i=1,2,3,4$ .		
$w^{\max}_i$ = sample maximum value of input price $i=1,2,3,4$ .		
$x^{\min}_i$ = sample minimum value of input quantity $i=1,2,3,4$ .		
$x^{\max}_i$ = sample maximum value of input quantity $i=1,2,3,4$ .		
$y^{\min}$ = sample minimum value of output quantity		
$y^{\max}$ = sample maximum value of output quantity		
$S_{wi} = 0,00001 - \ln w^{\min}_i$		
$S_{xi} = 0,00001 - \ln x^{\min}_i$	Scale factor	Mean value (1)
$S_{yi} = 0,00001 - \ln y^{\min}_i$	$\lambda$	0,410
$M = \text{sample maximum value of } \ln w^{\max}_i + S_{wi}$	$\xi_1$	1,956
$\lambda = 6/M$	$\xi_2$	2,598
$\xi_i = 6/[\ln x^{\max}_i + S_{xi}], i=1,2,3,4$ .	$\xi_3$	4,196
$\mu = 6/[\ln y^{\max} + S_y], j=1,2$ .	$\mu$	2,015

**Independent Variables - Input prices**

**Canada**

Symbol	Mean	Std Dev.	Minimum	Median	Maximum
$(\ln w_1 + S_{w1}) \lambda$	0,494	0,277	0,000	0,600	1,320
$(\ln w_2 + S_{w2}) \lambda$	3,228	0,282	0,000	3,244	4,977
$(\ln w_3 + S_{w3}) \lambda$	1,557	0,505	0,000	1,426	6,000

**Independent Variables - Input quantities**

**Canada**

Symbol	Mean	Std Dev.	Minimum	Median	Maximum
$(\ln x_1 + S_{x1}) \xi_1 \lambda$	2,246	0,809	0,000	2,253	6,000
$(\ln x_2 + S_{x2}) \xi_2 \lambda$	1,608	1,128	0,000	1,603	6,000
$(\ln x_3 + S_{x3}) \xi_3 \lambda$	0,595	0,638	0,000	0,386	6,000

**Independent Variables - Output quantities**

**Canada**

Symbol	Mean	Std Dev.	Minimum	Median	Maximum
$(\ln y + S_y) \mu \lambda$	2,190	0,831	0,000	2,197	6,000

(1) We present the results of a simple scaling process considering simultaneously both countries and all years. We also considered disaggregated analyses by country and year, but obtained similar results. These results are available from authors upon request.

Source: Confédération des Caisses Desjardins, National Credit Union Association.



**Table V**  
**Hypothesis tests**  
**1996-2000**

A. Equation <sup>(1)</sup>			
$\begin{aligned} \ln C = & \alpha_0 + b'x + (1/2)x'AX + \sum_{h=1}^6 [u_h \cos(x_i) + v_h \sin(x_i)] + \sum_{h=4}^5 [u_h \cos(y_i) + v_h \sin(y_i)] \\ & + \sum_{h=6}^{11} [u_h \cos(x_i + x_j) + v_h \sin(x_i + x_j)] + \sum_{h=12}^{17} [u_h \cos(x_i - x_j) + v_h \sin(x_i - x_j)] + S_{h=18}^{23} [u_h \cos(w_i - w_j) + v_h \sin(w_i - w_j)] \\ & + \sum_{h=24}^{29} [u_h \cos(w_i - w_j + y_i) + v_h \sin(w_i - w_j + y_i)] + \sum_{h=30}^{35} [u_h \cos(w_i - w_j - y_i) + v_h \sin(w_i - w_j - y_i)] \\ & + \sum_{h=36}^{41} [u_h \cos(w_i + w_j - y_i) + v_h \sin(w_i + w_j - y_i)] + S_{h=42}^{47} [u_h \cos(w_i + w_j + y_i) + v_h \sin(w_i + w_j + y_i)] \end{aligned}$			
$i, j = 1, \dots, 3; i \neq j \quad \forall w, x \quad i, j = 1 \quad \forall y$			

**B. Characteristics of models**

Model (2):	H=47	H=24	H=0
N. obs.	11 035	11 035	11 035
N.obs. <sup>2/3</sup>	496	496	496
N. coefficients	168	138	118
R <sup>2</sup>	96,54%	96,04%	96,00%

**C. Exclusion tests**

Model:		Canada		
		H=47	H=24	H=0
Ho:	$A_{w_i} = A_{x_i} = A_y = 0$ (3)			
	F-statistic	33,70	321,61	329,93
	p-value	0,000	0,000	0,000
Ho:	$b_T = A_T = 0$ (4)			
	F-statistic	254,91	198,36	197,30
	p-value	0,000	0,000	0,000
Ho:	$b_{CRR} = b_{CAP} = 0$ (5)			
	F-statistic	20,37	20,70	23,93
	p-value	0,000	0,000	0,000
Ho:	$b_{CRR} = 0$			
	F-statistic	15,42	16,95	17,43
	p-value	0,000	0,000	0,000
Ho:	$b_{CAP} = 0$			
	F-statistic	25,37	24,54	30,03
	p-value	0,000	0,000	0,000
Ho:	$b_{GRI} = A_{GRI} = 0$ (6)			
	F-statistic	53,67	90,27	91,13
	p-value	0,000	0,000	0,000
Ho:	$u_h = v_h = 0$ , for all h (2)			
	F-statistic	37,44	5,95	NA
	p-value	0,000	0,000	
Ho:	$u_h = v_h = 0$ , for h > 24 (2)			
	F-statistic	61,97	NA	NA
	p-value	0,000		

(1) The reader is referred to the production approach of Mitchell and Onvural (1996) for further details on the model. We limit our analysis to 50 FF terms, though we noted that Eastwood and Gallant (1991) recommend to use a number of parameter near the number of observations raised to the two thirds power, 496 in our case. We understand that addition of additional FF terms should further lower our F-statistics.

(2) As presented in Gallant (1982), H refers to half the number of Fourier coefficients.

H=47 Hypothesis:  $H_0: u_h = v_h = 0$ , for h > 47

H=24 Hypothesis:  $H_0: u_h = v_h = 0$ , for h > 24

H=0 Hypothesis:  $H_0: u_h = v_h = 0$ , for all h

(3) Test of homogeneity of input prices hypothesis  $A_{w_i}$  and  $A_{x_i}$  include all cross terms of input prices.

(4) Exclusion test of technical trend coefficients including both the coefficient related to trend variable ( $b_T$ ) and all its cross terms ( $A_T$ ).

(5) Exclusion test of both credit risk and capital coefficients.

(6) Exclusion test of size groups coefficients including both the coefficient related to size groups ( $b_{GRI}$ ) and all its cross terms ( $A_{GRI}$ ).

Source: Confédération des Caisses Desjardins, National Credit Union Association.

**Table VI**  
**Mean Performance Measures**

**Equation**

$$\begin{aligned} \text{Ln } C = & a_0 + b'x + (1/2)x'Ax + S_{h=1}^4 [u_h \cos(x_i) + v_h \sin(x_i)] + S_{h=5}^6 [u_h \cos(y_i) + v_h \sin(y_i)] \\ & + S_{h=7}^{12} [u_h \cos(x_i + x_j) + v_h \sin(x_i + x_j)] + S_{h=13}^{13} [u_h \cos(y_i + y_j) + v_h \sin(y_i + y_j)] \\ & + S_{h=14}^{19} [u_h \cos(x_i - x_j) + v_h \sin(x_i - x_j)] + S_{h=20}^{20} [u_h \cos(y_i - y_j) + v_h \sin(y_i - y_j)] + S_{h=21}^{26} [u_h \cos(w_i - w_j) + v_h \sin(w_i - w_j)] \\ & + S_{h=27}^{38} [u_h \cos(x_i - x_j + y_i) + v_h \sin(x_i - x_j + y_i)] + S_{h=39}^{50} [u_h \cos(x_i - x_j - y_i) + v_h \sin(x_i - x_j - y_i)] \\ & i, j = 1, \dots, 4; i \neq j \end{aligned}$$

**Panel A: X-efficiency**

$$\text{EFF} = \epsilon^{\text{Min}}_i / \epsilon_i$$

	Canada					United States						
	1996	1997	1998	1999	2000	1996-2000	1996	1997	1998	1999	2000	1996-2000
< 5M	72,55%	71,96%	68,24%	72,92%	77,80%	<b>72,31%</b>	79,54%	70,48%	67,80%	70,21%	73,31%	<b>72,52%</b>
5-10M	71,04%	71,73%	69,18%	74,66%	75,76%	<b>72,30%</b>	77,21%	70,05%	68,44%	72,50%	73,99%	<b>72,39%</b>
10-25M	70,81%	73,90%	71,56%	75,91%	69,00%	<b>72,44%</b>	75,44%	69,61%	68,97%	74,84%	73,56%	<b>72,39%</b>
25-50M	71,57%	72,34%	71,02%	84,39%	64,75%	<b>72,66%</b>	73,74%	68,91%	69,22%	77,06%	73,38%	<b>72,41%</b>
>50M	73,17%	70,34%	70,48%	96,01%	58,33%	<b>73,71%</b>	72,08%	68,23%	70,15%	79,32%	72,72%	<b>72,59%</b>

**Panel B: X-efficiency including size group adjustment**

$$\text{EFF} = (\epsilon^{\text{Min}}_i + b_{\text{GRPi}} * \text{GRP}_i) / (\epsilon_i + b_{\text{GRPi}} * \text{GRP}_i)$$

	Canada					United States						
	1996	1997	1998	1999	2000	1996-2000	1996	1997	1998	1999	2000	1996-2000
< 5M	83,35%	83,86%	84,47%	83,71%	83,06%	<b>83,73%</b>	77,82%	79,00%	79,33%	78,98%	78,29%	<b>78,66%</b>
5-10M	86,23%	84,67%	85,01%	85,51%	85,52%	<b>85,39%</b>	83,53%	84,60%	84,83%	84,19%	84,17%	<b>84,26%</b>
10-25M	88,97%	84,52%	84,80%	89,53%	90,82%	<b>87,51%</b>	83,70%	84,59%	84,63%	83,71%	83,60%	<b>84,08%</b>
25-50M	91,17%	86,36%	86,40%	90,95%	94,41%	<b>88,76%</b>	84,30%	85,05%	84,93%	83,73%	83,08%	<b>84,26%</b>
>50M	92,71%	89,74%	89,48%	92,14%	97,96%	<b>92,59%</b>	86,27%	86,87%	86,70%	85,35%	85,58%	<b>86,14%</b>

Source: Confédération des Caisses Desjardins, National Credit Union Association.

**Table VII****Expense preference test for institutions with diffuse ownership**

PANEL A:	<b>Labor Factor</b>			<b>Capital Factor</b>		
	Complete sample	Quebec	United States	Complete sample	Quebec	United States
z	0,125	0,259 ***	1,940 ***	2,831 **	0,678 ***	20,048 ***
Std Dev.	0,19	0,0128	0,205	1,401	0,0337	3,902
R-squared:	0,921	0,854	0,961	0,956	0,859	0,799
Durbin Watso	1,636	1,995	1,53	1,586	2,007	1,595
Number of ob	6512	3286	3226	6504	3286	4693

PANEL B:	<b>Labor Factor</b>			<b>Capital Factor</b>		
	Complete sample	Quebec	United States	Complete sample	Quebec	United States
r	1,198***	0,5669 ***	1,364 ***	0,818***	0,575 ***	1,387 ***
Std Dev.	0,002	0,021	0,003	0,002	0,019	0,004
R-squared:	0,7461	0,865	0,69	0,925	0,86	0,958
Durbin Watso	1,678	1,994	1,37	1,666	2,008	1,38
Number of ob	6512	3286	3226	6512	3286	3226

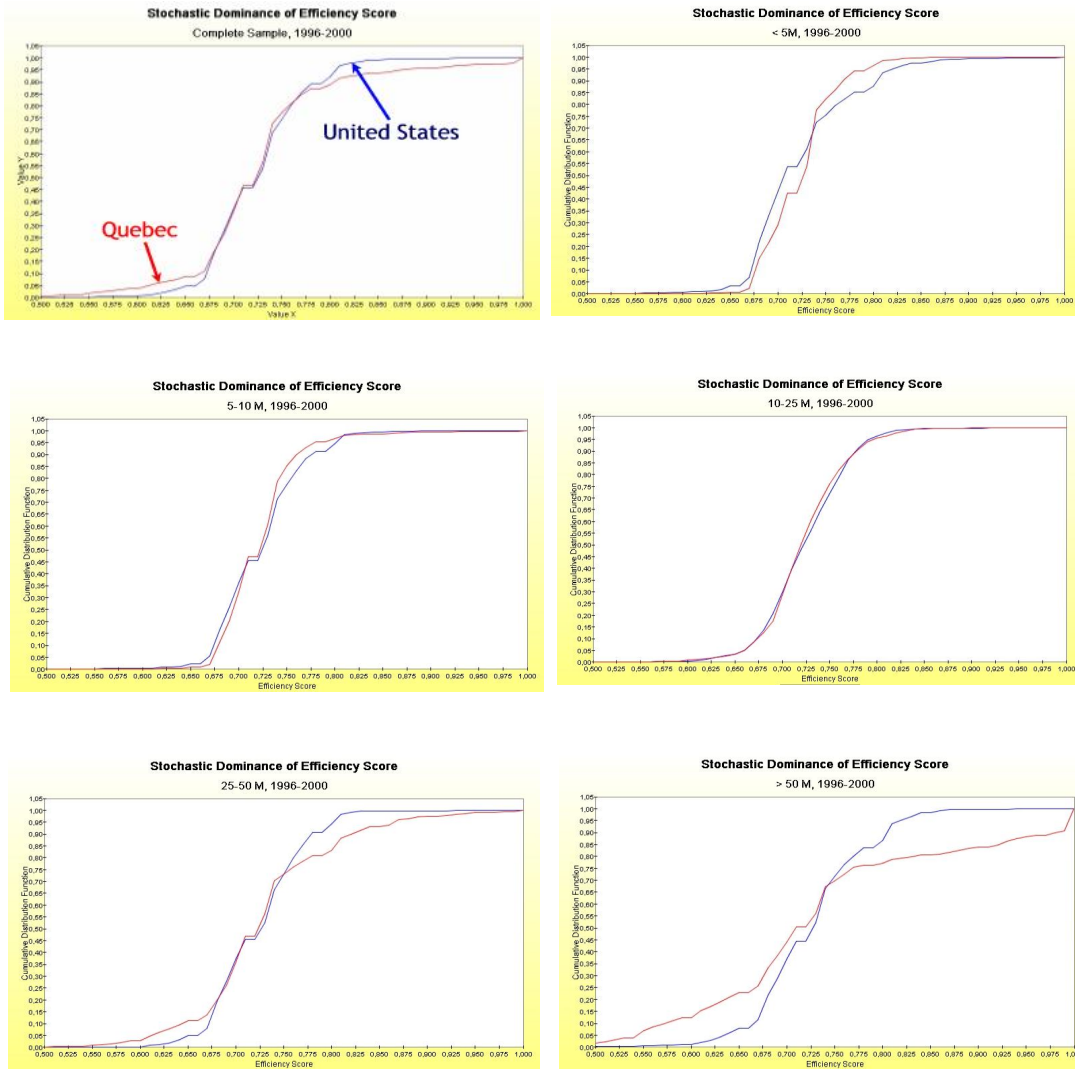
Note: This table shows the coefficients for expense preference parameters defined in equations 10

\*\*\*: Significant at 1%.

\*\*: Significant at 5%.

\*: Significant at 10%.

**Figure 2**  
**X-efficiency**  
 $EFF = \epsilon_{Mini} / \epsilon_i$



**Figure 3**  
**X-efficiency including size group adjustment**  
 $EFF = (\epsilon Mini + bGRPi * GRPi) / (\epsilon i + bGRPi * GRPi)$

