Managing contractual risk through organization: Strategic vs. consensual networks

Martin Desrochers,[a] Klaus P. Fischer[b,1] and Jean-Pierre Gueyie[c]

[a] Développement International Desjardins. Lévis. Québec, Canada.
[b] Centre Interuniversitaire de Recherche en Risques, Politiques Économiques et l'Emploi (CIRPÉE). Faculté des sciences de l'administration, Université Laval, Québec (Québec) G1K 7P4, Canada
[c] Université du Québec à Montréal, École des sciences de la Gestion C.P. 6192, Succursale Centre Ville, Montréal (Québec) H3C4R2, Canada.

May, 2004

[1] Corresponding author. Phone: 1-418-656-2131 Ext. 3679. E-mail : Klaus.Fischer@fas.ulaval.ca. Financial support from the National Research Program in Financial Services and Public Policy (The Schulich School of Business, York University), 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 Quebec's cooperatives. We also thank the Desjardins Movement and the Deposit Insurance Corporation of Ontario (DICO) for the enthusiastic support offered in the collection of the data used in the research. These institutions do not necessarily endorse the conclusions of the paper.

Managing contractual risk through organization: Strategic vs. consensual networks

Abstract

This paper presents a study of the economic organization of systems of financial cooperatives (FC). The first part is a theoretical framework rooted in principles of transaction cost economics that seeks to explain empirical regularities observable in systems of FC worldwide. The second part is an empirical analysis that compares the Quebec Desjardins Movement (DM) and the Ontario Credit Union (OCU) system that are both organized as networks with different degree of development. The fundamental proposition is that networks, particularly strategic networks, are a superior form of governance mechanism for relatively wide ranges of contractual hazard and size of institutions. Strategic networks provide a substitute control mechanism when the size of the institution dilutes internal governance mechanisms. It thus discourages subgoal pursuits and expense preferences, and possibly economizes on bounded rationality both occurring in large FC. The theory allows us to generate a set of testable hypotheses of which three are tested in the paper, namely: i). Over a range of small FC, differences in efficiency will be relatively small, if any. ii). Large independent institutions should display systematically lower efficiency than similar sized FC members of strategic networks. iii). FC in strategic networks should display lower variance in size as well as in performance indicators. Our empirical results are consistent with these theoretical propositions. Opponents to networks often argued that the benefits associated to the vast array of financial services offered to large sectors of the population, and in particular to rural communities, come at a heavy price of running an expensive bureaucracy. Our data suggest that the success of the DM in servicing its vast and rural clientele effectively comes at a price. But, even paying this price, the DM outperforms the OCU system.

Keywords: Transaction cost economics, Financial cooperatives, Networks, Corporate governance, Technical efficiency, X-Efficiency.

JEL Codes: G2, G3.

Managing contractual risk through organization: Strategic vs. consensual networks

Résumé

Ce papier présente une étude de la structure organisationnelle des systèmes de coopératives financières. La première partie est une analyse théorique qui se base sur la théorie économique des coûts de transaction pour expliquer des faits empiriquement observés dans les systèmes de coopératives financières à travers le monde. La seconde partie est une étude empirique qui compare le Mouvement Desjardins au Québec et le système de Credit Unions de l'Ontario. Ces ensembles sont tous deux organisés sous forme de réseau, mais à des degrés de développement différents. La proposition fondamentale est la suivante : les réseaux, et plus particulièrement les réseaux stratégiques, représentent une forme supérieure de mécanisme de gouvernance, pour une vaste gamme de risques contractuels et de tailles d'institutions. Les réseaux stratégiques représentent un mécanisme de contrôle alternatif lorsque la taille de l'institution paralyse les mécanismes internes de gouvernance. Ils découragent la poursuite d'objectifs personnels et de dépenses oisives et réduisent les possibilités de rationalité limitée qu'on rencontre couramment dans les grandes coopératives financières. De la partie théorique découle un ensemble d'hypothèses testables dont trois sont testées dans cet article, à savoir : i). Pour de petites coopératives financières, les différences d'efficience, s'il en existe seront relativement faibles. ii). Les grandes coopératives financières indépendantes devraient systématiquement enregistrer une efficience plus faible que les coopératives financières de même taille appartenant à des réseaux stratégiques. iii). Les coopératives financières membres de réseaux stratégiques devraient présenter une faible variance de taille et d'indicateurs de performance. Nos résultats empiriques sont consistants avec ces propositions théoriques. Les opposants aux réseaux argumentent souvent que les bénéfices associés à l'étendue des services financiers offerts à une vaste population, et en particulier aux communautés rurales sont amoindris par les coûts d'une lourde bureaucratie. Nos données suggèrent que les succès du Mouvement Desjardins dans la couverture de sa vaste clientèle rurale ont effectivement un prix à payer. Toutefois, même en payant ce prix, le Mouvement Desjardins garde une performance supérieure à celle du système de Credit Unions de l'Ontario.

Mots clés : Économie des coûts de transaction, Coopératives financières, Réseaux, Gouvernance d'entreprise, Efficience technique, X- efficience.

JEL Codes: G2, G3.

Managing contractual risk through organization: Strategic vs. consensual networks

"... there is an opportunity for the credit union movement to build a system that is capable of achieving in the rest of Canada the same level of success achieved by the Movement Desjardins in Quebec"

Report McKay, 1998

1. Introduction

In places like Austria, France, French Canada (Quebec), Germany, Japan, Netherlands, and others, mutual financial intermediaries -financial cooperatives (FC) in particular- are, taken as a group, the, or one of the, largest financial intermediary of the country. They are organized in networks of hundreds, or thousands of institutions, tied together by some form of multilateral contract. Often, member institutions are undistinguishable one from the other despite the fact that each is an independent and separately owned. In Germany, Sparkassen (community banks) and Raiffeisen FC taken together control nearly 60% of the country's financial assets and serve 80 million members. In France, adding Credit Agricole, Credit Mutuel, Caisses Populaires and Credit Maritime, they reach a similar market share. In Quebec, the FC's market share is around of 45% with over 5 million members on a population of 7.5 million. By contrast, in other places, FC play a marginal role in the economy, controlling only a small share of financial assets. Typically, these systems also present a lower level of macro-organization and integration. Observing systems of FC worldwide, it becomes apparent that in countries with lower levels of development, systems of FC tend to be relatively small and present a low levels of integration. As one moves up the ladder of income, the presence of FC systems with high levels of integration becomes more frequent, although not universal. What are the economic arguments that explain these important differences in the level of development and integration of systems of

FC? Why are FC a dominant force in some economies and marginal in others? More importantly, do differences at the macro level also reflect in differences at a micro level, in particular, efficiency? The purpose of this paper is to address this last question.

The paper consists of two parts. The first, presents a theoretical framework that builds on existing work [Desrochers and Fischer, 2003] (D&F) using transaction cost economics (TCE) to explain integration of large numbers of FC into networks. We distinguish two types of networks that we call “consensual” and “strategic” networks, respectively, and explain their existence on TCE principles. This distinction is necessary since consensual networks such as those found in the United States and the English Canada are quite different from those in Quebec, France, Germany, Netherlands, Austria or Japan. The second part presents an empirical analysis based on a matched sample of Quebec and Ontario FC, in which we test some hypotheses that follow the theoretical framework.

2. TCE based theory of cooperative networks

The fundamental proposition in D&F is that for FC, networks are a superior form of governance mechanism, over markets and mergers, for relatively wide and relevant -but not all- ranges of contractual hazard. That is, networks, a hybrid form of corporate organization, is a discriminating alignment adopted by movements of mutual financial intermediaries that is adapted to the attributes of transactions they face. The main focus of attention in their work is the contractual relations that are established between FC to acquire inputs or allocate resources jointly. In contrast to the analysis of buy vs. make usually performed in the context of TCE, the contractual arrangements they (and we) are focusing on is not one with a supplier or a buyer but the one that develops between FC. The inter-mutuals lateral dependency arises from a pure production-economics imperative. This consists of the need to engage in joint ventures to exploit

economies of scale [Littlechild, 1975] and to reduce the uncertainty in the acquisition of inputs and the management of infrastructure required to perform the intermediation process. To perform this, they can choose horizontal mergers that would establish a hierarchy-like organization supported by relational contracts. Alternatively 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 elsewhere (Macneil, 1978, pp. 865), these contracts provide support for long term relationships with two key characteristics: the existence of gaps in the planning of responses by the contracting parties; and the use of processes and techniques employed by contract planners to create flexibility. The units that participate in such a contract maintain autonomy, but an elastic contracting mechanism mediates the relation. In this choice, merger vs. network, the arguments that play the central role are transaction costs, governance costs and economies of scale.

D&F propose that in the case of FC, exercise of manager's expense preference (EP) facilitated by ownership dilution and weak governance, plays a determinant role in governance costs. As institutions grow in size due to mergers, EP will accentuate. Thus, FC that face the need --due to economies of scale and scope arguments-- to engage in lateral contracts that imply increasing levels of appropriability hazard (AH), must decide among three choices: i). forego joint investments and continue input acquisition (jointly or separately) through spot contracts; ii). engage into merger operations with partners, creating large organizations, where EP hazard is high, made possible by the dilution of ownership; or iii). engage in alliances with improved protection against AH and where the exercise of EP is limited. Accentuated governance costs associated with mergers (due to EP) in turn implies that hybrids networks will be the governance mechanism of choice over a wide range of levels of AH --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.[2]

2.1 Strategic vs. consensual networks

In this section, we describe networks with varying levels of integration and then develop the TCE based arguments that explain their existence. We used the expression "consensual" and "strategic" networks to describe respectively two multi-node alliances with significant differences in levels of lateral dependency. The differences between strategic and consensual networks has already been noted and described [Greve, 2002; Polster, 2001]. While many features are common to both forms of networks, these authors note differences that modify significantly how the respective organizations work. The main difference between the two forms of networks appear in the representation governance and the way decisions are taken. We will first present a few institutional aspects of both types of networks --some already noted by these

[2] D&F attribute the upward shift in costs associated with mergers to EP. While this may indeed be the case, given the well documented inefficiency of governance mechanisms in FC, this is not necessarily the only argument that could explain that shift. In fact, there are more reasons why transaction costs may increase with size of the institution. Two further arguments that come to mind are loss of informational efficiency and increase in exposure to moral hazard by its borrower members. The first argument is based on the positive relation between the size of the institution and the pool of information managers must handle to assess the quality of the typical FC borrowers. This is particularly important if the information is of "soft" nature [Stein, 2002]. Stein's model implies that small units are at an advantage in evaluating assets when information about these assets is naturally "soft" and cannot be credibly communicated among agents. The theory has recently found empirical support [Berger et al., 2002 and Berger, Klapper and Udell, 2001]. The second argument suggests that as the size of the institution increases members may be more willing to engage in moral hazard towards the institution. This in turn cold be due to several reasons, reduction of the bond and reduction of peer group pressure. Thus, the argument is not necessarily limited to EP, any factor that will shift or increase the slope of the efficient frontier for mergers will produce the same effect. One factor that contradicts this line of reasoning is portfolio diversification. As the size of a mutual increases, specific risk is eliminated approaching asymptotically systemic risk to which the entire financial system is exposed. However, networks of FC have successfully created mechanisms that yield the benefit of risk pooling while limiting the growth in size of the individual member FC.

authors-- and then explain why they are discriminating organizational alignments in response to intensity in contractual hazard.

2.1.1. Institutional features of networks

Gulati and Singh [1998] noted that in joint ventures "when firms anticipate appropriation concerns, they are likely to organize alliances with more hierarchical contracts".[3] They also suggest that inter-firm alliances build governance structures to manage anticipated coordination costs --in TCE terminology, cooperative adaptation mechanisms-- and to address appropriation concerns. Likewise, it has been proposed [Canal, Lianeza and Arino, 2003] that the need of introducing formal control mechanisms --as opposed to pure relationship asset development-- to manage an alliance increases when it involves multiple parties, clearly the case of FC networks.

Jarrillo (1988) was among the first to use the expression "strategic networks" in a formal context. According to this author, these networks are "long-term, purposeful arrangements among distinct but related for profit organizations that allow those firms to gain or sustain competitive advantages vis-à-vis their competitors outside the network." Focusing more (but not exclusively) on FC, [Greve, 2002 and Polster, 2001] distinguish the two forms of networks which we now characterize as follows:

- *Consensual networks* (CN) consist predominantly of collections of multilateral agreements between first-tier nodes. They operate on the basis of continued consensus of all or a subset of participants of the collective. An "apex organization"[4] may --and usually does-- exist but it

[3] According to Stinchcombe [1985] business alliances in general may create a number of hierarchical features including: i). a command structure and authority system; ii). incentive systems; iii). standard operating procedures and control mechanisms; iv). dispute resolution procedures and mechanisms (that is, private ordering mechanisms that bypass courts [Macneil, 1978] and markets; and a non-market pricing system. While Stinchcombe was not studying systems of FC, most features are typically present in a SN, but absent in CN.

[4] Throughout the remainder of the paper central nodes typically created by systems of FC in CN will be designed as "apex organizations". In the case of SN we will call these central bodies the “hub”.

has mostly representation and some limited pooled resource management function. Strategic decision control and management is explicitly excluded of the functions of the apex[5]. In a CN both strategic and operational decision management and control remains ankered in the first-tier nodes. Decision management is at the level of the first-tier node's managers and control at the level of the node's board of directors. These nodes may transfer a share of strategic planning activity to the apex, but they retain both strategic management decision and control. The apex simply plays an advisory role and its recommendations have no binding character. In CN pooling and standardization is voluntary and most likely partial as some members opt out for diverse reasons while remaining members of the network. Members of the collective remain free to opt out from the use of network services. This implies that strategic decision making remain under control of first-tier nodes for a significant domain of operations, and may conflict over that domain with the collective. This arrangement reduces the incentives to create governance mechanisms that insure compliance and the need for regulatory bodies responsible for controlling behavior by members of the collective. Reciprocity is thus the dominant mechanism for contract enforcement. The organizational kernel required to run these networks is relatively small.[6] The FC systems of the United States, UK, Spain and English Canada are examples of CN. [7]

- In *strategic networks* (SN) decisions taken by the collective, according to defined governance mechanisms become mandatory for the entire collective. The decision process is made

[5] In presenting decision management and control in this fashion, useful for our purpose, we adopt definitions of the concept proposed in the agency theory [Fama and Jensen, 1983a], and adopted by TCE theorists [Williamson, 1996, pp. 175].

[6] We define as “organizational kernel” the essential organizational nucleus for the system to work.

operational through the cession by first-tier nodes to the apex of some of the decision control about issues that affect the collective, that is, strategic aspects related to the network. The apex becomes a "hub node" [Greve, 2002; Polster, 2001], with meta-coordination function.[8] This includes power over decision control and management in representation of the collective (with or without "vote" by the collective) in all strategic issues assigned to it. Decisions become mandatory for members of the collective as long as they belong to it. The domains subject to meta-coordination is agreed upon by the collective and includes areas such as: products and services offered, price setting, marketing and advertising, institutional and contractual arrangements to acquire inputs and levels of standardization in different operational aspects (operational procedures, information technology, accounting standards, etc.). First-tier nodes maintain operational decision management and control under their respective executive and governing bodies. However, they loose independence with respect to domains subject to meta-coordination under the hub, keeping only the right to vote on those issues through the governance bodies. Alternatively, they may abandon the network altogether. In a SN, member nodes exercise control over decision not by keeping the right to opt out from those agreement but through its participation in a representation governance structure. Strategic networks present features that are specific to hierarchies and that provide an additional effectiveness to operate in highly competitive environments [Greve, 2002]. One immediate result is the need to introduce private ordering mechanisms --regulatory bodies--

[7] It is our understanding that the Spanish FC system is currently engaged in an active debate on whether and the domains on which to expand the authority of its apex organizations in the strategic management of the system. A move in that direction would make of this apex a hub and the network moving rapidly to a SN type of structure.

[8] Among the tasks included in the meta-coordination function we include all activities cataloged by Stinchcombe [1985] (see footnote 6) for alliances, but particularly the function of strategic decision control and management.

to enforce the collective contract.[9] Thus, regulation is the dominant mechanism for contract enforcement. Due to expanded meta-coordination and regulatory function, organizational kernel required to run these network is, in consequence, considerably larger. The FC systems of Austria, Australia, France, Germany, Ireland, Japan, Netherlands, among others, are examples of SN.

2.1.2. The economics of networks

There are two issues when comparing CN and SN: their relative position on the governance cost economizing frontier, and the economic arguments that explain the adoption of one or the other form. To address them we will use Figure 1, an adaptation of a well-known graphic tool in TCE (e.g. Williamson, 1996, pp.108-109).

Insert Figure 1 about here

Our analysis builds on that presented by D&F, in which we introduce two alternative forms of hybrid organizations, our consensual and strategic networks. As one moves to higher levels of contractual hazard (i.e., to the right along the governance cost economizing frontier), the governance mechanisms become increasingly intrusive, leaving less room to autonomous adaptations and increasing the power of cooperative adaptations. This framework of analysis admits the existence of hybrids that differ in some relevant feature, such as the existence or not of a hub. The line of arguments is similar to the one supporting the existence of "M-form" and

[9] It is often argued that SN decisions are centralized in the hub with "total loss" of independence for the first-tier nodes that must comply with decision taken by the first, like in a joint-stock divisional enterprise. This is false. In a SN, representation governance bodies responsible for the supervision of the hub's operation maintain strategic decision control. Whether these governance bodies are indeed efficient in their function and independent of the hub's management is another question altogether. In this sense the debate is similar the one that exist at the level of any firm, and indeed, since Fama [1980], it has been often argued that board of directors is principally an instrument used by incumbent managers to legitimize their own goals for the firm.

"U-form" organizations in the corporate world, with the first dominating in a range to the right but close to the intercept point with projection on the contractual hazard axe, k'_m, and the other dominating, to the right and further away of the same intercept.[10] In those cases the form of contractual hazard at the heart of the relation is asset specificity (a specific measure of AH). The same discussion that justifies the existence of different curves for each major governance form (and for M and U forms) applies to the analysis of the different network forms. Thus, a CN, with a smaller organizational kernel, presents lower setup costs than a SN, implying $G_{CN}(0) < G_{SN}(0)$. In a CN, adaptive incentives are stronger, as members tend to resolve changes in market conditions with autonomous adjustments. A SN presents a larger organizational kernel, with the hub's corporate headquarter-like function of meta-coordination responsible for administering cooperative adaptation mechanisms. Thus, setup costs are higher. On the other hand, a CN presents lower cooperative adaptation capacity to disturbances. A CN presents less flexibility to adapt to consequential changes in market conditions or to competitive pressures, resulting from changes in technology or in shift in the demand of financial products. The result is that $G'_{CN} > G'_{SN}$ with an intercept at k'_m where dominance of one over the other crosses. Let N_C and N_S represent two hypothetical networks with $k_m < k_C < k_S$. The lower level of exposure to contractual hazard of N_C implies that it requires simpler mechanisms for ex-post cooperative adaptation to disturbances, and thus a smaller organizational kernel. Would this network adopt a more intrusive and complex corporate governance structure --e.g. typical of a SN-- that lead to higher governance costs it would cause it to shift away from the governance cost economizing frontier. The set of attributes that characterize CN and SN suggest that the first N_C fall towards the left end of the domain over which hybrids dominate as governance form. Strategic networks

[10] The issue of M and U-from organisations has been covered in the industrial organization literature by Williamson [1975] and others [Ingham, 1992; Armour and Teece, 1978; and Steer and Cable, 1978].

N_S, on the other hand fall closer to the intercept of G_{Hm} as they involve considerably large intrusion through the hub. As noted by D&F, FC systems with very low level of integration, which they called "atomized" are subject to very low contractual hazard that places them to the left of k_m where the curve G_{Mm} dominates. In this region FC present only low level of lateral relations and thus avoid the need to establish formal long-term contractual relations.

But what drives the creation of SN? What encourages individual FC, presumably members of a CN, to abandon their strategic independence, ceding strategic decision control power to a hierarchy and decision management to a hub and agreeing to comply with collective strategic decisions? Why is it that in higher-level income countries --except a few-- FC systems, when they exist, tend to take the form of strategic rather than consensual networks? One argument that could be invoked --but to which we do not adhere-- is subgoal pursuit on the side of managers in the apex. Opportunistic self-aggrandizing managers in the apex increasingly appropriate power from the first-tier nodes to the point that they take over control of a portion or all strategic decision making. While managers with such intentions might exist, one limitation of this power-grabbing argument is that they need not stop at the creation of a network. Why not merge outright the first-tier nodes into a single institution eliminating local board of directors --that limits the power of central bodies-- and take over control of the entire system? Those managers, if they succeeded in convincing first-tier nodes to give up strategic decision management --and perhaps decision control, even though neither may be economically justifiable, should also be able to convince the same nodes of the advantages of a merger. This, however, is an event that does not occur. In fact, besides exceptional situations --mostly triggered by external factors-- one

almost *never* sees SN of mutuals merging to become M-form organizations. In other words, integration stops at the SN, never moving to an M-form consolidated organization.[11]

The complexity of coordinating operational and strategic decision control and management in a complex environment is another tempting argument that may actually play a role. As the complexity of the market and the diversity of financial products and services required by member-clients increases, bounded rationality by managers limits their capacity to take informed decisions at strategic and operational levels. The relatively small size of (most) mutuals prevents establishing local capacity to perform the evaluation and planning function required to exploit economies of scale and scope. Thus, local managers of first-tier nodes may find it useful to pool resources with other first-tier nodes and create the capacity in the apex to perform this complex function. This, however, does not explain why first-tier nodes will be willing to cede strategic decision management and control to the network.

We conjecture that SN are created to control appropriability hazard (AH). AH "can be traced to difficulties in adequately specifying payoff-relevant activities, monitoring the execution of prescribed activities, and/or enforcing contracts through the courts [Oxley, 1997]." It appears in inter-firm alliances that involve technology transfers and joint production of goods and services in the presence of weak property rights [Hagedoorn, 1993; Oxley, 1997]. As the number of products subject to joint production/contracting increases and technology involved in their production becomes more sophisticated, FC become increasingly tied up in mutual dependence. The resources that have been invested in developing the capacity to produce those services, and the risks of loss of investments, also multiply. That is, AH is positively related to the

[11] Further, in cases where networks were forced to merge by a hostile legal and regulatory framework, the merger is only apparent. First-tier nodes conserve the governing bodies that characterize them as independent institutions. This is the case for example of Banco Credicoop of Argentina, Caja Popular Mexicana of Mexico and COFAC of Uruguay.

sophistication of the mix of financial services offered in the network. With AH increases the need to incorporate to the organizational kernel cooperative adaptation mechanisms that consist of the range of hierarchical features proposed by Stinchcombe [1985]. If, say, the level of AH resulting from lateral relations is k_S but the level of governance has not moved from one of a CN, then, maladaptation and ex-post haggling between participants will cause increases in relation governance costs along the curve G_{CN} which, for equal contract hazard will be considerably less efficient than, say, G_{SN}. A CN run under such conditions will operate in an inefficient contractual environment likely to reflect in low performance both individually and globally. Maladaptation can be reduced by standardizing operations, establishing common strategic plans across the relevant domain of activities and introducing private ordering mechanisms to insure party compliance over the activities in which AH is most relevant. This implies giving up own decision management and control to cede it to a hub, resulting in a separation of operational and (at least some) strategic decision making between first-tier and the apex. The relevant domain for the hub's meta-coordination needs to be defined by network members according to the particularities of the market and the areas over which cooperation exist. Thus it varies from one system to another.

Conversely, the absence of a hub may encourage the use of inefficient solutions to economies of scale and scope problems. In systems operating as CN, meta-coordination designed to protect property rights of members are underdeveloped. Thus, these systems will be less able to face consequential disturbances and members will be less willing to engage in collective-wide joint investments that may increase their exposure to AH. They will, instead, be more inclined to engage in autonomous adaptations to disturbances. With respect to inputs they will be reluctant to exploit economies of scale through system-wide joint ventures and will seek alternative means

to solve those concerns. Radial growth or mergers with other units that allow exploitation of economies of scale and scope will be one solution they may choose. Often, this option will be helped by the oversizing and EP of their managers. However, as argued above EP --and other factors related to size --will results in inefficiencies and a loss of competitivity of the institutions involved.

The arguments presented above provide a reasonable explanation of how, as financial systems become more complex and the mix of products offered by the networks more sophisticated, CN tend to transform into SN. However, what we are not able to explain satisfactorily is what prevents some CN that operate under almost identical market conditions than SN, from becoming SN. What explains, for example, that the English Canada, United States or UK credit union systems, while operating in markets almost identical to those of France, Germany, Netherlands or Quebec, have chosen thus far to remain CN? We do not attempt to respond to this question. However, in the empirical portion of the paper, we will test the hypothesis whether the SN is a discriminating alignment better suited to cope with the levels of AH found in Canada. Further, that addressing economies of scale and scope concerns is better achieved through SN than through alternative mechanisms such as radial growth and large scale mergers, a path chosen by English Canada credit unions.

2.2 Strategic networks and M-form organizations

The organizational characteristics of SN places them close to the M-form organization within the group of hierarchical structures, with which it shares important attributes. In fact, SN are so much M-form like organizations that it is often difficult to differentiate the way daily business activities are carried out in both. It might thus seem likely that SN could easily become M-form organizations or vice-versa. In both a central node has the responsibility and is accountable for

the meta-coordination function of a hub, while lower tier nodes are responsible and accountable for operating performance. Yet, a fundamental difference between a SN and an M-form joint stock enterprise --to which the expression applies in the literature-- is that in the latter, residual property rights remain ankered at the top of the pyramid, while in a SN of mutuals residual property rights remain ankered at the bottom of the pyramid. Thus in an M-form organization --like in any other joint stock company-- successive layers in the organization are agents of the immediately superior layer, with shareholder as principals placed at the top. In SN successive layers of the organization are agents of the immediately inferior layer with shareholders as principals placed at the bottom. In order to protect property rights of the ultimate shareholders, SN require governance mechanisms that control network decision and protect the residual rights of shareholders, making the hub both responsible for insuring compliance by first-tier nodes to strategic plans and accountable to the same for the network's strategic performance. These governance mechanisms are usually the board of directors, not composed by outsiders --or insiders-- representing shareholders at large as is usual in joint-stock companies, but of representants of the lower tier nodes.

These differences are relevant to assess the likelihood of conversion of a SN to a M-form organization. While this passage may appear to be relatively simple in the case of joint-stock organizations, this is not the case for mutuals. In effect, in a mutual such a passage would require an important change of the distribution of property rights among principals. For example, residual property right holders of a node in a SN would see their rights pooled into the M-form governance bodies with loss of direct influence on decision making at the node level. This node now part of the merged M-form organization will respond to goals established by the hub of the merged company, whether this is on the interest of local shareholders or not. In the case of joint

stock organizations it only represents a change in the distribution of agents, totally controlled by principals (located at the central node). This, of course, does not exclude the possibility of mergers in SN occurring locally between pairs or groups of first tier nodes to become larger members of the SN.

Until now we have considered large scale --often movement-wide-- integration. It is not the only governance solution to economize on bounded rationality related to the mutual lateral dependency. Credit union services organizations (CUSOS) in the United States represent a half-way solution standing between CN and SN. In effect, this system is characterized by the presence of numerous central nodes, which offer a reduced list of core activities that are delegated on a voluntary basis by some nodes. Notwithstanding, it is possible that some activities realized by central node become mandatory in some cases, which indeed confers such an arrangement the character of a SN. Despite these arrangements we argue that overall the system operates as a CN rather than as a SN. Such an arrangement may be of interest when the territory to be covered is very extensive and the range of activities (and so AH) is limited.

2.3 Testable hypotheses

The theoretical analysis presented in the previous sections, combined with that of D&F, yields a set of propositions some of which are tested in this paper. The propositions of interest are the following:

Hypothesis 1: For small FC, no differences in X-efficiency in consensual and strategic networks should be observed (D&F).

Hypothesis 2: Large independent institutions should display systematically lower X-efficiency than similar sized FC members of networks.

Hypothesis 3: FC in strategic networks should display lower variance in the size as well as in performance indicators of FC operating in a particular market (D&F).

Some other propositions not directly tested in this paper are presented as follows:

Hypothesis 4: In the case of larger FC created by mergers that resulted from the exercise of EP, these institutions should present governance --and overall-- costs, for equal level of contractual hazard, that are superior than those operating in a network regime.

Hypothesis 5: FC members of networks should manifest lower exposure to EP.

3. Data

We consider an unbalanced panel data set of 306 Ontario credit unions (CU) paired with equal number of Quebec caisses populaires (caisses), yielding a total of 1530 observations per province between 1996 and 2000. Table 1 defines the variables used in the paper.

Insert Table 1 about here

The smallest 126 OCU do not have a match in size in the DM, thus they were excluded from the sample. They were excluded when they were smaller than 88% of the value of the smallest caisse. The characteristics of our final samples are presented in Table 2.

Insert Table 2 about here

We observe that Quebec's caisses have somewhat larger median of assets than their Ontario's counterparts despite the size matching done at the beginning of the sample period. This is so

because the caisses have grown faster than the CU. Including remaining Caisses from Quebec into our sample would increase the median figure of total assets by near 40%.

The pairing was performed as follows. The sample for Quebec is larger than that for Ontario's, thus we found one caisse for each Ontario credit union whose assets were most similar as of December 1996. We keep the initial matching throughout study period and provide no substitute for exiting observations --most due to the recent merger wave in Quebec. A test of difference of means for the two pairs samples (Z-test) yields size is not statistically different. More precisely, computing the difference in size for each pair yields that in 232 pairs the difference is less than half a percent, in 47 pairs it is between 0.5% and 2.5%, in 14 pairs between 2.5% and 5%, and in only 13 pairs is the difference more than 5%. In more than 95% of our pairs the difference is less than 5% of asset value.

In Quebec, we consider pre-merger and post-merger FC as different institutions. We use a different Quebec 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, 1996, 1999]. In each of the two provinces, we divided the sample into five size groups in terms of asset values: < 3.0 million; 3-10 million; 10-25 million; 25-50 million and, last group, > 50 million. The groups were recomposed each year to control for migration due to natural growth or merger.

4. Methodology

4.1 Measure of performance

Much of the empirical test will be based on measures of efficiency that have become standard in analysis of performance of financial intermediaries. 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, X-efficiency (EFF). 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 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 these costs. Our definition of efficiency [Berger and Mester, 1997] is:

$$EFF = \frac{\in_i^{Min}}{\in_i}, \quad (1)$$

where $\in_i$ is the minimal cost associated to the most efficient CU or caisse, 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 $\in_i$ is representing 70% of $\in_i$, 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.

4.2 The statistical model

We use the intermediation approach, considering the amount of loans as output [Mitchell and Onvural, 1996], except for a few modifications that we present below. The value of deposits, capital and the number of employees are the other inputs. In addition to operational costs, the approach also includes input prices on the right hand side. The model is based on a work that has become somewhat of a standard in the literature [Sealey and Lindley, 1977]. Since homogeneity of input prices ($\sum A_{ij} = 0$) 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 previously used in other 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, 1996; 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 $E[X|\varepsilon] \neq 0$, that is, if the X matrix of covariates is not independent of individual factors).[12]
- 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 Weszel, 1996; Altunbas, Gardener, Moluneux and Moore, 2001 and Kumbhakar, Lozano, Lovell and Hassan, 2001].

[12] 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]. Other [Lang and Welzel, 1996] present results for both fixed and random effect estimators but do not indicate which is the unbiased vector. As shown [Hausman, 1978], only one set of estimators is adequate for a specific sample, with one of them either inefficient, or biased.

- 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, 1996].[13]
- Due to differences in definition of loan products in both systems, we focus on product specific economies of scale (EOS) for all loan products grouped into a single category. While it might have been desirable to introduce more than one output, we do not see this as a weakness of the study. Loans, in their different forms, are one of the two main products that characterize the service of a FC to its members. The other, savings products, was used as an input in order to respect the intermediation approach to EOS studies that was considered as more suitable in the present context than the production approach to EOS. For this reason the study can be viewed as based on a loan specific EOS approach.

The model is defined as follows:

$$\mathrm{LnC} = \alpha_0 + \mathrm{b}'\mathrm{X} + \frac{1}{2}\mathrm{X}'\mathrm{AX} + \mathrm{FF} + \in + \varepsilon, \qquad (2)$$

where LnC is the log total costs (which include both operational expenses and interest expenses), α_0 is a constant, b is a vector of coefficients, X is a matrix of independent variables including non-scaled log-input price and non-scaled log-input quantity on interest rate on deposits, cost of personnel and cost of fixed capital, 1 non-scaled log-output quantity (of loans), 1 trend variable to reflect technological changes, log of credit risk, log of capitalization, and a dummy for acquiring institutions.

[13] We note however that various authors imposed cost minimization for non-profit financial intermediaries [Murray and White, 1983; Rezvanian, Mehdian and Elyasiani, 1996; Westley and Shaffer, 1999].

We include nine dummy variables to separate FC into five size groups for each province. Thus, the intercept represents Quebec FC with assets < 3.0 million, the first dummy includes Quebec FC with real assets between 3 and 10 million, the second one between 10 and 25 million, the third between 25 and 50 million, while the fourth includes the ones above 50 million. The fifth to ninth dummies includes Ontario FC whose assets are distributed among similar size groups. More precisely, the fifth includes FC whose assets are below 3 million, while the ninth group includes Ontario FC whose assets are above 50 million. Through the use of size and province dummies we estimate unrestricted models that are specific to each province and group size. A technical change variable is estimated by the trend variable. We also integrate ex post risk measures: the proportion of bad loans over net loans and the amount of capital over assets. Evidence exists that the larger the capital, the larger the EOS [Hugues and Mester, 1993, 1998]. This variable control for heterosckedasticity 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].

$A = [A_{w1}, A_{w2}, A_{w3}, A_{X1}, A_{X2}, A_{X3}, A_{y}, A_{T}, GR1,...,GR9]$, a matrix of 90 coefficients most of which are related to cross terms. The usual constraints to insure homogeneity in input prices and

symmetry of second-order coefficients are imposed: $\sum b_{wi} = 1, \sum A_{ij} = 0.$ Besides these restrictions we also assure that trigonometric terms including input prices respect the condition $\sum k_h = 0.$ [Gallant, 1982].

In Equation (2) FF, $\in$ and ε components respectively refer to the Fourrier transform terms (FF), an inefficiency term ($\in$) and a purely random error term (ε). These terms are discussed in the next sections.

Fourier Flexible terms require scaled variables comprised within $[0,2\pi]$ range. The characteristics of scaled variables and scaling factors are presented in Table 3. The scaling process is consistent with earlier work [Mitchell and Onvural, 1996].

We insured poolability of data first by controlling for time trend. Our second control for poolability consists in estimating Equation (2) excluding and then including GR1,...,GR9 (size) and province dummy variables and test for the importance of residual individual and time effect present in the error by means of an ANOVA, a common approach with panel data. The inclusion of size dummies and all FF terms significantly reduced the F-statistics of both effects (time and individual) but they remains significant. This suggests the presence of latent individual and time effects that are correlated with the included explanatory variables. After demeaning the series to eliminate the individual based latent effects we performed yet another ANOVA on the error term and found no residual time effect. Then we performed a Hausman specification test to check whether the fixed or the random effect estimation procedure is the correct one. The Hausman test yielded a very high Chi-square significant at least at the 1% level. This suggests that using a random effect estimation procedure, although more efficient, would yield biased coefficients. As Westley and Shaffer (1999) and other authors referenced therein, we added a scalar to total costs

(10000) when we estimated our regressions. Since the typical regression generates about 290 coefficients, we do not present these estimates.

4.3 Fourier Flexible functional form

In order to be coherent with some recent critics of the translog cost function for efficiency measurement [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. The Fourier Flexible (FF) functional form enables the cost function to better fit data than the Translog cost function eliminating some of the assumptions of parametric models. It then permits to estimate the bias introduced by traditional translog cost function. 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 amply demonstrated [Gallant, 1981, 1982; 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 [Altunbas, Gardener, Molyneux and Moore, 2001]. Like previous works [see 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 3.

4.4 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 Data Envelopment Analysis (DEA) or Free Disposal Hull (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 Mehdian, 1990].

The second alternative is to set an arbitrary limit between random error and efficiency, with a methodology such as the Thick Frontier Analysis (TFA) [Lozano, 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].

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). In Equation (2), the error term is divided into an inefficiency $\in$ and a random ε component. Our method consists in estimating average individual inefficiency over the five year period. This constitutes the non-random component $\in$ 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 (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.[14]

5. Results

5.1 Descriptive statistics

Table 2 shows that Quebec caisses and size-paired Ontario CU have similar clienteles, i.e., have comparable median size of loans and deposits. However smaller CU concentrate on much smaller transactions than their counterparts in Quebec. The median loan per employee of the smallest CU is $554, almost half the 1021$ of the caisses. Despite their almost identical size and similar clientele, Ontario's CU display a substantially greater ratio of loans to administrative

[14] 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.

expenses. In effect, the ratio varies between 140 and 253 for CU, and between 27 and 44 for the caisses. This can be explained, at least in part, by the fact that Ontario CU rely considerably on volunteer workers to run the institutions. As Table 2 reveals the average real wage rate, in thousands by equivalent full-time employee -- deflated by the CPI-- is almost 10 times larger in the caisses than in the CU. In terms of assets, wages are 0.29% and 1.79% for Ontario and Quebec respectively. This means that for each $100 of assets the caisses pay six times more in wages than a CU. The ratio can be as small as 0.0% (all volunteer-run CU) in Ontario. More interestingly, smaller CU appear to be more efficient than larger ones, as the ratio of loans over administrative costs declines with increase in asset size, contrary to the behavior observed in the caisses and to common argument of scale economies. In other words, large Ontario CU do not perform better operationally than their smaller counterparts while the opposite happens in Quebec. This could be due to the fact that larger CU may rely less on volunteer workers but is also consistent with the argument that networks tend to better control subgoal pursuit in large FC.

The intermediation margin is, in the context of a FC, the ultimate measure of cost facing members (borrowers and savers) that includes 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. Except for the smaller units, this intermediation margin is smaller for CU than for caisses. Given the 10 times lower personnel cost of the CU this is not a too surprising result. Further the savings in personnel costs compared to the caisses are evidently passed on to members.[15] These

[15] The fact that the intermediation margin is lower in Quebec than Ontario for the smallest FC may be explained by the process of cross-subsidization between caisses that impose a greater intermediation margin on members of medium and large institutions to subsidize small, urban FC. Also it should be remembered that Quebec's caisses have a larger presence in rural areas, characterized by greater intermediation costs.

preliminary results suggest that efficiency test should yield a clear advantage for the CU over the caisses. This would support the hypothesis often advanced that the average cost of running the Quebec complex network is higher than the cost of running a system of non-integrated FC. We will see that despite the important difference in labor costs, this is not the case.

The first sign of an important weakness in the Ontario system is suggested by the ratio of deposits over loans. It is substantially higher for Ontario than for Quebec FC. In the banking literature this is a measure of credit risk exposure, but in the context of FC it may reflect the use of member funds for unproductive purposes such as fixed asset. This is a measure of funds acquired from members that are not used for financial intermediation --production of loans-- but might rather be wasted in inefficient operations such as maintaining luxury offices, cars for managers, etc.[16]

To settle some of these contradictory evidences, we use more formal measures of performance that have become standard in financial intermediation literature. For this we make use of the concepts of X-efficiency (EFF), and technical efficiency (TEC). We present results of estimation related to Equation (2) in Panels A to C of Table 4.

5.2 Hypotheses tests

Hypothesis 1 proposes that over a range of small FC, differences in X-efficiency will be relatively small, if any, and Hypothesis 2 stipulates that larger Quebec FC, which belong to Strategic network should be more efficient than the equivalent sized Ontario FC member of a consensual network.

---

[16] The ratio can be associated to Jensen's [Jensen, 1986] Free Cash Flow theory stating that the larger the Free Cash Flow, the greater the incentives to incur into agency costs. This is confirmed by the Fixed-to-Total Assets ratio, that starts smaller for Ontario than Quebec but becomes equal or larger for all size-groups larger than 3.0 million in assets.

Panel A and B of Table 4 presents mean individual X-efficiency scores in their usual presentation (Panel A) and adjusted values (Panel B). In Panel B Quebec FC present X-efficiency scores between 86.7% (the smallest FC by assets) and 90.1%, while Ontario CU the efficiency scores go from 81.2% (the largest FC) to 88.4% (the second smallest group of FC). What is of interest is that while the X-efficiency of the caisses stays relatively stable or increases with size, in the case of the CU, there is a net fall in X-efficiency. For small FC the difference in efficiency scores is small, with the Ontario FC even presenting some advantage. However, the difference in efficiency increases with size of the institution in favor of Quebec. The same pattern can be observed by inspecting the stochastic dominance graphs (See Figure 2). In the first three size-groups no system really first order stochastically dominates the other. The larger variance of efficiency measures results in a pattern in which Quebec starts to dominate in the lower range of the size group and, after the crossing of the curves, Ontario dominates. To see which system dominates, one would need to compute second order dominance graphs. For the two largest groups however, Quebec dominates unambiguously Ontario in terms of efficiency scores. We also produced a diagram that plots the difference is efficiency scores after ordering the institutions by size. This plot is presented in Figure 3. While barely noticeable there is a positive relationship between size and difference in X-efficiency (EFF_Q-EFF_O). What is important, however, is that all larger Ontario FC fall on the positive quadrant of the graph. That is, larger Ontario FC display systematically lower efficiency scores than Quebec FC of similar size. 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. Thus, Hypotheses 1 and 2 are both supported by data.

Hypothesis 3 stipulates that strategic networks should display lower variance in the size as well as in performance indicators of FC operating in a particular market. As Panel C of Table 4 shows, the whole OCU system presents a standard deviation of asset size more than twice that of the DM (103 221 vs. 40 369). We can also note that although the mean size of the OCU institution is larger than that of the caisses (39 772 vs. 37 783), the median of the first is much smaller than that of the second (10 785 vs. 22 480). This means that while there are a few very large CU in Ontario, most of them are very small.

X-efficiency is about the same if the unadjusted measure is used (i.e. if we ignore any systematic differences in efficiency) but larger and with lower variance for the Quebec system if the adjusted measure is used (the standard deviation of the X-efficiency measure is 6.94 % for Quebec vs. 9.49% for Ontario). Thus, our Hypothesis 3 is unambiguously supported by data.

5.3 Additional analyses

While the measures in efficiency suggest that smaller FC of both systems are similarly equivalent, this numbers hide three important fact: i). Even the smallest caisses offer to its members a much larger range of financial services and products than some of the larger Ontario CU; ii). The DM has a much larger presence in rural communities than the OCU, a key measure of outreach that necessarily induces a loss in efficiency. The proportion of rural institutions in the DM is relatively large (51.3%) compared to that of the OCU system (38.5%) --see Table 1--; iii). The DM has succeeded in extending its services to nearly 42% of the lower income population of Quebec -- often rationed by the commercial banking system-- with a range of essential financial products that compares favorably with that offered by the banks.

To investigate the source of inefficiency in both system we regressed the measures of efficiency against a set of correlates including measures of outreach and service (proportion of FC in rural communities, average size of transaction, number of member per office), expense preference (size of institution, fixed assets over total assets) and measures of risk (past due loans and leverage).[17] Results are presented in Table 5. Being a rural FC impacts negatively and significantly efficiency. The rural presence is cross-subsidized by the rest of the system. The median loan per member, another measure of outreach, is not significant in either system. In terms of expense preference, size is negatively related to efficiency in Quebec and, somewhat surprisingly, unrelated to efficiency in Ontario. Leverage is a significant factor for efficiency in OCU but has no effect on Quebec caisses. Finally, credit risk is unrelated to efficiency in both systems.

Conclusion

This paper presents a study of the economic organization of systems of FC. It consists of two parts. The first part presents a theoretical framework rooted in principles of 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 Quebec Desjardins movement and the Ontario Credit Union system that are both organized as networks but whose development has reached different levels of complexity.

[17] Here again we checked through an ANOVA for the presence of latent individual and time effects. Their presence can be expected since they where reincorporated in the scores when computing the adjusted efficiency measure. The presence of both effects was verified at highly significant levels. Thus, the regression of correlates was estimated using a fixed effect error decomposition controlling for both individual and time effects. We also computed the correlation matrix of correlates. The largest ρ took the absolute value of only 0.25.

The three hypotheses formulated from the theoretical analysis, namely: i). Over a range of small FC, differences in efficiency will be relatively small, if any. ii). Large institutions should display systematically lower efficiency that similar sized FC members of strategic networks and iii). strategic networks should display lower variance in the size as well as in performance indicators of FC operating in a particular market are all supported by data. Specifically, we that small Ontario and Quebec based FC display essentially the same level of efficiency, albeit this can be explained by the considerably larger presence of the Desjardins movement in rural communities. Large Ontario FC, on the other hand, are considerably less efficient than Quebec FC of similar size. Finally, the variability of size and X-efficiency of Ontario FC is larger than that of Quebec 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, the success of the DM is servicing its vast and rural clientele effectively comes at a price. But, even paying that price, the evidence provided by the measures of X-efficiency indicates that the DM outperforms the OCU system.

References

Altunbas, Y., E.P.M. Gardener, P. Molyneux, and B. Moore, "Effciency in European Banking", European Economic Review, 2001, 45, 1931-1955.

Aly, H.Y., R. Grabowski, C. Pasurka, and N. Rangan, "Technical, Scale, and Allocative Efficiencies in U.S. Banking: An Empirical Investigation", Review of Economics and Statistics, 1990, 72, 211-218.

Armour, H.O., and D.J. Teece, "Organizational Structure and Economic Performance: A Test of the Multidivisional Hypothesis", Bell Journal of Economics, 1978, 9, 106-122.

Berger, A.N., "Distribution-Free Estimates of Effciency in the U.S. Banking Industry and Tests of the Standard Distributional Assumptions", Journal of Productivity Analysis, 1993, 4, 261-292.

Berger, A.N., and L.J. Mester, "Inside the Black Box : What Explains Differences in the Effciencies of Financial Institutions?", Journal of Banking and Finance, 1997, 21, 895-947.

Berger, A.N., and R. DeYoung, "Problem Loans and Cost Efficiency in Commercial Banks", Journal of Banking and Finance, 1997, 21, 849-870.

Berger, A.N., J.H. Leusner, and J.J. Mingo, "The Effciency of Bank Branches", Journal of Monetary Economics, 1997, 40, 141-162.

Berger, A.N., L.F. Klapper, and G.F. Udell", The Ability of Banks to Lend to Informationally Opaque Small Business", Journal of Banking and Finance, 2001, 25, 2127-2167.

Berger, A.N., N.H. Miller, M.A. Petersen, R.G. Rangan, and J.C. Stein, "Does Function Follow Organizational Form? Evidence Fromn the Lending Practices of Large and Small Banks", 2002, SSRN Working Paper. http://papers.ssrn.com/abstract=294669.

Canal, E.G., A.V. Lianeza and A. Arino, "Effectiveness of Dyadic and Multi-Party Joint Ventures", Organization Studies, 2003, 24, 743-770.

Desrochers, M., and K.P. Fischer, "Theory and Test on the Corporate Governance of Financial Cooperative Systems: Merger Vs. Networks", CIRPÉE Working Paper No. 03-34 http://ssrn.com/abstract=448982

DeYoung, R., "A Diagnostic Test for the Distribution-Free Efficiency Estimator: An Example Using U.S. Commercial Bank Data", European Journal of Operational Research, 1997, 98, 243-249.

Elyasiani, E., and S.M. Mehdian, "A Non-Parametric Approach to Measurement of Efficiency and Technological Change: The Case of Large U.S., Commercial Banks", Journal of Financial Services Research, 1990, 4, 157-168.

Fama, E.F., "Agency Problems and the Theory of the Firm", Journal of Political Economy, 1980, 88, 288-307.

Fama, E.F., and M.C. Jensen, "Separation of Ownership and Control", Journal of Law and Economics, 1983, 26, 301-325.

Ferrier, G.D., and C.A.K. Lovell, "Measuring Cost Efficiency in Banking: Econometric and Linear Programming Evidence", Journal of Econometrics, 1990, 46, 229-245.

Fried, H.O., C.A.K. Lovell, and P.V. Eeckaut, "Evaluating the Performance of US Credit Unions", Journal of Banking and Finance, 1993, 17, 251-265.

Gallant, R.A., "On the Bias in Flexible Functional Forms and Essentially Unbiased Form: The Fourier Flexible Form", Journal of Econometrics, 1981, 15, 211-245.

Gallant, R.A., "Unbiased Determination of Production Technologies", Journal of Econometrics, 1982, 20, 285-324.
Greene, W., "A Gamma Distributed Stochastic Frontier Model", Journal of Econometrics, 1990, 46, 141-163.
Greve, R., "Kooperation und Genossenschaft: Organisationsstrukturen in Kooperativen Netzwerken", 2002, Working Paper, IfG, Westfaelische Wilhelms Universitaet Muenster.
Gulati, R. and H. Singh, "The Architecture of Cooperation: Managing Coordination Costs and Appropriation Concerns in Strategic Alliances", Administrative Science Quarterly, 1998, 43, 781-814.
Hagedoorn, J., "Understanding the Rationale of Strategic Technoclogy Partnering: Interorganizational Modes of Cooperation and Sectoral Differences", Strategic Management Journal, 1993, 14, 371-385.
Hausman, J.A., "Specification Tests in Econometrics", Econometrica, 1978, 46 (6), 1251-1271.
Hennart, J.F., "Explaining the Swollen Middle: Why Most Transactions are a Mix of "Market" and "Hierarchy"", Organization Science, 1993, 4, 529-547.
Hugues, J.P., and L.J. Mester, "A Quality and Risk-Adjusted Cost Function for Banks: Evidence on the "Too-Big to-Fail" Doctrine", Journal of Productivity Analysis, 1993, 4, 293-315.
Hugues, J.P., and L.J. Mester, "Bank Capitalization and Cost: Evidence of Scale Economies in Risk Management and Signaling", Review of Economics and Statistics, 1998, 314-325.
Hugues, J.P., L.J. Mester, and C.G. Moon, "Are Scale Economies in Banking Elusive or Illusive? Evidence Obtained by Incorporating Capital Structure and Risk-Taking Into Models of Bank Production", 2000, Working Paper.
Huges, J.P., W.W. Lang, L.J. Mester, and C.G. Moon, "Efficient Banking Under Interstate Branching", Journal of Money, Credit, and Banking, 1996, 28, 1045-1071.
Ingham, H., "Organization Structure and Firm Performance: An Intertemporal Perspective", Journal of Economic Studies, 1992, 19, 19-35.
Jarrillo, J.C., "On Strategic Networks", Strategic Management Journal, 1988, 9, 31-41.
Jensen, M.C., "Agency Costs and Free Cash Flows, Corporate Finance and Takeovers", American Economic Review, 1986, 323 -329.
Kumbhakar, S.C., V.A. Lozano, C.A.K. Lovell, and I. Hassan, "The Effects of Deregulation on the Performance of Financial Institutions: The Case of Spanish Savings Banks", Journal of Money, Credit, and Banking, 2001, 33, 101-120.
Lang, G., and P. Welzel, "Efficiency and Technical Progress in Banking: Empirical Results for a Panel of German Cooperative Banks", Journal of Banking and Finance, 1996, 20, 1003-1023.
Lang, G., and P. Welzel, "Mergers Among German Cooperative Banks: A Panel-Based Stochastic Frontier Analysis", Small Business Economics, 1999, 13, 273-286.
Littlechild, S.C., "Common Costs, Fixed Charges, Clubs and Games", Review of Economic Studies, 1975, 42, 117-124.
Lozano, V.A., "Profit Effciency for Spanish Savings Banks", European Journal of Operational Research, 1997, 98, 381-394.
Macneil, I.R., "Contracts: Adjustment of Long-Term Economic Relations Under Classical, Neoclassical and Relational Contract Law", Northwestern University Law Review, 1978, 72, 854-906.

Mester, L.J., "Efficiency in the Savings and Loan Industry", Journal of Banking and Finance, 1993, 267-286.

Mitchell, K., and N.M. Onvural, "Economies of Scale and Scope at Large Commercial Banks: Evidence from the Fourier Flexible Functional Form", Journal of Money, Credit, and Banking, 1996, 28, 178-199.

Murray, R.W., and J.D. White, "Economies of Scale and Scope in Multiproduct Financial Institutions: A Study of British Columbia Credit Unions", Journal of Finance, 1983, 32, 887-902.

Oxley, J.E., "Appropriability Hazards and Governance in Strategic Alliances: A Transaction Cost Approach", Journal of Law, Economics and Organizations, 1997, 13, 387-409.

Polster, D., "Finanzintermediation und Institutioneller Wandel", Muenster, F.R. of Germany: IfG Muen-ster, 2001.

Rezvanian, R., S. Mehdian, and E. Elyasiani, "Economies of Scale and Scope in Small Depository Institutions: Evidence from U.S. Cooperative Banks", Quarterly Review of Economics and Finance, 1996, 36 (1), 39-54.

Schmidt, P., and R.C. Sickles, "Production Frontiers and Panel Data", Journal of Business and Economic Statistics, 1984, 2, 367-374.

Sealey, C.W.Jr., and J.T. Lindley, "Inputs, Outputs, and a Theory of Production and Cost of Depository Financial Institutions", Journal of Finance, 1977, 32, 1251-1266.

Steer, P., and J. Cable, "Internal Organization and Profit: An Empirical Analysis of Large U.K. Companies", Journal of Industrial Economics, 1978, 27, 13-30.

Stein, J.C., "Information Production and Capital Allocation: Decentralized Vs. Hierarchical Firms", Journal of Finance, 2002, 57 (5), 1891-1922.

Stinchcombe, A.L., "Contracts as Hierarchical Documents", in A. Stinchcombe and C. Heimer, eds., Organization Theory and Project Management, Bergen, Norway: Norwegina University Press, 1985, 121-171.

Westley, G.D., and S. Shaffer, "Credit Union Policies and Performance in Latin America", Journal of Banking and Finance, 1999, 23, 1303-1329.

Williamson, O.E., Markets and Hierarchies, New York: Macmillan, 1975.

Williamson, O.E., The Mechanisms of Governance, New York: Oxford University Press, 1996.

Figure 1 : Contractual hazard and governance choice

This figure presents the governance cost economizing frontier for alternative organizational arrangements of systems of FC as a function of contractual hazard. The focus of interest is on the curves G_{CN} and G_{SN} that represent consensual and strategic networks respectively. Over the region of contractual hazard $k_m k'_m$ consensual networks will be the organization of choice. Strategic networks become the organization of choice over the region of contractual hazard $k'_m k''_m$.

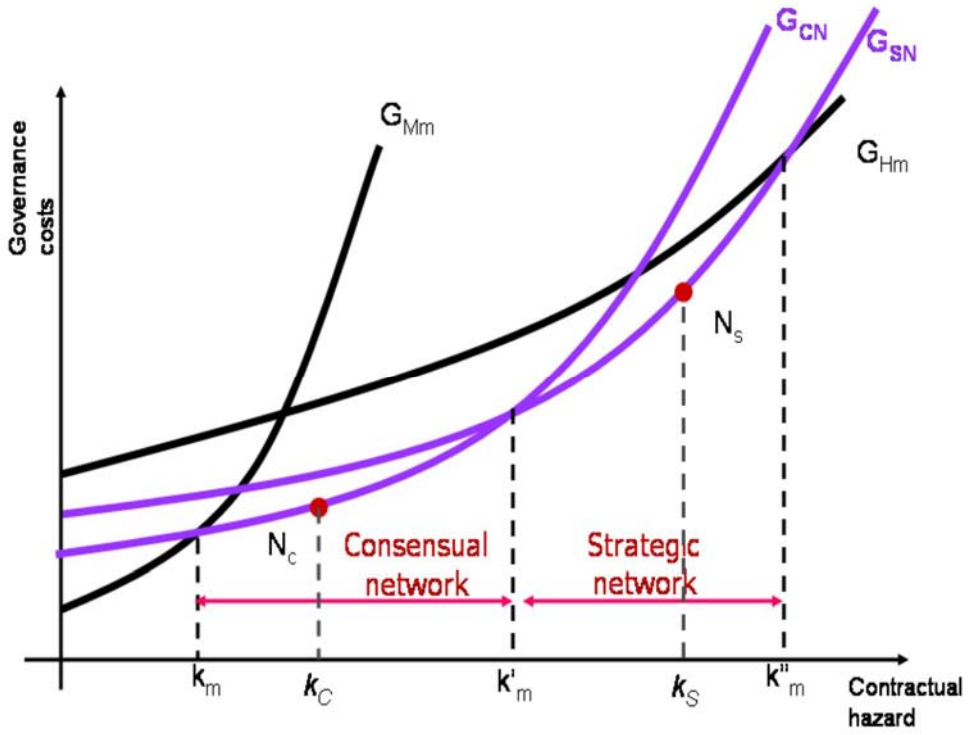


Table 1
Definition of variables and their basic characteristics (*)
1996-2000

Dependent Variable

		Quebec					Ontario				
Symbol	**Definition**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**
C	Real total costs, in thousands, deflated by the Consumer Price Index (CPI) with 1995 as the base year.	1 579	2 897	-155	442	23 195	1 881	4 872	0	645	68 323

Independent variables - Input prices

		Quebec					Ontario				
Symbol	**Definition**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**
W_1	Real annual, ex post interest rate on deposits and dividend rate on shares, in percentage.	2.38%	2.05%	0.00%	3.00%	24.00%	2.40%	1.44%	0.00%	2.59%	7.54%
W_2	Real wage rate, in thousands by equivalent full-time employee and deflated by the CPI.	40	11	14	37	90	5	5	0	4	32
W_{2MOD}	Real wage rate, in thousands over assets and deflated by the CPI.	1.79%	0.51%	0.70%	1.71%	5.84%	0.29%	0.27%	0.00%	0.20%	2.50%
W_3	Real occupancy expenses, defined as occupancy expenses divided by fixed assets.	0.70	3.03	0.00	0.26	50.24	0.33	0.92	0.00	0.11	12.06

Independent variables - Input quantities

		Quebec					Ontario				
Symbol	**Definition**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**
X_1	Deposits and shares, in thousands, deflated by the CPI.	32 674	60 171	0	14 775	698 757	30 771	65 096	0	12 369	813 629
X_2	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 Ontario we used the sum of employees.	16	21	0	8	124	17	35	0	7	410
X_3	Amount of fixed assets, in thousands, deflated by the CPI.	578	1 136	0	209	12 892	659	1 327	0	170	14 375

(*) To avoid extreme observations, we limited the interest rate on deposits at 24%.
Note: Credit unions of Ontario, despite our pairing process, showed larger costs than their Quebec counterparts. These greater costs cannot be explained by the cost of deposits, almost identical in both provinces, neither by wages (Ontario's credit unions are benefiting of much lower wages, despite a similar number of employees, so we conjecture the presence of voluntary workers is rather important in this province). The explanation rather seems to be rooted in the number of offices, somewhat larger in Ontario. These offices are also less dominantly located in rural regions. The portfolio of loans of credit unions in this province is less diversified than Quebec's Caisses, and present a marginally greater delinquency ratio.

(Continued on next page)

TABLE 1 (Continued)

Independent variables - Output quantities

		Quebec					Ontario				
Symbol	**Definition**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**
Y_1	Commercial loans, in thousands, deflated by CPI.	10 459	22 149	0	3 430	271 089	4 441	18 387	0	0	262 155
Y_2	Consumer loans, in thousands, deflated by CPI.	7 792	17 819	0	3 243	255 355	6 525	13 869	0	3 030	196 274
Y_3	Mortgage loans, in thousands, deflated by CPI.	14 745	26 406	0	6 466	299 483	15 048	33 564	0	5 775	397 246

Independent variables - Environmental factors

		Quebec					Ontario				
Symbol	**Definition**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**	**Mean**	**Std dev.**	**Minimum**	**Median**	**Maximum**
CRR	Total delinquent loans / Total loans	1.64%	3.22%	0.00%	1.03%	96.96%	1.96%	2.48%	0.00%	1.27%	26.81%
CAP	Total equity / Total assets	6.45%	5.68%	-9.80%	6.30%	163.92%	6.56%	2.30%	-12.43%	6.40%	16.32%
OFF	Number of offices	2.00	1.49	1.00	1.00	9.00	2.17	2.40	1.00	1.00	24.00
HER	Herfindahl index of loans	41.64%	8.51%	33.34%	39.07%	130.80%	60.27%	18.90%	33.35%	54.42%	100.00%
RUR	Dummy: 1=Rural, 0=Urban	51.33%	50.00%	0.00%	100%	100.00%	38.53%	48.69%	0.00%	0.00%	100.00%
GR_1	Ontario CU with real assets between 0 and 3 million.	0.00%	0.00%	0.00%	0.00%	0.00%	18.37%	38.73%	0.00%	0.00%	100.00%
GR_2	Ontario CU with real assets between 3 and 10 million.	0.00%	0.00%	0.00%	0.00%	0.00%	18.17%	38.57%	0.00%	0.00%	100.00%
GR_3	Ontario CU with real assets between 10 and 25 million.	0.00%	0.00%	0.00%	0.00%	0.00%	17.78%	38.25%	0.00%	0.00%	100.00%
GR_4	Ontario CU with real assets between 25 and 50 million.	0.00%	0.00%	0.00%	0.00%	0.00%	15.29%	36.01%	0.00%	0.00%	100.00%
GR_5	Ontario CU with real assets above 50 million.	0.00%	0.00%	0.00%	0.00%	0.00%	14.05%	34.76%	0.00%	0.00%	100.00%
GR_6	Québec CU with real assets between 0 and 3 million.	8.17%	27.40%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GR_7	Québec CU with real assets between 3 and 10 million.	19.94%	39.96%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GR_8	Québec CU with real assets between 10 and 25 million.	18.63%	38.95%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GR_9	Québec CU with real assets between 25 and 50 million.	15.56%	36.26%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GR_{10}	Québec CU with real assets above 50 million.	17.12%	37.68%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Source: Confédération des Caisses Desjardins, Deposit Insurance Corporation of Ontario.

Table 2
Description of data (**)
Median figures
1996-2000

Panel A: Credit Unions of Ontario

	< 3M	3-10M	10-25M	25-50M	>50M	Total
N	281	278	272	234	215	1280
% of total	22%	22%	21%	18%	17%	100%
Total assets (in thousands)	1 408	5 458	16 485	35 563	87 817	13 565
Deposit by employee	835	1 348	1 838	2 091	2 273	1 715
Loan by employee	554	993	1 455	1 709	2 002	1 393
Loans/Administrative costs	253	185	151	140	175	156
Deposits/Loans	142.7%	127.5%	123.3%	119.1%	112.7%	122.7%
Fixed assets/Total assets	0.2%	0.7%	1.5%	1.8%	1.8%	1.3%
Real intermediation margin /Loans	7.2%	4.4%	3.0%	2.8%	2.3%	3.1%

Panel B: Size-Paired Quebec's Caisses Populaires

	< 3M	3-10M	10-25M	25-50M	>50M	Total
N	125	305	285	238	262	1215
% of total	10%	25%	23%	20%	22%	100%
Total assets (in thousands)	2 283	5 562	16 056	34 929	91 512	17 691
Deposit by employee	1 070	1 428	2 005	2 179	2 199	1 840
Loan by employee	1 021	1 451	1 874	2 104	2 216	1 858
Loans/Administrative costs	27	32	40	42	44	39
Deposits/Loans	97.7%	97.7%	99.7%	100.1%	98.7%	99.0%
Fixed assets/Total assets	0.4%	0.7%	1.3%	1.5%	1.4%	1.2%
Real intermediation margin /Loans	6.0%	4.7%	4.1%	3.6%	3.4%	4.2%

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

Source: Confédération des Caisses Desjardins, Deposit Insurance Corporation of Ontario.

(Continued on next page)

Table 2 (Continued)

Panel C: Characteristics of paired Credit Unions as of December 1996

	Number of observations	Mean value of assets (in thousands)	Median value of assets (in thousands)
Quebec's Caisses Populaires	306	40 972	17 699
Paired Ontario's Credit Unions	306	40 581	17 682
Remaining Ontario's Credit Unions	126	795	651

Panel D: Absolute difference in paired assets over smallest value of assets as of december 1996

Difference in percentage	Number of observations
0%-0.5%	232
0.5%-2.5%	47
2.5%-5.0%	14
5.0%-12%	13

Note: In panels A and B we observe that Quebec's Caisses grew more rapidly than their Ontario's counterparts. In effect, despite almost perfect matching of size in December 1996 (as can be seen in Panel C and D, where we show that 232 of the 306 observations are different by less than 0.5% and that differences of more than 12% were rejected, as well as all Ontario's credit unions whose size was below 88% of the smallest caisse of Quebec, eliminating 126 observations), the proportion of Ontario's credit unions staying below 3 millions dollars is more than twice that of Quebec's Caisses. This phenomenon is explained by the important merger process completed in Quebec in the last few years. We also note that median operations of Ontario's credit unions are much smaller than operations in Quebec.

These characteristics bring lower efficiency by employee, although if one compares the amount of loans over administrative costs it seems that Ontario's credit unions are much more efficient, with a ratio almost ten times greater for small cooperatives. This result, coupled with a lower intermediation margin of Ontario's credit unions, can be explained by the important use of unpaid employees in Ontario's credit unions. We will detail these aspects in Table II.

Source: Confédération des Caisses Desjardins, Deposit Insurance Corporation of Ontario.

Table 3
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.		
w^{max}_i = sample maximum value of input price i=1,2,3.		
x^{min}_i = sample minimum value of input quantity i=1,2,3.		
x^{max}_i = sample maximum value of input quantity i=1,2,3.		
y^{min}_i = sample minimum value of ouput quantity i=1,2,3.		
y^{max}_i = sample maximum value of ouput quantity i=1,2,3.	Scale factor	Mean value
$S_{wi} = 0.00001 - Ln\ w^{min}_i$	λ	0.890
$S_{xi} = 0.00001 - Ln\ x^{min}_i$	ξ_1	0.496
$S_{yi} = 0.00001 - Ln\ y^{min}_j$	ξ_2	1.135
M = sample maximum value of $Ln\ w^{max}_i + S_{wi}$	ξ_3	0,704
$\lambda = 6/M$	μ_1	0,787
$\xi_i = 6/[Ln\ x^{max}_i + S_{xi})$, i =1,2,3,4.	μ_2	0.553
$\mu = 6/[Ln\ y^{max} + S_y)$, j =1,2.	μ_3	0.523

Independent variables - Input prices

Symbol	Mean	Std dev.	Minimum	Median	Maximum
$(Lnw_1+S_{w1})\lambda$	0.675	0.541	0.000	0.901	2.827
$(Lnw_2+S_{w2})\ \lambda$	0.228	0.287	0.000	0.000	1.570
$(Lnw_3+S_{w3})\lambda$	0.703	0.841	0.000	0.470	6.000

Independent variables - Input quantities

Symbol	Mean	Std dev.	Minimum	Median	Maximum
$(Lnx_1+S_{x1})\xi_1\lambda$	4.204	0.597	0.000	4.239	6.000
$(Lnx2+S_{x2})\xi_2\lambda$	2.050	1.173	0.000	1.997	6.000
$(Lnx_3+S_x)\xi_3\lambda$	3.133	1.328	0.000	3.377	6.000

Independent variables - Output quantities

Symbol	Mean	Std dev.	Minimum	Median	Maximum
$(Lny_1+Sy_1)\ \mu_1\lambda$	2.029	1.662	0.000	2.279	6.000
$(Lny_2+Sy_2)\ \mu_2\lambda$	4.018	0.594	0.000	4.007	6.000
$(Lny_3+Sy_3)\ \mu_3\lambda$	3.838	1.173	0.000	4.109	6.000

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

Source: Confédération des Caisses Desjardins, Deposit Insurance Corporatio of Ontario.

Table 4
Mean performance measures

Equation Estimated

$$\text{Ln } C = a_0 + b'x + (1/2)x'Ax + \sum_{h=1}^{3}[u_h\cos(x_i) + v_h\sin(x_i)] + \sum_{h=4}^{7}[u_h\cos(y_i) + v_h\sin(y_i)]$$
$$+ \sum_{h=8}^{10}[u_h\cos(x_i + x_j) + v_h\sin(x_i + x_j)] + \sum_{h=11}^{13}[u_h\cos(y_i + y_j) + v_h\sin(y_i + y_j)]$$
$$+ \sum_{h=14}^{16}[u_h\cos(x_i - x_j) + v_h\sin(x_i - x_j)] + \sum_{h=17}^{18}[u_h\cos(y_i - y_j) + v_h\sin(y_i - y_j)] + \sum_{h=19}^{20}[u_h\cos(w_i - w_j) + v_h\sin(w_i - w_j)]$$
$$+ \sum_{h=21}^{28}[u_h\cos(x_i - x_j + y_i) + v_h\sin(x_i - x_j + y_i)] + \sum_{h=29}^{37}[u_h\cos(x_i - x_j - y_i) + v_h\sin(x_i - x_j - y_i)]$$
$$i,j = 1,2,3;\ i \neq j$$

Panel A: X-efficiency

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

	Quebec	Ontario
	1996-2000	**1996-2000**
< 3M	**86.55%**	**86.79%**
3-10M	**86.57%**	**86.87%**
10-25M	**86.23%**	**86.65%**
25-50M	**85.74%**	**86.71%**
>50M	**85.44%**	**86.73%**

Panel B: Adjusted X-efficiency

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

	Quebec	Ontario
	1996-2000	**1996-2000**
< 3M	**86.73%**	**88.04%**
3-10M	**90.08%**	**88.39%**
10-25M	**86.77%**	**85.57%**
25-50M	**90.09% ***	**84.38%**
>50M	**87.77%***	**81.18%**

(*) Difference statistically different from 0 at the 5% level.

Panel C: Distribution of assets and X-efficiency

	Quebec						Ontario					
	Mean	**Std dev**	**Min**	**Median**	**Max**	**N**	**Mean**	**Std dev**	**Min**	**Median**	**Max**	**N**
Assets (Thousands)	**37.78**	40.37	2.10	22.48	258.68	306	**39.77**	103.22	7.00	10.79	1.235.169	306
X-Efficiency	**86.08%**	6.88%	58.80%	84.13%	100.00%	306	**86.75%**	6.48%	63.21%	84.36%	100.00%	306
Adjusted X-Efficiency	**88.46%**	6.94%	78.94%	85.45%	100.00%	306	**85.52%**	9.49%	63.21%	81.34%	100.00%	306

Source: Confédération des Caisses Desjardins, Deposit Insurance Corporatio of Ontario.

Table 5
Correlates of adjusted X-Efficiency

Quebec

Independant variables	Coefficient	Std Dev	T-Statistic	Significance
Constant	0.900	0.006	161.909	0.000
Log(Assets), adjusted for individual and time effect	-0.041	0.014	-2.988	0.003
Number of offices	0.001	0.002	0.573	0.566
Dummy variable (1 = Rural, 0 = Urban)	-0.012	0.006	-2.216	0.027
Median loan by member, adjusted for individual and time effect	0.003	0.016	0.172	0.864
Fixed assets over total assets ratio, adjusted for individual and time effect	-1.008	0.624	-1.616	0.106
Pass-due loans ratio, adjusted for individual and time effect	0.110	0.174	0.635	0.525
Capital over assets ratio, adjusted for individual and time effect	0.041	0.084	0.487	0.626
Rho	0.193	0.032	6.023	0.000
R-square 0.995				
Durbin-Watson Statistic 2.03				

Ontario

Independant variable	Coefficient	Std Dev	T-Statistic	Significance
Constant	0.855	0.015	55.319	0.000
Log(Assets), adjusted for individual and time effect	-0.025	0.031	-0.790	0.430
Number of offices	0.000	0.003	0.127	0.899
Dummy variable (1 = Rural, 0 = Urban)	-0.041	0.022	-1.833	0.067
Median loan by member, adjusted for individual and time effect	-3.848	3.532	-1.090	0.276
Fixed assets over total assets ratio, adjusted for individual and time effect	-2.636	0.444	-5.942	0.000
Pass-due loans ratio, adjusted for individual and time effect.	0.035	0.113	0.313	0.755
Capital over assets ratio, adjusted for individual and time effect	0.494	0.208	2.373	0.018
Rho	0.790	0.024	32.853	0.000
R-square 0.996				
Durbin-Watson Statistic 2.06				

Figure 2
Stochastic Dominance (First Order)

This figure presents first order stochastic dominance (SD) diagrams. The first diagram uses data over the whole range of sizes. The remaining five present SD diagrams for each of the size groups used in the empirical test procedures. X-Efficiency observations are ordered from lowest to largest, and presented for both samples. The most efficient sample is located below as it has less observations at the beginning (at low efficiency levels) and more at the end (at high efficiency levels). For example, in the last graphic, Quebec's Caisses Populaires show more efficiency than their Ontario's counterpart.

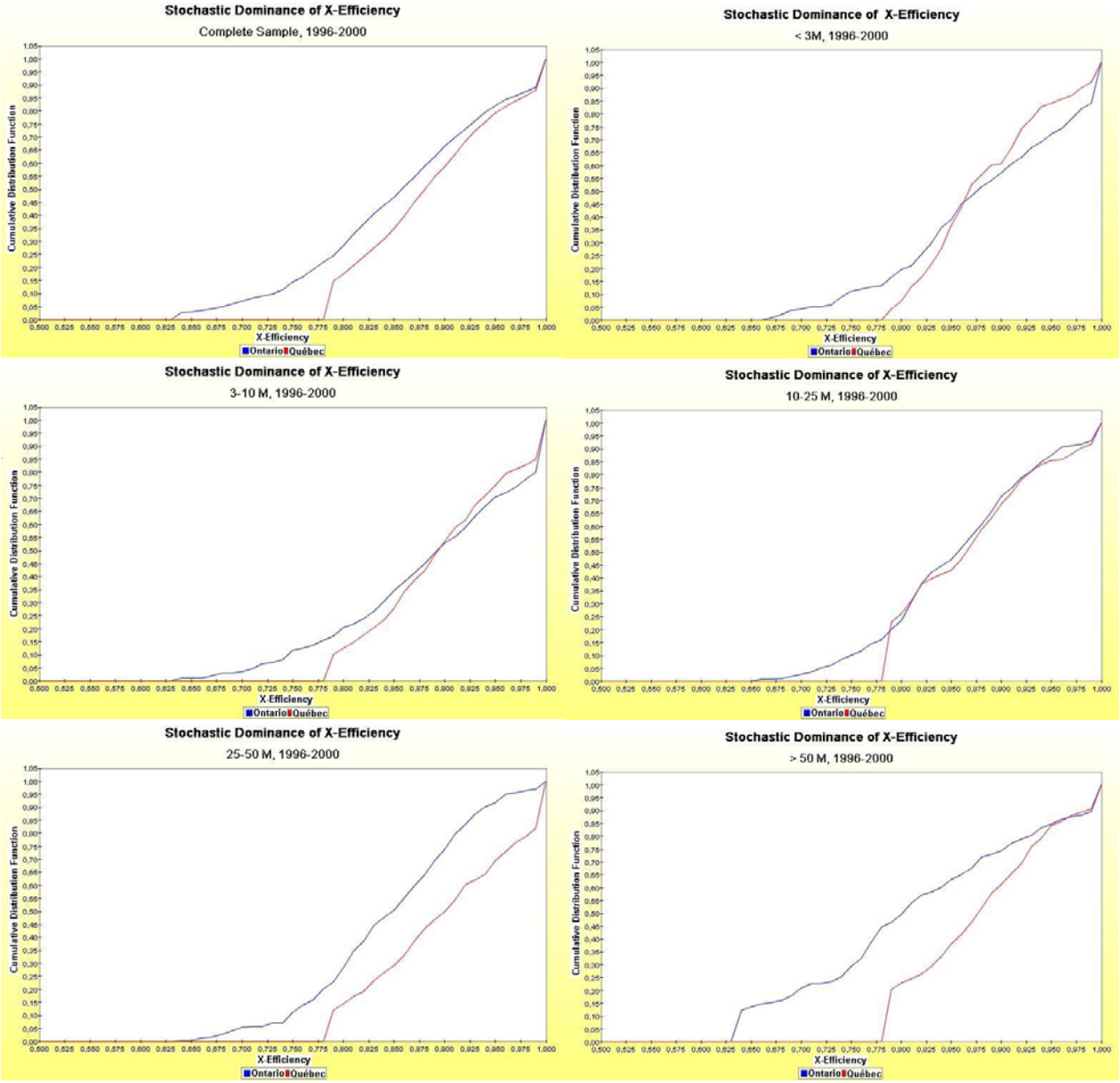
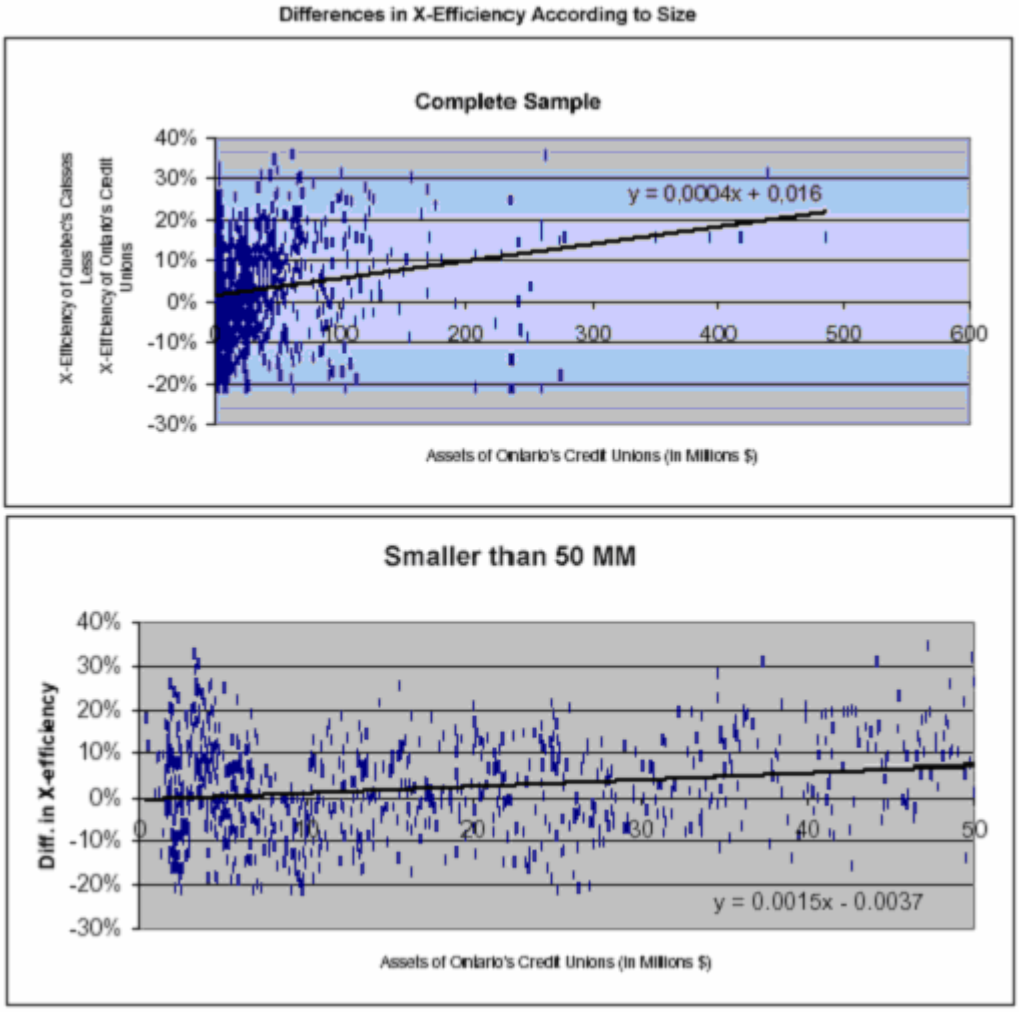


Figure 3


Differences in X-Efficiency According to Size
Complete Sample
X-Efficiency of Quebec's Caisses Less X-Efficiency of Ontario's Credit Unions
40%
30%
20%
10%
0%
-10%
-20%
-30%
y = 0.0004x + 0.016
100
200
300
400
500
600
Assets of Ontario's Credit Unions (In Millions $)
Smaller than 50 MM
Diff. in X-efficiency
40%
30%
20%
10%
0%
-10%
-20%
-30%
0
20
30
40
50
y = 0.0015x - 0.0037
Assets of Ontario's Credit Unions (In Millions $)