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Résumé de l'article

Les compagnies d'assurance effectuent deux types d'activités. Elles fournissent de la protection financière aux agents économiques et exercent l'activité d'intermédiation financière. Tout comme les banques, les compagnies d'assurance convertissent leur passif (les réserves) en actifs générateurs de revenus; sur une base contractuelle, elles acquièrent des fonds à des intervalles périodiques qu'elles investissent dans des portefeuilles d'actifs financiers. Malgré son importance, l'activité d'intermédiation financière des compagnies d'assurance a rarement soulevé l'intérêt qu'elle mérite. La plupart des études existantes sur les compagnies d'assurance limitent leur portée à l'activité d'intermédiation financière. La contribution de l'activité d'intermédiation financière à la performance économique des compagnies d'assurance est en général considérée comme une donnée. Le propos de ce papier est d'examiner les structures de l'industrie canadienne d'intermédiation financière et la performance économique de l'activité d'intermédiation financière des compagnies d'assurance canadiennes. En dépit de chute de la part de l'assurance vie sur le marché de l'épargne contractuelle à la suite des changements successifs dans les régimes fiscaux depuis le début des années 80, et malgré l'émergence d'une concurrence effrénée de la part des fonds mutuels et des régimes de pension en fiducie, l'activité d'intermédiation financière des compagnies d'assurance a fait preuve d'une croissance remarquable et sa part de marché est restée stable. Cette performance peut être attribuée a une combinaison de l'avantage comparatif qu'elles possèdent sur le marché des RÉER et un taux de croissance annuel moyen enviable de la productivité multifactorielle de 1,17 % durant la période 1985-1994.

INSURERS AS FINANCIAL INTERMEDIARIES: STRUCTURES, CONDUCT, AND ECONOMIC PERFORMANCE*

By Tarek M. Harchaoui

'The trade of insurance gives great security to the fortunes of private people, and by dividing among a great many that loss which would ruin an individual, makes it fall light and easy upon the whole society. In order to give this security, however, it is necessary that the insurers should have a very large capital.'

(Adam SMITH; Wealth of Nations, Book V, Chapter 1).

ABSTRACT

Insurance companies are engaged in a joint activity. They provide financial protection to economic agents and perform a financial intermediation activity. Much like banks, insurance companies transform liabilities (reserves) into earning assets; they acquire funds at periodic intervals on a contractual basis and invest in portfolios of financial assets. Despite its importance, the financial intermediation activity of insurance companies has rarely been examined for its own right. Most of the studies currently available on insurance companies typically restrict their focus to only the financial protection activity. The contribution of the financial intermediation activity to the economic performance of the insurance companies as a whole is usually taken as given. The purpose of this paper is to examine the structures of the Canadian financial intermediation industry and the economic performance of insurance companies' financial intermediation activity. Despite the dramatic loss of ground of life insurance within the market of contractual savings as a result of the various tax policies that have been implemented during the eighties, and despite strong competition from mutual funds and trusteed pension funds, insurance companies' financial intermediation activity experienced a remarkable growth and their market share remained steady. This performance can be attributed to the combination of a comparative advantage in the market of RRSPs and an enviable 1.17 average annual growth of multifactor productivity during the period 1985-1994.

Journal of Economic Literature Classification Numbers: C8, G2 and L8

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RÉSUMÉ

Les compagnies d'assurance effectuent deux types d'activités. Elles fournissent de la protection financière aux agents économiques et exercent l'activité d'intermédiation financière. Tout comme les banques, les compagnies d'assurance convertissent leur passif (les réserves) en actifs générateurs de revenus; sur une base contractuelle, elles acquièrent des fonds à des intervalles périodiques qu'elles investissent dans des portefeuilles d'actifs financiers. Malgré son importance, l'activité d'intermédiation financière des compagnies d'assurance a rarement soulevé l'intérêt qu'elle mérite. La plupart des études existantes sur les compagnies d'assurance limitent leur portée à l'activité d'intermédiation financière. La contribution de l'activité d'intermédiation financière à la performance économique des compagnies d'assurance est en général considérée comme une donnée. Le propos de ce papier est d'examiner les structures de l'industrie canadienne d'intermédiation financière et la performance économique de l'activité d'intermédiation financière des compagnies d'assurance canadiennes. En dépit de chute de la part de l'assurance vie sur le marché de l'épargne contractuelle à la suite des changements successifs dans les régimes fiscaux depuis le début des années 80, et malgré l'émergence d'une concurrence effrénée de la part des fonds mutuels et des régimes de pension en fiducie, l'activité d'intermédiation financière des compagnies d'assurance a fait preuve d'une croissance remarquable et sa part de marché est restée stable. Cette performance peut être attribuée a une combinaison de l'avantage comparatif qu'elles possèdent sur le marché des RÉER et un taux de croissance annuel moyen enviable de la productivité multifactorielle de 1,17 % durant la période 1985-1994.

Codes du Journal of Economic Literature : C8, G2 et L8.

I. INTRODUCTION

The economic system has adopted many institutions that intermediate between buyers and sellers. In commodity markets there are retailers and supermakets; in the housing market there are real estate agents; in financial markets there are depository institutions (commercial banks, savings and loans institutions, credit unions), contractual savings institutions (insurance companies and pension funds) and investment intermediaries (mutual funds, finance companies). Without financial intermediation, the full benefits of a financial market cannot be achieved. The reason why financial intermediaries are needed to obtain the full benefits of financial markets is that there are substantial information costs and transactions costs in the economy. For lenders to identify potential borrowers and for borrowers to identify potential lenders is a costly process.[1]

Insurance companies perform a joint activity. They provide financial protection to economic agents of all kinds and perform a financial intermediation activity. Much like banks, insurance companies transform liabilities (reserves) into earning assets; they acquire funds at periodic intervals on a contractual basis and invest

in portofolios of financial assets. However, unlike banks, insurers' financial intermediation activity is not the hub of the economy' payment system. For this reason, insurance companies do represent a particular type of financial intermediaries. Within insurance companies, the difference in the maturity of life and non-life (or property and casualty, P&C) insurance policies generate differences in the structure of portfolio of financial assets held by life and non-life insurance companies. Non-life insurance companies, more concerned about precautionary liquidity, favour short-term and highly marketable bonds and money market instruments. Life insurance companies prefer precautionary liquidity and, therefore, seek for financial instruments with a maturity horizon that suit their long-term liabilities (actuarial reserves). The difference in the structure of financial assets between life and non-life insurance companies shows some regularities not only over time but also on an international basis. Regulation has also a major impact on the composition of the different portfolios of assets, so that countries with stringent regulation rules tend to favour investment in less risky financial assets. Insurance premiums and annuity considerations, which are the insurers financial intermediation's sources of funds, have seen their output mix affected by the changes that took place in the tax treatment of households and in the market of financial protection. All these and other facts have been documented in Harchaoui (1996).

The purpose of this paper is to address the market structures and economic performance of the financial intermediation industry of Canadian insurance companies. Issues such as market concentration within the Canadian financial intermediation industry and within some specific investment and savings vehicles are addressed.. Despite the dramatic loss of ground of life insurance within the market of contractual savings as a result of the various tax policies that have been implemented during the eighties, and despite strong competition from mutual funds and trusteed pension funds, life insurance companies experienced a remarkable growth and their market share remained steady in the meantime. This performance can be attributed to the combination of a comparative advantage in the market of RRSPs and an enviable 1.17 average annual growth of multifactor productivity during the period 1985-1994.[2]

The remainder of the paper is organized as follows. Section II looks at the structures and conduct of the financial intermediation market in'Canada with a special focus on the role of the financial intermediation activity of insurance companies. Section III develops the production framework to estimate the multifactor productivity

of insurers' financial intermediary activity. I conclude the paper by summarizing the findings in section IV.

II. THE CANADIAN FINANCIAL INTERMEDIATION MARKET: STRUCTURES AND CONDUCT

Insurance companies are engaged in a joint activity, that is, financial protection and financial intermediation. In the first case, the competition comes from other insurance companies. In the second case, competition comes from two places. Not only is there competition among insurance companies, but also, and primarily, between them and the other financial intermediaries. This competition comes in the form of offering better rates of return and better service (which includes better information for the client).

Financial intermediation activity is possible because of the households that are saving money. In the financial intermediation market, these households represent the supply side, whereas the financial intermediaries represent the demand side. Traditional agents such as chartered banks and near banks (co-operatives and credit unions) make up part of the demand side. However, there is also another heterogeneous group, better known for its portfolio diversification than for its role as a financial intermediary. This group includes trusteed pension funds, insurance companies, trust companies and, in the last few years, mutual funds. Table 1 indicates the market share (in terms of financial assets) of various financial intermediaries and its evolution over the period 1978-1994. Chartered banks are the major players of the financial intermediation market, averaging roughly 43% of the market for the period 1978-1995. The balance of the market is shared primarily between trusteed pension funds (16.0%), life insurance companies (including segregated funds) (12.0%), trust companies (10.2%), credit unions and *caisses populaires* (7.2%), mutual funds (3.2%), P&C insurance companies (2.7%), sales finance and loan companies (2.6%), and investment dealers (1.3%). Life insurance companies are in third position. However, combined with their P&C insurance counterparts, they display roughly the same market share as trusteed pension funds, second in size after the chartered banks. The P&C insurance industry is so small in relation to the rest of the financial intermediaries that it is not a major player in the market for any financial instrument.

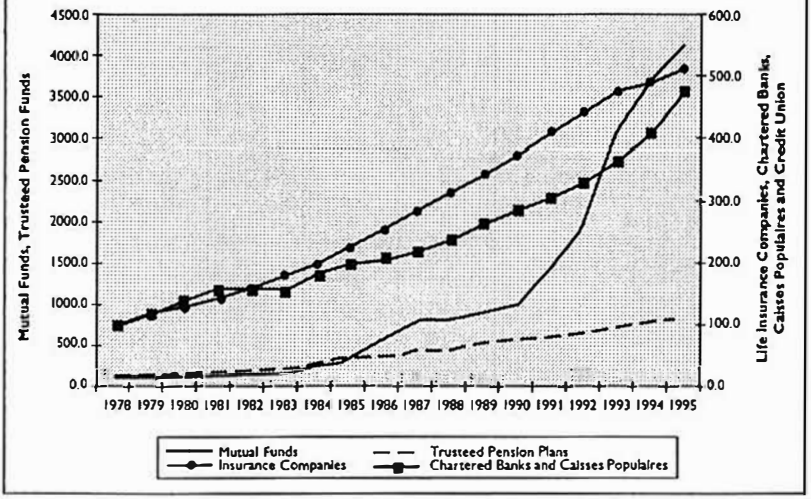
TABLE 1
MARKET SHARE OF FINANCIAL INTERMEDIARIES
(PERCENTAGE OF FINANCIAL ASSETS)

	1978	1982	1986	1990	1995
Chartered Banks	47.4	46.6	42.4	40.2	42.1
Credit Unions and Caisses Populaires	7.7	6.9	7.0	7.2	6.5
Trust Companies	8.9	9.1	11.6	12.7	5.0
Mortgage Loans	3.9	5.6	0.0	0.0	0.0
Life Insurance Companies*	11.0	10.7	12.1	12.4	12.1
Trusteed Pension Plans	11.1	13.6	16.9	18.4	19.0
Investment Dealers	2.0	1.7	2.0	0.6	0.8
Mutual Funds	1.1	1.0	2.9	3.4	10.1
Property and Casualty Insurance Companies	2.7	2.3	3.0	2.9	2.7
Sales Finance and Loan Companies	4.2	2.5	2.3	2.2	1.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

*The figures include segregated funds and accident and sickness.
Source: Statistics Canada: National Balance Sheet Accounts, 13-214, Tables 13-26, Ottawa.

These figures, however, do not show the tremendous rise of certain financial intermediaries between 1978 and 1995, nor do they show the decline of the most traditional among them. Chart 1 displays the trend of financial intermediaries market share. It indicates that mutual funds' market share has experienced an average annual growth rate of 24%, almost double that of trusteed pension plans (12.8%), slightly more than double that of insurance companies (9.9% for life insurance and 9.4% for P&C insurance), close to triple that of the chartered banks and *caisses populaires* (about 8.7%), and more than triple that of all the other financial intermediaries. As a result of this growth, the market share of mutual funds and trusteed pension funds shown in Table 1 moved from 11.1% to 19% and from 1.1% to 10.1% respectively. Market share for the chartered banks, trust companies, investment dealers, and sales finance and loan companies declined from 47.4% to 42.1%, 8.9% to 5.0%, 2.0% to 0.8%, and 4.2% to 1.7%, respectively. After experiencing a secular downward trend that begun in the forties (Neufeld 1972), insurance companies' market share remained unchanged during the period 1978-1995.

CHART 1
TRENDS OF FINANCIAL ASSETS: MAJOR FINANCIAL INSTITUTIONS (1978 = 100)



It seems that the changes in their product mix (from whole life insurance to term insurance policies and other investment vehicles) were unfavourable for market share growth relative to other traditional or more recent financial intermediary newcomers. Table 2, which shows the structure and evolution of long-term personal savings between 1978 and 1994, indicates a decrease in the share of life insurance (10.8%) and trusteed pension plans (9%) and an increase of RRSPs, whose share more than doubled. The decline of life insurance occurred mostly because of successive changes to the rules governing the tax treatment of investment income accruing in life insurance policies. As such, there is now much less incentive for the consumer to hold a life insurance policy in comparison to other savings vehicles.

Since the early 1980s, investment income from policies issued between December 1982 and December 1989 is taxed every three years; income from policies issued after 1989 must be included in taxable income. In an attempt to recover lost ground, new products, such as universal life insurance, have been developed to provide savers with rates of return equal to those of other kinds of savings vehicles. Essentially, the savings elements of these products now pay interest rates commensurate with changing market conditions. A relatively new and rapidly growing segment of insurance company activity has been the management of segregated funds, particularly those administered as RRSPs. This change in the structure of

TABLE 2
SELECTED COMPONENTS OF PERSONAL SAVINGS (IN PERCENTAGE)

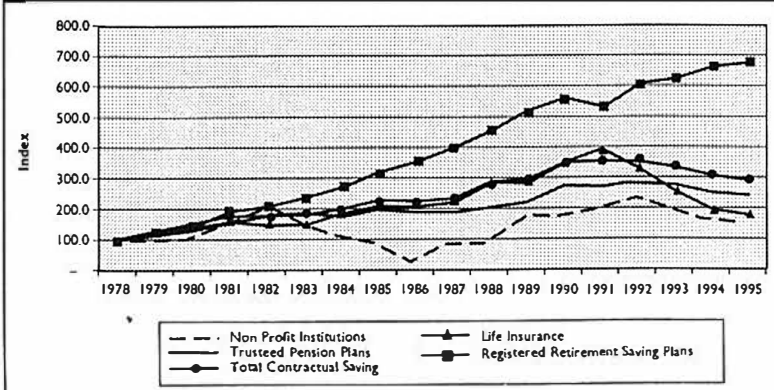
	1978	1982	1986	1990	1995
Non Profit Institutions	5.7	6.5	0.9	3.0	3.0
Life Insurance	28.9	24.5	27.3	29.5	18.1
Trusteed Pension Plans	45.2	45.6	39.4	35.2	36.2
Registered Retirement Saving Plans	20.2	23.3	32.4	32.3	42.7
Total Contractual Saving	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Statistics Canada: National Income and Expenditure Accounts, Table 56, Catalogue 13-201

savings is marked by the remarkable growth of RRSPs in the period 1978-1994. Chart 2, which depicts the trends in the various components of personal savings, indicates that RRSPs grew at an annual rate of 11.8%, followed far behind by trusteed pension plans (5.6%) and life insurance (4.2%).

Since RRSPs are one of the main areas of personal savings, it is worth investigating the evolution of market structures within this line of business. RRSPs are offered by many different financial institutions. These governmentally approved plans (both federal and provincial) attempt to encourage savings by providing tax deferral privileges on contributions, subject to maximums imposed by the

CHART 2
TRENDS IN SELECTED COMPONENTS OF PERSONAL SAVINGS (1978 = 100)



appropriate federal or provincial tax regulations. Investments chosen by these funds must meet certain criteria specified in legislation and in tax regulations in order for contributors to receive tax savings. For example, to qualify as an RRSP, a fund cannot have more than 15% of its assets invested in foreign stocks. Of the many savings plans, RRSPs are the most popular, and competition to administer savers' assets is intense. The contributions and the compounded investment income earned on accumulated contributions remain untaxed until the RRSP is collapsed, perhaps as late as age 71. The rules governing RRSPs were made more flexible and the maximum contributions were increased over the years, with major changes in the eighties, while at the same time effective marginal tax rates rose, making RRSPs more attractive (see Burbidge and Davies 1994 p. 39). Both annuities and life insurance policies can be registered, but most life insurance companies' RRSPs are individual annuities.

Table 3 shows the evolution of investment vehicles held by households and the unincorporated sector in Canada and managed by financial intermediaries during the period 1980-1995. In 1980, life insurance companies (including segregated funds) occupied second place with a 23% market share, behind trust and loan companies (31%), but ahead of the chartered banks (19%). During the period spanned by the data, all financial institutions steadily lost market share to the chartered banks and mutual funds. The average annual rate of growth of RRSPs held by chartered banks and mutual

TABLE 3
SHARE OF VARIOUS FINANCIAL INSTITUTIONS IN THE RRSPs* MARKET (IN PERCENTAGE)

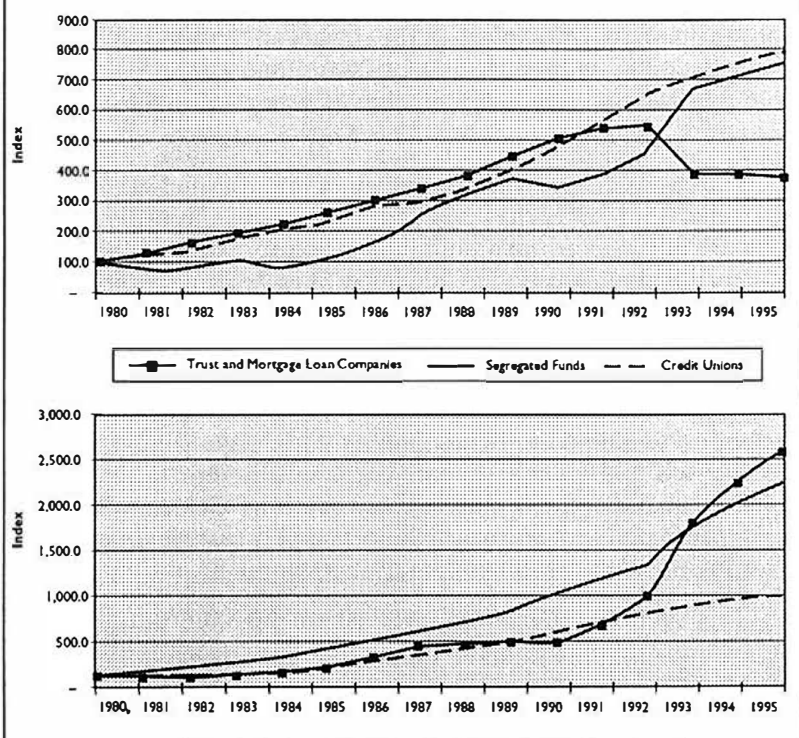
	1980	1984	1988	1992	1995
Life Insurance	20.6	15.6	19.2	19.8	18.0
Segregated Funds	2.2	0.8	1.6	1.3	1.9
Chartered banks	19.0	27.9	29.4	31.1	36.1
Trust and Mortgage Loan Companies	30.7	32.6	26.2	20.7	10.0
Credit Unions	15.3	14.7	11.4	12.3	10.7
Mutual Funds	12.2	8.4	12.2	14.9	23.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes: Registered retirement savings plans.
Source: Statistics Canada: Canadian National Balance Sheet Accounts, Supplementary Table IV, Catalogue 13-214, Ottawa.

funds was 15.7% and 23.1% respectively, or about twice that of life insurance companies (see Charts 3a-b). As a result, chartered banks and mutual funds saw their market share almost double during the period, to reach 34% and 23%, respectively, in 1993.

It appears that the management of pension funds, as a substitute to the traditional activity of life insurance carriers, has not had obvious beneficial effects on the market share of their business in comparison with other financial intermediaries. Government tax policy since the early eighties has created a situation where there is little marginal incentive for life insurance saving for policyholders. However, despite the fact that life insurers seem nowadays to lag behind other financial intermediaries, their situation is not necessarily irreversible. RRSPs managed by a financial institution must be collapsed by age 71 or converted to an annuity or a registered

CHARTS 3A AND 3B
TRENDS OF RRSPs MANAGED BY MAJOR FINANCIAL INTERMEDIARIES (1980 = 100)



retirement investment fund (RRIF). RRIFs have proven to be less popular than annuities, and since only life insurance companies can offer annuities, they benefit eventually from the RRSP business, even when the RRSP is registered with other financial intermediaries.

■ III. ASSESSING THE ECONOMIC PERFORMANCE OF THE INSURANCE BUSINESS

□ A. General Considerations

The previous sections outlined the major changes that took place in the market of financial intermediation. It has shown that while government tax policies have had significant negative effects on the demand for life insurance, it has also encouraged savings through tax sheltered RRSPs and increased the demand for annuities by individuals who initially register their RRSPs with a life insurance company or any other financial institution. Parrallel to the changes that have taken place in the market structures, it might also be interesting to address the issue of the economic performance of insurers' financial intermediation activity measured in terms of productivity.

Traditionally, the neoclassical framework of the firm has been supplanted by Markowitz-Tobin portfolio theory in analyzing the behaviour of financial institutions. The primary focus of the portfolio theory is the allocation of funds between heterogeneous investments (see Berndt and McCurdy 1980, for example). Portfolio theory views financial intermediaries not as producers, but as investors characterized by risk and uncertainty. There is at least two problems with this approach. The first stems from the omission of production and cost constraints under which financial intermediaries operate, and the role of these constraints in determining inputs mix. The second is the exclusive focus given by the portfolio literature to financial performance indicators and a complete neglect of the economic performance of financial institutions.

This section extends the neoclassical production framework into two directions. First, the production framework is developed by assuming that insurers' financial intermediation activity requires an inventory of non-financial assets (capital) and liabilities. There are revenues and costs associated with holding these inventories over time. The financial intermediation production units are

assumed to choose the input-output combination which maximize profit during the production period. Second, the basic framework of multifactor productivity (MFP) accounting is outlined and then related. The technology of insurers' financial intermediation activity to single-factor (for example labour) productivity indexes. This framework in then applied, apparently for the first time in Canada, to estimate the economic performance of one of the industries with output that is 'hard to measure' (Griliches 1994): the insurance financial intermediation activity. The contribution presented in this section belongs to the tradition initiated by Solow (1957) in that it makes use of economic theory in order to infer from statistical data the information which would otherwise be missing.

☐ B. The Measurement Framework

In the popular press of today, most discussions of economic performance refer to measures of labour productivity-output per person or output per hour at work. Although labour productivity is an important measure, it is not the only way to measure gains in productive efficiency. Indeed, the almost exclusive attention devoted in the popular press and in policy discussions to labour productivity is unfortunate, for in our judgement it is clearly preferable to measure economic performance in a way that compares output with the combined use of all resources, not just labour. The production of output requires the combination of inputs of capital, labour, and other materials in a technologically feasible manner. Hence, in its general form, productivity deals with all inputs, not just labour or capital or intermediate inputs.[3]

By defining technical change as the change in output not explained by the change in an index of all inputs, the MFP index attempts to isolate the contribution of technological improvements, including improvements in the performance of individual inputs, from the effects of changes in the quantities of inputs. For a production function that satisfies the three key assumptions that underlie the MFP measure "constant returns to scale, perfect competition, and variable factors of production" the rate of technical change can be computed from commonly available data without resorting to econometrics or any other form of statistical inference.

MFP measures are frequently used to compare the performance of different industries (say manufacturing and insurers' financial intermediation activity). In order to be meaningful, such comparisons must be based on similar assumptions about the production function and must rely on identical methodologies from one

sector to the next. If the standard production function (i.e., the one based on capital, labour and intermediate inputs) is used in computing MFP, will interindustry comparisons be meaningful? The answer is that such comparisons are likely to be misleading because, although the conventional factors of production have identical definitions, the production model overlooks an important ingredient of the financial intemediation activity. In addition to the conventional inputs such as capital, labour, and intermediate inputs, the financial intermediation activity of insurance carriers use an extra input, reserves, which needs to be accounted for in the production function.[4] The output of this activity, measured by the investment income, is derived in a large part from the reserves. These are, in effect, loaned to the company by policyholders and for which they do not receive any explicit interest revenue.

Under the three assumptions outlined above and the appropriate specification of the insurers financial intermediation production function,[5] the MFP framework is defined as[6]

$$\dot{A} = \dot{Q} - s_K \dot{K} - s_L \dot{L} - s_M \dot{M} - s_R \dot{R} \quad , \qquad (1)$$

where

$\dot{A}$ = Annual rate of change (in percentage) in multifactor productivity.

$\dot{Q}$ = Annual rate of change (in percentage) in gross output.

s_K = Average mean cost share of capital services between t and $t-1$.

$\dot{K}$ = Annual rate of change (in percentage) in quantity of capital.

s_L = Average mean cost share of labour services between t and $t-1$.

$\dot{L}$ = Annual rate of change (in percentage) in quantity of labour.

s_M = Average mean cost share of intermediate inputs services between t and $t-1$.

$\dot{M}$ = Annual rate of change (in percentage) in quantity of intermediate inputs.

s_R = Average mean cost share of reserves services between t and $t-1$.

$\dot{R}$ = Annual rate of change (in percentage) in quantity of reserves.

In other words, multifactor productivity $\dot{A}$ is simply growth in output minus the cost-share-weighted growth in inputs. It is also known as the percentage of outward shift in the production function resulting from technical progress. Although the value of the reserves services is not usually observed, under the assumptions of the TFP approach, computing s_R does not cause any difficulties provided all other shares can be measured directly so that the last one can be obtained as the complement of the others to unity.[7]

After some manipulations, equation (1) can be written as follows[8]

$$\dot{A} = s_K\left(\dot{Q} - \dot{K}\right) + s_L\left(\dot{Q} - \dot{L}\right) + s_M\left(\dot{Q} - \dot{M}\right) + s_R\left(\dot{Q} - \dot{R}\right) \quad . (2)$$

Equation (2) has a very nice interpretation. Since $\dot{Q} - \dot{K}$ is the (average) rate of growth of capital productivity, $\dot{Q} - \dot{L}$ is the rate of growth of labour productivity, $\dot{Q} - \dot{M}$ is the rate of growth of intermediate inputs productivity, and $\dot{Q} - \dot{R}$ is the rate of growth of reserves productivity, equation (2) indicates that MFP is a weighted average of productivity of all inputs required by the technology of insurers' financial intermediation activity, where the weights are the respective input shares. When capital, labour, intermediate inputs and reserves grow at the same rate, say, because of Hicks neutral technical change, MFP $\dot{A}$ is simply the common rate of capital, labour, intermediate inputs and reserves productivity growth.

Equation (2) can be used to obtain the following labour productivity framework measurement[9]

$$\dot{Q} - \dot{L} = \dot{A} + s_K\left(\dot{K} - \dot{L}\right) + s_M\left(\dot{M} - \dot{L}\right) + s_R\left(\dot{R} - \dot{L}\right) \qquad (3)$$

which is interpreted as follows. The growth in labour productivity $\left(\dot{Q}-\dot{L}\right)$ is the sum of four terms: the effects of technological progress ($\dot{A}$), the capital-share-weighted change in the capital/labour ratio $\left(s_K\left(\dot{K}-\dot{L}\right)\right)$, the intermediate inputs-share-weighted change in the intermediate inputs/labour ratio $\left(s_M\left(\dot{M}-\dot{L}\right)\right)$, and the reserves-share-weighted change in the reserves/labour ratio $\left(s_R\left(\dot{R}-\dot{L}\right)\right)$.

C. Empirical estimates

The empirical part consists of describing the data sources and the methods used to measure the accounting equations (2) and (3).

1. Data

This study uses data on the investment activities of insurance companies operating in Canada (life insurance and P&C insurance) collected by the Office of the Superintendent of Financial Institutions (OSFI) during the period 1985 to 1994, 1994 being the last year for which data are available. The P&C insurance data are particularly appealing since they differentiate investment activities from other activities such as general insurance and claims adjustment. The data include information on labour compensation, capital depreciation, and intermediate inputs. The latter include tangible intermediate inputs but also payments made by the investment activity in the form of professional fees, management fees, and counselling fees for various services obtained in the market.

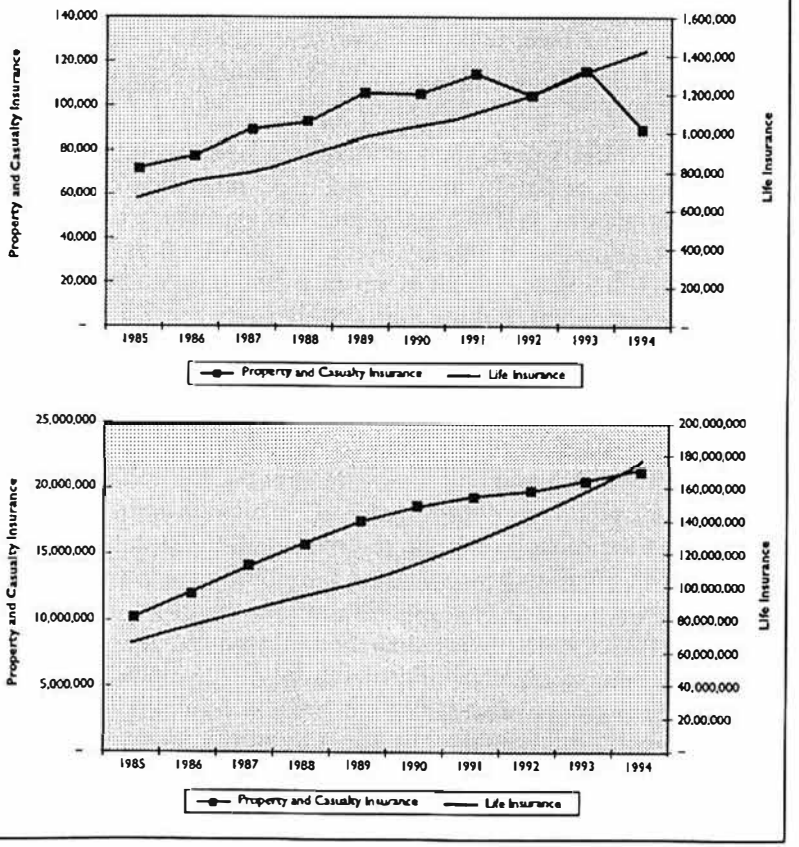
The data on life insurance companies' investment activities are available only for Canadian companies and do not have the consistency or continuity of their P&C counterpart. Data on Canadian life insurance companies' investment activities are only available for the period 1985-1992. Information on the operating costs of the investment activity of Canadian life insurance companies was not collected for the subsequent years. We imputed the data for 1993 and 1994 as follows: we assumed that the missing data on labour expenses, capital services, and intermediate inputs for Canadian life insurance companies in 1993 and 1994 grew at the same rate as the average annual rate of growth for the period 1985-1992. Labour

expenses, capital services, and intermediate inputs of foreign life insurance companies' investment activities were imputed by assuming that they have the same share in financial intermediation nominal output as the Canadian companies. Nominal output of the financial intermediation activity stems from the investment of premiums that have been collected over time and the gains or losses from the sale of financial assets. It is calculated as the sum of investment income and capital gains (losses).

Charts 4 and 5 show the historical trends of the output and the input expenses of life insurance and P&C insurance companies. Chart 4a indicates that the output of life insurance companies' financial intermediation activity averaged 14 billion dollars during the period 1985-1994, which is seven times greater than its P&C insurance counterpart. It more than doubled between 1985 and 1994 to reach approximately 20 billion in 1994; it also experienced smooth and constant growth over this period. On the other hand, the P&C financial intermediation activity output tended to fluctuate annually, a reflection of the short-term nature of this business as opposed to life insurance more oriented toward longer horizon. For both life insurance companies and P&C insurance companies, output follows the same pattern as reserves (actuarial reserves for life insurance companies and unearned premiums and provisions for unpaid claims for P&C companies), which therefore suggests an almost perfect correlation between the two variables (see Chart 4b): the growth rate acceleration (deceleration) of life (P&C) insurance companies' reserves after (prior to) 1989 is reflected in the their output growth rate. Remarkably, the ratio of life insurance companies' reserves to their P&C counterpart (6.8) mirrors exactly the ratio of their nominal output (7).

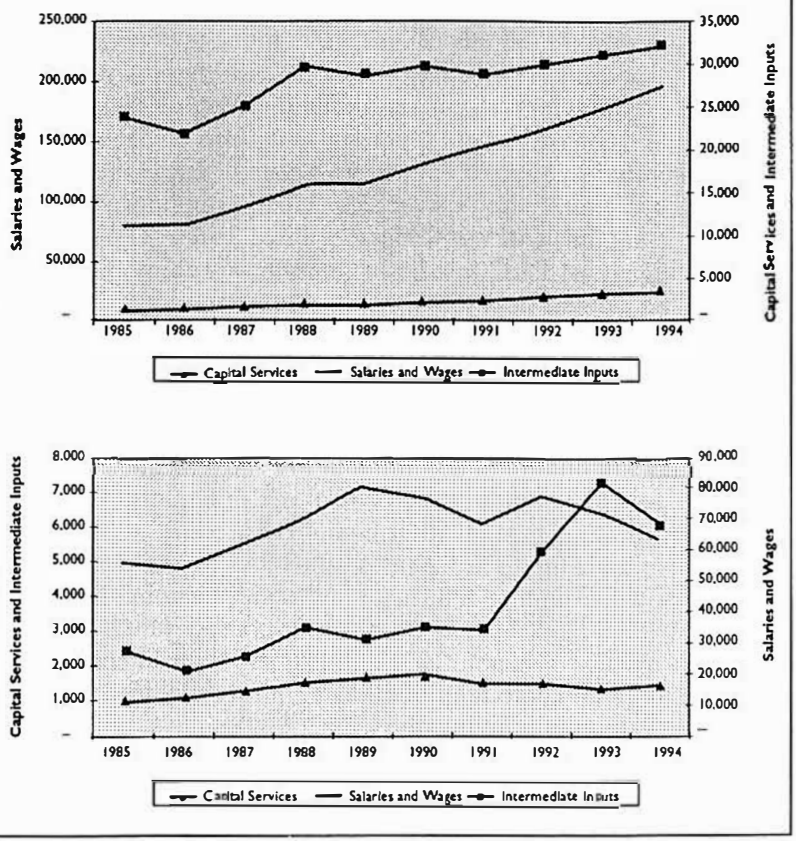
Input expenses for the financial intermediation activity of P&C insurance companies were approximately $50 million for the period 1985-1994, or approximately one third of that of their life insurance counterparts. However, for both types of insurance companies, expenses grew at the same annual rate: slightly more than 9%. The capital, labour, and intermediate inputs account for a different share of the investment operating expenses activities of P&C and life insurance companies. Approximately 75% of life insurance companies' operating expenses are labour costs, 17% are intermediate input expenses, and capital services account for the remainder (see Chart 5a). This contrasts with P&C insurance companies, where intermediate inputs account for 85% of the financial intermediation activity, labour expenses make up 12%, and capital services account for 3% (See Chart 5b). This suggests that life insurance

CHARTS 4A AND 4B
PATTERN OF INSURERS' FINANCIAL INTERMEDIATION OUTPUT ($,000)



companies have employees dedicated to undertaking financial intermediation activities, whereas P&C insurance companies rely mostly on subcontractors. Such a result can be corroborated by a close examination of labour and intermediate input trends. As shown in Charts 5a, labour and intermediate inputs displayed a similar pattern over the period 1985-1994 in the case of life insurance (both experienced growth), so that both can be characterized as complement factors of production. The results are different for P&C insurance companies, especially since 1989, the year in which labour expenses tended to decrease while intermediate inputs continued to rise. These two inputs seem to behave as substitute factors of production (see Chart 5b).

CHARTS 5A AND 5B
INPUT EXPENSES OF LIFE INSURERS' FINANCIAL INTERMEDIATION ACTIVITY ($,000)



To estimate MFP, the input and output data must be estimated in constant prices. Intermediate input expenses were deflated by the services component of the GDP implicit price index.[10] OSFI's data on capital and labour deal exclusively with flows of services of these inputs (depreciation and wages and salaries, respectively); however, estimates of the volume of capital stock and labour are needed to calculate MFP. The only data on the volume of capital and labour available are those published by Statistics Canada, but they deal with insurance activities in general and do not treat financial intermediation activity specifically.[11] We imputed the volume of capital stock and labour for the financial intermediation activity by assuming that it is proportional to the ratio of these two inputs' services in the investment activity to their value in the total insurance

activities. The volume of capital and labour imputed for the financial intermediation activity turned out to have a similar trend to the volume of capital and labour for all the insurance activities published by Statistics Canada. As a result, the latter has been used in the estimates of MFP.

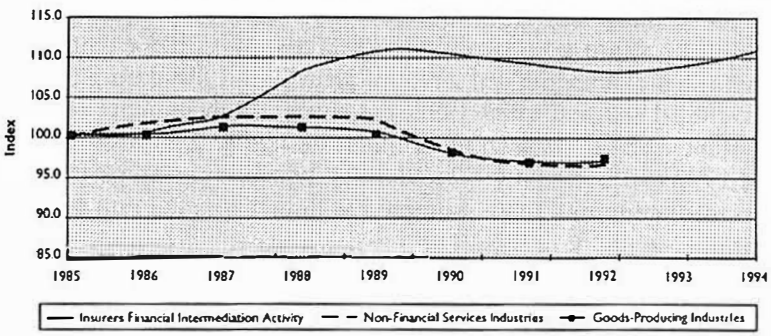
The two final components of MFP, regulatory reserves and investment income, are the only two for which there is no natural deflator. Our choice was therefore guided by common sense and the availability of data. Reserves represent in a large part the cumulative net premiums collected over time. It therefore seems appropriate to use a deflator based on the concept of premiums. Since the insurance component of the Consumer Price Index (CPI) account for the majority of P&C insurance premiums (automobile, home owners, and tenants insurance), this represents a good starting point.[12] For life insurance, we calculated the (implicit) deflator from the ratio of net premiums to the number of policies.[13] We then estimated a deflator for reserves from the weighted sum of the insurance component of the CPI and the implicit life insurance deflator. The weights were based on the value of life and P&C insurance net premiums earned over the value of total net premiums. To deflate the output of the financial intermediation activity—investment income—we used the CPI.[14] This is motivated by the fact that the majority of the insurance industry's investment income—87% for the period 1985-1994—stems from life insurance, which is a type of savings vehicle available to the consumer. Well informed consumers usually compare their purchasing power afforded by these savings with the cost of living, the CPI.

2. The results

The results of the estimate of equation (2) for the financial intermediation activity of insurance companies are shown in Chart 6, where they are compared with the MFP estimates of goods-producing industries and non-financial services industries published by Statistics Canada.[15] For the period 1985-1994, the financial intermediation activity of insurance companies experienced an average annual MFP rate of growth of 1.17%. On the other hand, estimates based on a production function that excludes reserves suggests an absence of productivity gains. (The results are not shown here.) This suggests that choosing a production function with conventional inputs in order to characterize the technology of the financial intermediation activity of insurance companies can be misleading.

During the period for which estimates of the productivity of goods-producing industries and non-financial services industries are

CHART 6
MULTIFACTOR PORDUCTIVITY INDEX (1985 = 100): COMPARISON BETWEEN INDUSTRIES



comparable, that is 1985-1992, the financial intermediation activity grew at an average annual rate of growth of 1.37%, compared with a negative annual average rate of 0.39% for goods-producing industries and 0.48% for non-financial services producing industries. In general, it is not so much the trend as it is the level of productivity that differentiates the performance of the financial intermediation activity from the other industries. All of the industries studied seem to have experienced a turning point in their economic performance in 1989. The estimates at equation (2) show three distinct periods: a period of growth (1985-1989) with an average annual rate of growth of 2.68% (compared with 0.17% and 0.55% for goods-producing industries and non-financial services producing industries, respectively), a period of slowdown (1989-1992) with an average annual growth rate of 0.89% (compared with -1.14% and -1.83% for goods-producing industries and non-financial services producing industries, respectively), and a period of recovery (1992-1994) with a sizeable average annual rate of growth of 1.27% about half the rate of growth for the period 1985-1989.

Remarkably, it is the financial intermediation activity that experienced the greatest productivity growth during the period of economic growth but also the lowest productivity slowdown during the recession. Such a result is consistent with the business cycle's stylized facts, which show that service industries experienced much milder fluctuations during business-cycle downturns over the last 40 years, whereas goods-producing industries have systematically experienced more extreme declines in growth during recessions than have services industries (Hall and Taylor 1991).

Table 4 provides more details on the breakdown of MFP estimates (Panel A) and the comparison between these and labour productivity (Panel B) for the various subperiods 1985-1989, 1989-1992, and 1992-1994. The table shows that conventional inputs (capital, labour, and intermediate inputs) have a relatively negligible share compared with reserves. With the exception of labour, which experienced a rate of growth of 7.8% during the periods 1985-1989 and 1989-1992, the share of other inputs remained constant. Labour share grew at the same rate (7.2%) between 1989 and 1992 and between 1992 and 1994, whereas capital services and intermediate inputs share increased at three times the rate of labour share.

Panel A shows the trends related to the productivity of each input and their effects on MFP. With the exception of capital, all inputs experienced significant productivity during the period of economic growth. The intermediate inputs had the highest productivity growth at 4.7% on average for the period 1985-1989, followed closely by labour (4.0%) and reserves (2.7%). The intermediate inputs and labour were the only inputs to experience a relatively modest drop in productivity during the period 1989-1992 (less than one percentage point) as well as the highest productivity growth rate during the period 1992-1994. It is in this latter period that capital experienced a positive productivity for the first time. Given the important share of reserves in the financial intermediation activity, the behaviour of MFP mirrors that of the productivity of the reserves during all the subperiods studied.The key issues raised by the data in Table 4 are as follows. The MFP pattern reflects the degree of cyclical activity in the financial intermediation activity of insurance companies, with a sharp decrease in productivity growth between 1989 and 1992. The 1989-1992 productivity decline was sudden and dramatic. What accounts for these variations? One possible hypothesis is that the greater the reduction in output growth, the greater the drop in MFP growth. As seen in Table 4 (Panel B), the evidence supports this hypothesis. The annual rate of growth of output fell by 4.05 percentage points between the periods 1985-1989 and 1989-1992, while the corresponding reduction in MFP growth was 3.54 percentage points. It appears that MFP time pattern reflects primarily a reduction in output in conjunction with sustained growth in the inputs.

Panel B follows the format of Panel A but focuses on aggregate labour productivity. Panel B breaks down the behaviour of labour productivity over time according to the ratios of each input in relation to labour. The rate of growth of the capital-labour ratio

TABLE 4
ECONOMIC PERFORMANCE INDICATORS OF INSURERS' FINANCIAL INTERMEDIATION ACTIVITY

A. Multifactor Productivity of Insurers' Financial Intermediation Activity (in Percentage)

	$\dot{A}$	=	s_K	×	$(\dot{Q}-\dot{K})$	+	s_L	×	$(\dot{Q}-\dot{L})$	+	s_M	×	$(\dot{Q}-\dot{M})$	+	s_R	×	$(\dot{Q}-\dot{R})$
1985-1989	2.678	=	.0009	×	-6.517	+	.0077	×	3.974	+	.0005	×	4.651	+	.9909	×	2.675
1989-1992	-.860	=	.0009	×	-10.280	+	.0083	×	-.885	+	.0005	×	-9.185	+	.9902	×	-.848
1992-1994	1.270	=	.0011	×	1.063	+	.0089	×	3.671	+	.0006	×	.1028	+	.9894	×	1.249

B. Labour Productivity of Insurers' Financial Intermediation Activity (in Percentage)

	$(\dot{Q}-\dot{L})$	=	$\dot{A}$	+	s_K	×	$(\dot{K}-\dot{L})$	+	s_M	×	$(\dot{M}-\dot{L})$	+	s_R	×	$(\dot{R}-\dot{L})$;	$\dot{Q}$
1985-1989	3.974	=	2.678	+	.0009	×	10.491	+	.0005	×	-.677	+	.9909	×	1.288 ;	5.96
1989-1992	-.885	=	-.860	+	.0009	×	9.394	+	.0005	×	8.300	+	.9902	×	-.0374 ;	1.91
1992-1994	3.671	=	1.270	+	.0011	×	2.608	+	.0006	×	3.568	+	.9894	×	2.4214 ;	6.13

Notes:

$\dot{A}$ = Annual rate of change (in percentage) in multifactor productivity.

$\dot{Q}$ = Annual rate of change (in percentage) in gross output.

s_K = Average mean cost share of capital services between t and $t-1$.

$\dot{K}$ = Annual rate of change (in percentage) in quantity of capital.

s_L = Average mean cost share of labour services between t and $t-1$.

$\dot{L}$ = Annual rate of change (in percentage) in quantity of labour.

s_M = Average mean cost share of intermediate inputs services between t and $t-1$.

$\dot{M}$ = Annual rate of change (in percentage) in quantity of intermediate inputs.

s_R = Average mean cost share of reserves services between t and $t-1$.

$\dot{Q}-\dot{K}$ = Annual rate of change (in percentage) in capital productivity.

$\dot{Q}-\dot{L}$ = Annual rate of change (in percentage) in labour productivity.

$\dot{Q}-\dot{M}$ = Annual rate of change (in percentage) in intermediate inputs productivity

$\dot{Q}-\dot{R}$ = Annual rate of change (in percentage) in reserves productivity.

$\dot{K}-\dot{L}$ = Annual rate of change (in percentage) in capital-labour ratio.

$\dot{M}-\dot{L}$ = Annual rate of change (in percentage) in intermediate inputs-labour ratio.

$\dot{R}-\dot{L}$ = Annual rate of change (in percentage) in reserves-labour ratio.

$\dot{R}$ = Annual rate of change (in percentage) in quantity of reserves.

has tended to decline over time, and especially during 1992-1994. Over all subperiods, the ratio's rate of growth is positive, which suggests that for the entire 1985-1994 period, capital and labour have behaved as complement factors of production in this industry. The results of the intermediate inputs-labour ratio and the reserves-labour ratio indicate that these factors of production behaved as complements during certain periods of time and as substitutes during others.

The strong labour productivity growth prior to 1989 did not continue in subsequent years. This reflects the deterioration in MFP and a falling-off in the rising trend of capital-labour and reserves-labour ratios. Since the cost share of capital services is small, however, the reduction in the capital-labour ratio had minimal direct effect on labour productivity trends (likewise for the intermediate inputs-labour ratio). It is interesting to observe and compare labour productivity growth rates over various subperiods. It has often been stated that labour productivity growth is highly correlated with growth in capital-labour ratio and that one way to increase labour productivity is to provide incentive for more rapid investments in technology, such as computers in the case of services industries. The entries in Panel B provide little support for this proposition. In particular, over the 1989-1992 period, growth of the capital-labour ratio was greater than in the 1992-1994 period, yet labour productivity growth in the 1989-1992 period was smaller than in the subsequent period. We conclude that the recent slowdown in labour productivity growth cannot be attributed to a slowdown in the rate of capital formation, for in fact the slowdown in labour productivity growth occurred simultaneously with an acceleration in the rate of growth of capital-labour ratio. The 1989-1992 fall in labour productivity growth is associated with a reduction in the rate of growth of output; but, again, it is not necessarily the case that the greater the reduction in output growth, the greater the drop in the labour productivity growth.

3. Decomposition of the Total Productivity Growth

In order to more completely understand MFP growth, the results of the MFP rates can be decomposed into technical change and economies of scale. The MFP growth rate can be decomposed as

$$\ell n\left(\frac{TFP_t}{TFP_{t-1}}\right) = \beta\, \ell n\left(\frac{Q_t}{Q_{t-1}}\right) + \gamma t + \varepsilon_t \qquad (4)$$

with $\beta \equiv (1 - \lambda_Q^{-1})$ and λ_Q^{-1} is the measure of scale economies, t is the rate of technological progress and ε_t is the residual due other factors. Increasing, constant or decreasing returns to scale exist if λ_Q is less than, equal to or greater than unity, respectively. From (4), if there are constant returns to scale then there is no scale effect on TFP growth rate. If there are increasing returns to scale along with positive rates of output growth then scale contributes to TFP growth rate. In addition, positive rates of technological change contribute to TFP growth rate. Based on data at the level of insurers' financial intermediation activity (establishment), the results on the decomposition of TFP growth rate are presented in Table 5. On average the results show that the most important element contributing to TFP growth of insurers' financial intermediation activity is technical progress. This result is consistent with Parsons et al. (1990), who found an average rate of technical change in Canadian banking of one percent over the period 1980-1987. On their part, scale economies, on average, account by far for a smaller effect on TFP growth than the rate of technological change. The residual term in the decomposition represents a number of elements. First, it may represent measurement errors in the rate of TFP that may stem from the use of inappropriate price deflators. It may also represent the importance of market structures and their impact on the existence of non-marginal cost pricing, in which case the measured rate of TFP growth does not capture the technological efficiency of this activity. A third possibility, is the importance of entry/exit in the insurance business that this simple framework fails to account for. The results indicate that on average the assumption of constant economies to scale underlying the non-parametric TFP model seems reasonnable but might be hampered by serious measurement errors. In another paper based on the estimation of a cost function (see Harchaoui 1997) with an incomplete panel data set where the TFP is decomposed into 1) scale effects, 2) market structures, and 3) technological change effect, I reached some of the results presented above, namely: technological change represents the major source of TFP and the hypothesis of constant economies to scale cannot be rejected. However, unlike the results based on (4), turnover characterized by entry/exit is significant as is non-pricing marginal cost.

TABLE 5
DECOMPOSITION OF TOTAL FACTOR PRODUCTIVITY GROWTH FOR SELECTED PERIODS (IN %)

Period	TFP	Contribution of		
		Economies of Scale	Technological Change	Residual
1985-1989	2.68	1.21	2.35	-0.88
1989-1992	0.89	1.03	2.09	-2.23
1992-1994	1.67	1.09	1.55	-0.97

IV. CONCLUSION

This paper investigated the market structures of the Canadian financial intermediation industry and the conduct and performance of insurance companies financial intermediation activity. The structures of this industry show that, at the aggregate level, chartered banks account for more than 43% of the Canadian financial intermediation market, followed by trusteed pension funds (16%) and insurance companies (15%). In terms of the (average annual) growth rate of the market share over the period 1978-1994, the performance of chartered banks is by far lower than that of mutual funds (24%) and trusteed pension plans (12.8%), and slightly lower than that of insurance companies financial intermediation activity (9.6%). The analysis of the evolution of certain savings instruments reveals some striking results. Except for the RRSPs whose market share within contactual savings has more than doubled between during the period 1978-1994 to reach 43% in 1994, the other major components of contractual savings such as life insurance and trusteed pension plans have seen their market shares declinining roughly by 10 percentage points.

Within the dynamic market of RRSPs, chartered banks and mutual funds have accounted in the recent years for more than 55 percent of the market, followed by life insurance companies' financial intermediation activity (including segregated funds) with 20 percent. While government tax policies have had significant negative effects on the demand for life insurance, it has also encouraged savings through tax sheltered RRSPs and increased the demand for annuities by individuals who initially register their RRSPs with a life insurance company or any other financial institution.

Insurance companies' financial intermediation activity have not only been able to maintain their share within the market of financial intermediation, they also experienced a remarkable 1.17 average annual growth rate of MFP during the period 1985-1994. During the period 1985-1992 for which Statistics Canada's MFP estimates of non-financial industries are available, the insurance companies financial intermediation activity displayed an average annual growth rate of 1.37 percent, compared to -.39 percent for goods-producing industries and -.48 percent for non-financial services industries. Even more remarkably, it is the financial intermediation activity that experienced the greatest productivity growth during the period of economic growth but also the lowest productivity slowdown during the recession. Such a result is consistent with the business cycle's stylized facts, which show that service industries experienced much milder fluctuations during business-cycle downturns over the last 40 years, whereas goods-producing industries have systematically experienced more extreme declines in growth during recessions than have services industries.

□ Appendix

Consider the following translog production function of the insurers' financial intermediation activity (see Ouellette and Lasserre (1985) for more details on the productivity framework)

$$\begin{aligned} \ell nQ = {} & \ell nA + \alpha_K \ell nK + \alpha_L \ell nL + \alpha_M \ell nM + \alpha_R \ell nR \\ & + \tfrac{1}{2}\beta_{KK}(\ell nK)^2 + \tfrac{1}{2}\beta_{LL}(\ell nL)^2 + \tfrac{1}{2}\beta_{MM}(\ell nM)^2 \\ & + \tfrac{1}{2}\beta_{RR}(\ell nR)^2 + \delta_{KL}(\ell nK \cdot \ell nL) + \delta_{KM}(\ell nK \cdot \ell nM) \\ & + \delta_{KR}(\ell nK \cdot \ell nR) + \delta_{LM}(\ell nL \cdot \ell nM) + \delta_{LR}(\ell nL \cdot \ell nR) \\ & + \delta_{MR}(\ell nM \cdot \ell nR), \end{aligned} \tag{A1}$$

where

Q = output of financial intermediation activity,

A = state of technology,

K = stock of capital,

L = labour,

M = intermediate inputs,

R = reserves,

α, β and δ = vectors of unknown parameters.

A natural way of measuring multifactor productivity is to take the change of Q in percentage with respect to time as follows

$$\frac{d\ell nQ}{dt} = \frac{\partial \ell nA}{\partial t} + \frac{\partial \ell nQ}{\partial \ell nK} \cdot \frac{\partial \ell nK}{\partial t} + \frac{\partial \ell nQ}{\partial \ell nL} \frac{\partial \ell nL}{\partial t} + \frac{\partial \ell nQ}{\partial \ell nM} \frac{\partial \ell nM}{\partial t} + \frac{\partial \ell nQ}{\partial \ell nR} \frac{\partial \ell nR}{\partial t}. \quad \text{(A2)}$$

According to (A2), the growth in output is the sum of the neutral multifactor productivity term $\left(\frac{\partial \ell nA}{\partial t}\right)$, plus the growth rate of capital $\left(\frac{\partial \ell nK}{\partial t}\right)$ times the output elasticity of capital $\left(\frac{\partial \ell nQ}{\partial \ell nK}\right)$, plus the growth rate of labour $\left(\frac{\partial \ell nL}{\partial t}\right)$ times the output elasticity of labour $\left(\frac{\partial \ell nQ}{\partial \ell nL}\right)$, plus the growth rate of intermediate inputs $\left(\frac{\partial \ell nM}{\partial t}\right)$ times the output elasticity of intermediate inputs $\left(\frac{\partial \ell nQ}{\partial \ell nM}\right)$, plus the growth rate of reserves $\left(\frac{\partial \ell nR}{\partial t}\right)$ times the output elasticity of reserves $\left(\frac{\partial \ell nQ}{\partial \ell nR}\right)$. For the translog function, these output elasticities are

$$\frac{\partial \ell nQ}{\partial \ell nK} = \alpha_K + \beta_{KK} \ell nK + \delta_{KL} \ell nL + \delta_{KM} \ell nM + \delta_{KR} \ell nR, \quad \text{(A2.1)}$$

$$\frac{\partial \ell nQ}{\partial \ell nL} = \alpha_L + \beta_{LL} \ell nL + \delta_{LK} \ell nK + \delta_{LM} \ell nM + \delta_{LR} \ell nR, \quad \text{(A2.2)}$$

$$\frac{\partial \ell nQ}{\partial \ell nM} = \alpha_M + \beta_{MM} \ell nM + \delta_{MK} \ell nK + \delta_{ML} \ell nL + \delta_{MR} \ell nR, \quad \text{(A2.3)}$$

$$\frac{\partial \ell nQ}{\partial \ell nR} = \alpha_R + \beta_{RR} \ell nR + \delta_{RK} \ell nK + \delta_{RL} \ell nL + \delta_{RM} \ell nM. \quad \text{(A2.4)}$$

Under conditions of constant returns to scale

$$\alpha_K + \alpha_L + \alpha_M + \alpha_R = 1, \quad \text{(A3)}$$

$$\beta_{KK} + \delta_{KL} + \delta_{KM} + \delta_{KR} = \beta_{LL} + \delta_{LK} + \delta_{LM} + \delta_{LR} = \beta_{MM} + \delta_{MK} + \delta_{MR} + \delta_{MR} = \beta_{RR} + \delta_{RK} + \delta_{RL} + \delta_{RM} = 0, \quad \text{(A4)}$$

and competitive markets, we can rewrite (2.1)-(2.4) as

$$\frac{\partial \ell nQ}{\partial \ell nK} = \frac{\partial Q}{\partial K} \cdot \frac{K}{Q} = \frac{w_K K}{pQ} = \omega_K, \quad \text{(A5.1)}$$

$$\frac{\partial \ell nQ}{\partial \ell nL} = \frac{\partial Q}{\partial L} \cdot \frac{L}{Q} = \frac{w_L L}{pQ} = \omega_L, \tag{A5.2}$$

$$\frac{\partial \ell nQ}{\partial \ell nM} = \frac{\partial Q}{\partial M} \cdot \frac{M}{Q} = \frac{w_M M}{pQ} = \omega_M, \tag{A5.3}$$

$$\frac{\partial \ell nQ}{\partial \ell nR} = \frac{\partial Q}{\partial R} \cdot \frac{R}{Q} = \frac{w_K R}{pQ} = \omega_R, \tag{A5.4}$$

where $w_i (i = K, L, M, R)$ represents the rental price of the input i. Equations (A5.1)-(A5.4) indicate that the output elasticities are simply equal to the input cost shares $\omega_i (i = K, L, M, R)$. Note, however, that these cost shares are not constant under a translog specification; as seen in (A2.1)-(A2.4), the cost shares (output elasticities) can vary with the level of the inputs. If we substitute cost shares from (A5.1)-(A5.4) into (A2), we have

$$\frac{d\ell nQ}{dt} = \frac{\partial \ell nA}{\partial t} + \omega_K \cdot \frac{\partial \ell nK}{\partial t} + \omega_L \frac{\partial \ell nL}{\partial t} + \omega_M \frac{\partial \ell nM}{\partial t} + \omega_R \frac{\partial \ell nR}{\partial t}. \tag{A6}$$

which in discrete time can be written as

$$\dot{Q} = \dot{A} + s_K \dot{K} + s_L \dot{L} + s_M \dot{M} + s_R \dot{R}, \tag{A7}$$

where the symbol "·" over the variable indicates the annual rate of change (in percentage) and the variable $s_i (i = K, L, M, R)$ represents the arithmetic average of cost shares $\omega_{i,t}$ and $\omega_{i,t-1}$. The associated measure of MFP, $\dot{A}$, is simply obtained by rearranging (A7)

$$\dot{A} = \dot{Q} - s_K \dot{K} - s_L \dot{L} - s_M \dot{M} - s_R \dot{R}, \tag{A8}$$

and it reads as: the total factor productivity is the annual growth rate of output not explained by the weighted sum of the annual growth rate of the different inputs.

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Notes

1 An important strand of the economic literature has dealt with the effect of the intermediary on the welfare of all parties involved in the trading process. See for example Rubinstein and Wolinsky (1987) and Townsend (1978).

2 During the period 1979-1992, the average annual growth rates of multifactor productivity for finance, insurance and real estate industries were -.77 for the US, .30 for Autralia, -1.97 for Canada, -2.57 for Japan, .22 for France, -0.09 for Germany, -0.09 for Italy and -2.62 for UK. See Gordon (1996).

3 A production function is a representation of the technology of a production unit (company, plant, etc.). It characterizes the best and feasible combination of capital (K), labour (L) and intermediate inputs (M) in order to produce a certain level of output (Q). Formally it is written as $Q = AF(K, L, M)$, where A is an index of the state of technology, that is, anything that can affect the output and that is not accounted for by the inputs.

4 Accounting liabilities as part of the input set is not an entirely new approach as it has a long standing tradition in the specification of banking technology. For example, Sealey and Lindley (1977) and Sealey (1980) consider deposits as inputs in the production of earning asset output.

5 The production function of insurers financial intermediation activity is defined as $Q = Af(K, L, M, R)$, where R represents the reserves; the other variables are defined in foonote 4.

6 See the appendix for the derivation of equation (1).

7 The constant returns of scale assumption imply that $s_K + s_L + s_M + s_R = 1$

8 Rewrite $\dot{Q}$ as $(s_K + s_L + s_E + s_M)\dot{Q}$ (recall that $s_K + s_L + s_E + s_M = 1$) and collect terms in equation (1).

9 To provide an interpretation of elements affecting labour productivity, we substract $\dot{L}$ from the left-hand side and $(s_K + s_L + s_E + s_M)\dot{L}$ from the right-hand side of (2), and then we collect terms.

10 Statistics Canada (1995a); Table 11, p. 40, Series D14481.

11 Statistics Canada (1995b); Table 1, p. 6 ('Estimates of Employment, for All Employees, by Industry, Canada, Provinces and Territories'), Industries 731-733, Canada; Statistics Canada (1995c); p. 185 ('Total All Components of End-Year Net Stock (Geometric Depreciation)').

12 Statistics Canada; Cansim, Matrix Series # 7463 (Automotive insurance premiums, Tenants' insurance premiums, and Homeowners' insurance premiums).

13 The net premiums earned, the annuity considerations and the number of policies of Canadian (domestic business) and Foreign life insurance companies are obtained from OSFI insurance data.

14 Statistics Canada (1995a); Table 12, p.42, series P800000.

15 Statistics Canada (1996).