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ARE CANADIAN-CONTROLLED MANUFACTURING FIRMS LESS PRODUCTIVE THAN THEIR FOREIGN-CONTROLLED COUNTERPARTS?

Working Paper Number 31
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ABSTRACT

The purpose of this paper is to analyse the multi-factor productivity (MFP) gap between Canadian- and foreign-controlled manufacturing firms. The evidence from micro (firm-level) data suggests that Canadian-controlled firms, on average, were 25 percent less productive than their foreign-controlled counterparts over the 1985-88 period. The MFP gap, however, narrowed to about 16 percent during the 1989-95 period. Labour quality, unionization, firm size, and industry dummies are significant determinants of inter-firm variations in productivity levels. However, they did not contribute to the MFP gap between Canadian- and foreign-controlled firms. In addition, contrary to popular perceptions, Canadian-controlled firms are not concentrated in low-productivity industries.

I. INTRODUCTION

The dramatic reduction in transportation and communication costs and the intense international competition for markets, capital, and technology have considerably increased the globalization of business. The Canadian business community has taken an active part in this process: Canada's trade and investment orientation is more than twice the average of the other G-7 countries, and the gap has widened over the past 10 years. Today, exports account for more than 40 percent of Canada's gross domestic product (GDP), and imports play an equally significant role in the Canadian economy. Likewise, the shares of inward and outward foreign direct investment stocks in GDP have increased significantly in the past decade.

Recent research suggests that foreign direct investment, trade, and technology/knowledge flows complement each other (Gera, Gu, and Lee, 1999; McFetridge, 1998; Rao and Ahmad, 1996; Rao, Legault, and Ahmad, 1994). For example, intra-firm trade accounts for close to half of all trade flows between Canada and the United States. One in 10 jobs in Canada depends directly on inward foreign direct investment. Foreign-controlled companies contribute about half of all Canada's manufacturing output, and their share has been increasing over the past 10 years.

Despite this growing trade and investment orientation, Canada's productivity and real income performance has been lagging behind that of other members of the Organisation for Economic Co-operation and Development (OECD). More worryingly, the Canada-U.S. manufacturing labour productivity gap has widened considerably since 1985, and Canada's productivity level is below that of the United States in most manufacturing industries (at the two-digit level). This widening of the productivity gap is surprising and seems to be inconsistent with the rising trade and investment orientation: theoretical and empirical research to date strongly suggests that an increase in foreign direct investment (both inward and outward) leads to trade expansion, increases technology and knowledge exchange, and improves productivity in both host and home countries (McFetridge, 1998; Globerman, Ries, and Vertinsky, 1994; Corvari and Wisner, 1993).

As expected, Canada's weak productivity record in the 1990s has attracted considerable attention among policy makers, the media, and academics. Some observers have actually blamed freer trade and the growing trade and investment orientation of the Canadian economy for the widening of the Canada-U.S. manufacturing labour productivity gap. The main goal of this paper, therefore, is to explore the role of foreign-controlled firms with respect to Canada's poor manufacturing productivity record. Using firm-level data, the paper examines the multi-factor productivity (MFP) performance of foreign- and Canadian-controlled firms and tries to answer the following important research questions:

- Are foreign-controlled manufacturing firms more (or less) productive than Canadian-controlled ones?
- Did the productivity gap widen (or narrow) during the 1990s?
- What factors explain (or do not explain) the difference in productivity performance?

The paper is complementary to work by Globerman, Ries, and Vertinsky (1994, hereafter referred to as GRV), and Corvari and Wisner (1993, hereafter CW). GRV compare the economic performance of Canadian- and foreign-controlled establishments, using Statistics Canada's Censuses of Manufacturing, Mines and Logging for 1986. They show that foreign affiliates had significantly higher value-added per worker but that this difference vanished once factors such as size and capital intensity were taken into account.[1] Using industry-level data, CW also arrived at the conclusion that foreign-controlled establishments had a higher value-added labour productivity level than domestic-controlled

establishments. They used labour intensity, labour quality, energy intensity, and R&D intensity, among others, in their attempts to explain the gap, but found that only energy intensity played a role in that regard.[2]

To some extent, our paper is also complementary to a more recent study by Baldwin and Dhaliwal (1998, hereafter BD). These authors examine labour productivity differences between domestic and foreign-controlled firms in the Canadian manufacturing sector, using the micro-economic establishments data collected in the Canadian Census of Manufacturers for the period 1973-93. Their analysis shows that Canadian-controlled manufacturing firms in different size and growth groups lagged behind their foreign-controlled counterparts in labour productivity growth.

Our study differs from BD, GRV, and CW on several aspects. First, we focus on multi-factor productivity measures rather than on partial productivity measures such as labour productivity. Second, we examine the impact of labour quality, firm vintage, export orientation, unionization, firm size, and industrial structure on inter-firm variations in productivity levels, and the productivity level gap between Canadian- and foreign-controlled firms.[3] Third, we use micro, firm-level data covering a period of 11 years.[4] The panel data on companies enable us to better capture firm-specific characteristics than do industry-level data, and to monitor productivity movements over time. In addition, our data are more up-to-date than those used by the other analysts.

Our research shows that, on average, Canadian-controlled manufacturing firms were 25 percent less productive than foreign-controlled firms during the 1985-88 period. The gap in MFP levels, however, narrowed to 16 percent over the 1989-95 period. Differences in labour quality, firm vintage, unionisation, export orientation, firm size, and industrial structure were not responsible for the superior productivity performance of foreign-controlled firms. Rather, differences in technological know-how and managerial strategies may have accounted for the productivity gap. These results imply that foreign ownership is not responsible for the widening of the Canada-U.S. productivity gap in manufacturing. On the contrary, our results suggest that without the greater foreign direct investment orientation, the gap would have been wider.

The remainder of the paper is organized as follows. In section 2, we identify five key determinants of productivity efficiency. In section 3, we outline an empirical framework for productivity level comparisons. Section 4 describes the characteristics of the manufacturing firms in our sample and discusses the regression results on the determinants of productivity performance of foreign- and Canadian-controlled firms. The role of industrial structure in the productivity gap is examined in section 5. In our final section, we summarize the main findings of our research and discuss their possible implications.

II. DETERMINANTS OF PRODUCTIVITY DIFFERENCES

Many studies attempt to explain productivity differences via observed differences among countries with respect to the factors that drive productivity. For example, Englander and Gurney (1994) use aggregate cross-country data to investigate the determinants of productivity growth. They find that inter-country differences in education and R&D contribute to the differences in productivity growth among countries. Pilat (1996) shows that the degree of competition and the growth of R&D stocks are positively related to productivity growth. Van Ark and Pilat (1993) explain differences in labour productivity levels of manufacturing industries between Germany, Japan, and the United States in terms of differences in capital intensity, labour quality, and industrial structure. Globerman, Ries and Vertinsky (1994) show that the labour productivity level advantage of foreign-controlled firms is entirely the result of differences in average firm size and capital intensity. Corvari and Wisner (1993) use labour intensity and quality, as well as energy and R&D intensity, among other factors, in their efforts to explain the labour productivity gap between Canadian-controlled firms and their foreign-controlled counterparts. Among these variables, they find that only energy intensity played a significant role. Consequently, much of the gap was not explained by differences in those variables.

In summary, past empirical studies suggest that differences in labour quality, R&D, the degree of competition, firm size, industrial structure, investment, technological know-how, and the effectiveness of managerial practices play an important role in explaining labour productivity differences.

We have identified five factors to explain inter-firm differences in MFP levels in the two groups of manufacturing firms – namely, labour quality, firm vintage, unionization, export orientation, and firm size.[5] Labour quality will be positively associated with productivity since skilled workers are more efficient than unskilled workers in operating machines and raising productivity. In this paper, we use the proportion of white-collar workers in total employment as a proxy for labour quality, because in general workers in these occupational groups have much higher skills than those in blue-collar occupational groups.

A priori, the effect of firm vintage (age) on productivity is ambiguous. Older firms tend to have more experience due to "learning-by-doing," as well as more established and efficient supply and distribution systems, factors that have a positive influence on productivity. On the other hand, old firms tend to be less flexible in their operations and are equipped with older capital stock,[6] which can have a negative impact on overall efficiency.

Trade unions clearly affect the distribution of profits, but their impact on productivity is not clear (Kuhn, 1998). They affect productivity through their influence on the production process. On the one hand, unions improve productivity by reducing labour turnover and by monitoring and putting pressure on management to continuously refine the firm's operations. On the other hand, unionization can have a negative influence on productivity as a result of strikes and lockouts. The empirical results on this issue are also mixed: Brown and Medoff (1978) and Clark (1980) found that unions have a positive influence on productivity, whereas Machin (1991) and Hoxby (1996) found the opposite.

All other things being equal, the export orientation variable should have a positive impact on MFP thanks to its influence on competition, innovation, and scale economies. Baily and Gersbach (1995) state that "the greater the exposure of an industry to best-practice methods, the closer it is to best-practice productivity." Pilat (1996), Nickell (1996), and Rao and Ahmad (1996) also show that productivity is

positively related to outward orientation because of the increased exposure to global competition and best-practice methods.

Firm size is introduced to capture differences in technology and innovative capacity across firms of different sizes.[7] Firm size can exert two opposing influences on productivity. Larger firms tend to have access to a larger pool of technology and to benefit more from scale economies. On the other hand, they tend to be less flexible in their operations, which could have a negative impact on productivity. Overall, however, the positive influences are expected to outweigh the negative ones. To capture the size effects, we divide the sample firms into three size classes: small firms, with fewer than 100 employees; medium-size firms, with between 100 and 499 employees; and large firms, with 500 employees or more.

III. EMPIRICAL FRAMEWORK

We assume that each firm's production activity is characterized by the following Cobb-Douglas production function[8]:

$$(1) \qquad Y = A(Z)K^{\alpha_K} L^{\alpha_L} M^{\alpha_M},$$

where Y is gross output, K is capital input, L is labour input, and M represents intermediate inputs. α_K, α_L, and α_M are the elasticities of output with respect to K, L, and M, and A is the efficiency parameter. As discussed in the previous section, we assume that production efficiency is a function of Z variables: labour quality, firm vintage, unionization, export orientation, and firm size.

The log-linear form of equation (1) is as follows:

$$\begin{aligned} \ln(Y) \; &= \alpha_0 + \alpha_{P_2} P_2 + \alpha_{P_3} P_3 + \alpha_D D + \alpha_{D_2} D \cdot P_2 + \alpha_{D_3} D \cdot P_3 + \sum_i \alpha_{I_i} I_i \\ (2) \qquad &+ \alpha_Q \ln Q + \alpha_V \ln V + \alpha_U \ln U + \alpha_E E + \alpha_{S_2} S_2 + \alpha_{S_3} S_3 \\ &+ \alpha_L \ln L + \alpha_K \ln K + \alpha_M \ln M, \end{aligned}$$

where I_i is a dummy for industry i aimed at capturing industry-specific impacts on productivity;

P_2 and P_3 are dummies for the periods 1989-92 and 1993-95 respectively (1985-88 is the control group);[9]

D is an ownership dummy, equal to one for Canadian-controlled firms and zero otherwise;

Q denotes labour quality, proxied by the share of white-collar employees in total employment;

V denotes firm vintage (age);

U denotes unionization, equal to one for unionized firms and zero otherwise;

E is the export orientation dummy, equal to one if the firm exports and zero otherwise;

S_2 and S_3 are firm-size dummies for medium-sized and large firms, respectively (small firms are the control group).

Using production function (2), we could compute the MFP level for each firm. However, we are interested in comparing the average productivity level of Canadian-controlled firms with that of foreign-controlled firms. Average MFP levels for the two groups can be calculated by assigning an equal weight to all firms. This scheme, unfortunately, tends to overestimate the contribution of small and medium-sized firms and to underestimate the contribution of large firms to the group's aggregate productivity level. We can overcome this problem by assigning different weights to firms of different sizes, using gross output shares as weights. For example, we define the firm average of variable X (in logarithm) for group i in sub-period t as $\overline{\ln X}_t^i = \sum_{j=1}^{N_t^i} w_{jt}^i \ln(X_{jt}^i)$. N_t^i denotes the number of observations in group i in sub-period t, and w_{jt}^i denotes the gross-output share of observation j in group i in sub-period t. Note that $\sum_{j=1}^{N_t^i} w_{jt}^i = 1$ for each group in each sub-period, so that $\overline{\ln X}_t^i$ is the weighted sum of logarithmic values of variable X for group i in sub-period t.

We first estimate the aggregate productivity gap between Canadian- and foreign-controlled firms in the manufacturing sector. We define the logarithmic MFP gap (without accounting for the differences in the *Z* variables) between the two sets of firms in sub-period *t* as the difference in their aggregate MFP levels:

$$(3)\quad \ln MFPG_t = \overline{\ln MFP_t}^{C} - \overline{\ln MFP_t}^{F},$$

where $\overline{\ln MFP_t}^{C}$ and $\overline{\ln MFP_t}^{F}$ are the weighted sums of the logs of the MFP levels of Canadian- and foreign-controlled manufacturing firms. The logarithmic MFP level of firm *j* controlled by group *i* in sub-period *t*, $\ln MFP_{jt}^{i}$, is defined as

$$(4)\quad \ln MFP_{jt}^{i} = \ln(Y)_{jt}^{i} - \hat{\alpha}_L \ln(L)_{jt}^{i} - \hat{\alpha}_K \ln(K)_{jt}^{i} - \hat{\alpha}_M \ln(M)_{jt}^{i}.$$

The MFP gap is the residual and could not be explained by capital, labour, and intermediate inputs. In order to examine what factors contributed to the MFP gap, we arrange equation (3) by using equations (2) and (4) and alternatively present equation (3) as

$$(5)\quad \ln MFPG_t = \hat{\alpha}_{Dt} + \sum_i \hat{\alpha}_{Z_i} \Delta\overline{\ln Z}_{it},$$

where $\hat{\alpha}_{Dt} = \Delta\overline{\ln(Y)}_t - \sum_i \hat{\alpha}_{Z_i} \Delta\overline{\ln Z}_{it} - \hat{\alpha}_L \Delta\overline{\ln(L)}_t - \hat{\alpha}_K \Delta\overline{\ln(K)}_t - \hat{\alpha}_M \Delta\overline{\ln(M)}_t$ and $\Delta\overline{\ln X}_t = \overline{\ln X}_t^{C} - \overline{\ln X}_t^{F}$ for any variable *X*.

The MFP gap consists of two terms. $\hat{\alpha}_{D_t}$ is the MFP gap after accounting for differences in the explanatory variables (*Z*) between the two sets of firms. The second term represents the contribution of the differences in *Z* variables to the MFP gap. The contribution of each explanatory variable Z_i is $\hat{\alpha}_{Z_i} \Delta\overline{\ln Z}_i$.

IV. EMPIRICAL ANALYSIS

In this section, we present the empirical results of our investigation. First, we describe briefly the micro-data set used for the analysis.

Data

The data on Canadian- and foreign-controlled firms were compiled from a number of sources. The primary sources were the Compustat and Compact-Disclosure/Canada databases, supplemented by data from Micromedia's "Profile Canada," Moody's International, Statistics Canada's Inter-Corporate Ownership, and the Canadian Trade Index of the Alliance of Manufacturers & Exporters Canada. All Canadian-based manufacturing firms for which financial data are available were selected.[10] A detailed description of data sources is contained in Appendix A. Most of the sampled firms are publicly traded companies, listed either on the Canadian or the American stock exchanges. A firm is labeled as Canadian-controlled if it is ultimately controlled by Canadians; otherwise it is considered as foreign-controlled.[11]

After eliminating outliers, our sample consisted of 1179 and 631 observations for Canadian- and foreign-controlled manufacturing firms, respectively, over the 1985-95 period.[12] These firms were classified into 19 manufacturing industries (corresponding to the two-digit level of Statistics Canada) on the basis of the Standard Industrial Classification (SCI) code given to each firm in the databases. The average firm size, measured in terms of output and employment, for the two groups of firms in the three sub-periods is displayed in Table 1, which shows that the average size of foreign-controlled firms, measured by output, is significantly greater than that of Canadian-controlled firms. The opposite is true when size is measured by employment. These results imply that, on average, labour productivity (gross output per employee) of Canadian-controlled firms is considerably below that of their foreign-controlled counterparts. Table 2 shows that our sample firms cover more than 50 percent of the manufacturing sector gross output.

Table 1
Number of Observations and Average Size of Firms
by Period and Firm Group

Period	Canadian-controlled			Foreign-controlled		
	Observations	Average size		Observations	Average size	
		Employees	Output*		Employees	Output*
1985-88	278	7,637	1,045	141	5,982	1,941
1989-92	486	5,259	808	353	2,250	687
1993-95	415	4,130	763	137	3,404	1,368
1985-95	1,179	5,422	848	631	3,335	1,115

*In millions of 1985 dollars.

Table 2
Coverage Ratios*

Year	Gross output of the sample as a % of the total gross output of the manufacturing sector
1985	53.8
1986	52.2
1987	50.0
1988	54.9
1989	53.1
1990	55.5
1991	53.0
1992	66.2
1993	60.8
1994	57.1
1995	52.7

*All nominal variables are deflated by the appropriate industry price deflators from Statistics Canada.

Results

The estimation results from equation (2) are reported in column (i) of Table 3.[13] Several interesting observations emerge. First, Canadian-controlled firms lag behind foreign-controlled firms in the unexplained MFP, and that lag is statistically significant, as shown by the coefficient on the ownership dummy. Second, all of the explanatory variables (with the exception of firm vintage and export orientation) have a significant impact on productivity. As expected, labour quality is statistically significant and has a positive influence on productivity. These findings are consistent with those of Corvari and Wisner (1993). The firm vintage variable has the expected positive sign but is statistically insignificant. The influence of unionization on productivity is negative and significant. The export orientation variable has the unexpected negative sign but is statistically insignificant. The estimation results also suggest that small firms are significantly less productive than large ones, a finding that is similar to those of Baldwin (1996) and Rao and Ahmad (1996). Third, industries such as electrical machinery and food and beverages are more productive than others, such as textiles and non-metallic mineral products – a fact that is reflected by the industry dummies (not reported).[14] Finally, the unexplained productivity (MFP) is significantly lower for all manufacturing firms in the recession period 1989-92 than in the periods that preceded and followed it (1985-88 and 1993-95).

To examine the sensitivity of scale parameters to the inclusion of the firm-size dummies, we estimated equation (2) without the dummies. The results are reported in column (iii). The regression results imply that the inclusion of firm-size dummies does not significantly affect the returns-to-scale parameter.

In column (iv), we report the regression results after the observations related to the transportation equipment industry are removed from the sample. The regression results are very similar to those of column (i) in all respects.[15] The exclusion of the transportation equipment sector from the sample does reduce somewhat the coefficient of the ownership dummy, but the coefficient remains negative, large, and statistically significant.

Table 3
Regression Results of Equation (2)[a]

Coefficients	(i)	(ii)	(iii)	(iv)
Constant	2.2827*	2.4112*	2.4064*	2.2599*
	(32.9)	(36.2)	(39.3)	(31.6)
Dummy: 1989-92	-0.1748*	-0.1875*	-0.1761*	-0.1585*
	(-5.7)	(-6.0)	(-5.7)	(-4.9)
Dummy: 1993-95	0.0217	0.0140	0.0201	0.0235
	(0.6)	(0.4)	(0.6)	(0.6)
Dummy: Canadian-controlled	-0.1331*	-0.1345*	-0.1335*	-0.1053*
	(-4.2)	(-4.2)	(-4.2)	(-3.2)
Dummy: Canadian-controlled and in 1989-92	0.0437	0.0463	0.0432	0.0287
	(1.2)	(1.2)	(1.1)	(0.7)
Dummy: Canadian-controlled and in 1993-95	-0.0060	-0.0037	0.0028	-0.0096
	(-0.1)	(-0.1)	(0.1)	(-0.2)
Labour quality	0.1677*	0.2029*	0.1652*	0.2086*
	(5.0)	(6.2)	(4.9)	(6.0)
Firm age	0.0060	0.0088	0.0052	0.0054
	(0.7)	(1.0)	(0.6)	(0.6)
Unionization	-0.0447*	-0.0503*	-0.0377*	-0.0447*
	(-2.6)	(-3.0)	(-2.2)	(-2.5)
Exporting	-0.0034	0.0346**	0.0014	-0.0001
	(-0.2)	(1.9)	(0.1)	(-0.0)
Medium size	0.1089*	0.1186*		0.1222*
	(3.7)	(4.0)		(4.1)
Large size	0.1405*	0.1562*		0.1706*
	(3.6)	(3.9)		(4.2)
Labour input	0.3810*	0.3932*	0.4032*	0.3786*
	(26.9)	(29.2)	(32.9)	(25.9)
Capital input	0.1170*	0.0976*	0.1172*	0.1161*
	(13.2)	(12.0)	(13.2)	(12.8)
Intermediate inputs	0.4903*	0.4962*	0.4854*	0.4832*
	(54.4)	(54.8)	(54.2)	(50.2)
Constant returns to scale	Not rejected	Not rejected	Not rejected	Rejected [b]
R^2 adjusted	0.98	0.98	0.98	0.98
Observations	1810	1810	1810	1672

[a] If applicable, the estimates of the coefficients associated with industry dummies are not reported. The t-ratio is in parenthesis.
[b] Decreasing returns to scale.
(i): Full specification of equation (2).
(ii): (i) without industry dummies.
(iii): (i) without firm-size dummies.
* Significant at the 5 percent level.
** Significant at the 10 percent level.

The parameter estimates of equation (2) in Table 3 are used to compute the MFP level gap between Canadian- and foreign-controlled firms. These results are reported in Table 4 as ratios of the productivity level of Canadian-controlled firms to that of foreign-controlled firms. A number less than one means that, on average, the productivity level of Canadian-controlled manufacturing firms is below that of foreign-controlled firms; if the ratio is greater than one, the relationship is reversed. Our estimates indicate that, on average, the MFP level of Canadian-controlled firms was 25 percent below that of foreign-controlled firms during the 1985-88 period, but this gap narrowed by 9 percentage points during the 1989-95 period.

Table 4
Productivity of Canadian-controlled Relative to Foreign-controlled Firms, Manufacturing Sector

Relative productivity level of Canadian-controlled firms[a] (Foreign-controlled firms = 1)			
Period	85-88	89-92	93-95
Multi-factor productivity	0.75	0.85	0.82
Adjusted for			
All of the following factors:	0.73	0.82	0.78
Labour quality	0.73	0.82	0.78
Vintage	0.75	0.86	0.82
Unionization	0.74	0.85	0.81
Exporting	0.75	0.85	0.82
Firm size	0.75	0.85	0.82
MFP gap between Canadian-controlled and foreign-controlled firms (in logarithm)			
MFP gap	-0.2896	-0.1587	-0.2012
Total contribution by all the following factors	0.0305	0.0416	0.0481
Labour quality	0.0281	0.0366	0.0457
Vintage	-0.0037	-0.0030	-0.0022
Unionization	0.0061	0.0075	0.0052
Exporting	0.0001	0.0001	0.0000
Firm size	-0.0002	0.0004	-0.0006
Unexplained MFP gap	-0.3201	-0.2003	-0.2493

[a] The relative productivity level of Canadian-controlled manufacturing firms is the exponential value of the logarithmic MFP gap between Canadian-controlled and foreign-controlled firms. The reported numbers are $\exp(\ln MFPG) = \overline{MFP}^{CAN} / \overline{MFP}^{FOR} = \overline{MFP}^{CAN}$, assuming that the MFP level of the foreign-controlled group is one.

To examine the sources of the productivity gap between the two sets of firms, we calculated the contribution of the difference between them with respect to each explanatory variable. These results are also presented in Table 4. Our calculations suggest that Canadian-controlled manufacturing firms, on average, have a slight advantage in labour quality vis-à-vis their foreign-controlled competitors. There are, however, no significant differences with respect to the other explanatory variables. Thus we conclude that the differences in the measured explanatory variables do not contribute significantly to the productivity gap between the two groups of firms.

V. CONTRIBUTION OF DIFFERENCES IN THE INDUSTRIAL STRUCTURE TO THE PRODUCTIVITY GAP

How much of the aggregate productivity gap between the two groups of firms is due to differences in their industrial structure? Are Canadian-controlled firms more concentrated in low-productivity industries than their foreign counterparts?

The industrial structure of the two groups of manufacturing firms – as determined by the distribution of gross output – is depicted in Table 5. It shows that a relatively high percentage of the activities of Canadian-controlled firms is in resource-based industries, such as lumber and wood, paper and allied products, and primary metals. In contrast, foreign-controlled firms specialize heavily in the transportation equipment industry, which accounts for more than 58 percent of the gross output of that group. In fact, all of the activity in the motor vehicle industry is controlled by foreign affiliates.

Table 5
Sample Gross-output Shares of Manufacturing Industries by Firm Group [a]

Industry	Industry gross output as a % of manufacturing gross output					
	Canadian-controlled			Foreign-controlled		
	85-88	89-92	93-95	85-88	89-92	93-95
Food and allied products	10.3	8.9	7.7	12.4	10.3	7.0
Textile mill products	1.5	1.4	1.6	0.0	0.1	0.2
Lumber and wood	7.4	5.5	7.1	1.6	1.9	2.4
Paper and allied products	17.2	16.2	11.8	4.3	3.3	5.2
Chemicals	7.1	5.3	6.1	3.0	5.3	3.3
Stone, clay, and glass	0.3	0.3	0.0	1.4	1.8	2.8
Primary metal	36.8	32.5	29.1	0.2	0.5	0.3
Electrical machinery	10.8	12.8	18.5	3.2	3.1	2.6
Transportation equipment	2.5	7.0	9.3	57.9	63.8	67.2
Other manufacturing	6.2	10.1	8.8	16.0	10.0	9.0

[a] Tobacco; furniture and fixtures; printing, publishing and allied; and leather industries are excluded because data were unavailable for at least one control group. Other industries not listed are included in other manufacturing.

The relative MFP (level) of Canadian-controlled firms in individual manufacturing industries is reported in Table 6. In general, Canadian-controlled firms tend to be more productive than foreign-controlled firms in lumber and wood; paper and allied products; and electrical machinery. However, the reverse is true in stone, clay, and glass; transportation equipment; and other manufacturing.[16] In the remainder of the industries, both sets of firms are more or less productive.

It is interesting to note that the activities of Canadian-controlled firms are concentrated more in industries where they have a higher level of productivity than that or foreign-controlled firms, or one that is comparable.

Table 6
MFP of Canadian-controlled Industries
Relative to Their Foreign-controlled Counterparts, Manufacturing Sector

Industry	85-88	89-92	93-95
Food and allied products	1.01	1.08	0.98
Textile mill products	0.91	0.84	1.01
Lumber and wood	1.02	1.14	1.17
Paper and allied	1.00	1.04	1.03
Chemicals	0.95	0.96	0.89
Stone, clay, and glass	0.74	0.88	0.78
Primary metal	0.97	0.88	0.90
Electrical machinery	1.17	1.14	1.08
Transportation equipment	0.58	0.70	0.65
Other Manufacturing	0.74	1.04	0.75
Total manufacturing	0.75	0.85	0.82

To compute the impact of the differences in industrial structure on the MFP gap between the two groups of firms, we used the following equation:

$$
\begin{aligned}
\ln MFPG &= \sum_{j=1}^{N^C} w_j^C \ln MFP_j^C - \sum_{j=1}^{N^F} w_j^F \ln MFP_j^F \\
&= \sum_{j=1}^{S} \left[\overline{\ln MFP}_j^C \sum_{k=1}^{M_j^C} w_k^C - \overline{\ln MFP}_j^F \sum_{k=1}^{M_j^F} w_k^F \right] \qquad (6) \\
&= \sum_{j=1}^{S} (v_j^C - v_j^F) \overline{\ln MFP}_j^C + \sum_{j=1}^{S} v_j^F \ln MFPG_j ,
\end{aligned}
$$

where N^i = the number of observations for control group *i*;

M_j^i = the number of observations for control group *i* in industry *j*;

S = the number of industries;

$\ln MFP_j^i$ = the logarithmic MFP level of firm *j* controlled by group *i*;

$\overline{\ln MFP}_j^i$ = the weighted sum of firm logarithmic MFP levels for control group *i* in industry *j*;

$\ln MFPG_j$ = the logarithmic MFP gap between the two control group in industry *j*,

$$\ln MFPG_j = \overline{\ln MFP}_j^C - \overline{\ln MFP}_j^F ;$$

w_j^i = the gross-output share of observation *j* controlled by group *i*, where $\sum_{j=1}^{N^C} w_j^C = 1$ and

$\sum_{j=1}^{N^F} w_j^F = 1$; and

v_j^i = the gross-output share of industry *j* in the industry controlled by group *i*, where

$\sum_{k=1}^{M_j^C} w_k^C = v_j^C$, $\sum_{k=1}^{M_j^F} w_k^F = v_j^F$, and $\sum_{j=1}^{S} v_j^C = \sum_{j=1}^{S} v_j^F = 1$.

Thus, the MFP gap between the two sets of firms in any sub-period *t* (i.e. ignoring the subscript *t*) can be decomposed into two components – the contribution of the differences in industrial structure, and a residual that cannot be explained by the industrial structure. If there is no MFP gap at the industry level, then the total MFP gap between Canadian- and foreign-controlled firms is solely due to structural differences between the two groups. The opposite is true if the industrial structure is identical in the two groups. As we discussed earlier, however, the industrial structure of Canadian-controlled firms in the manufacturing sector differs considerably from that of foreign-controlled firms. A positive number for the first term of equation (6) would mean that the industrial structure of Canadian-controlled firms is more conducive to productivity than that of their foreign-controlled counterparts and vice versa.

The results for the impact of the industrial structure on the MFP gap are presented in Table 7. The contribution of the industrial structure to the productivity gap is positive, implying that Canadian-controlled enterprises are, on average, more concentrated in high-productivity industries. Consequently, the MFP gap is entirely due to the relatively poor productivity performance of Canadian-controlled manufacturing firms. Therefore, our results contradict the popular perception that Canadian-controlled firms are concentrated in low-productivity industries.

Table 7
Impact of the Industrial Structure of Canadian-controlled Manufacturing Firms on Their MFP Performance

Productivity	**85-88**	**89-92**	**93-95**
MFP	0.75	0.85	0.82
MFP adjusted for industrial structure	0.70	0.81	0.73
Impact of industrial structure on MFP	+	+	+

VI. CONCLUSION

The main purpose of this paper was to analyse the productivity performance of Canadian- and foreign-controlled manufacturing firms in Canada. Our estimates indicate that, on average, the multi-factor productivity level of Canadian-controlled firms was about 19 percent below that of foreign-controlled firms during the 1985-95 period. Testing for differences in firm vintage, labour quality, unionization, export orientation, and firm size revealed that these factors did not contribute to the productivity gap. The same applies to differences in industrial structure. In fact, the structure of Canadian-controlled firms places them in a relatively favourable position from a productivity performance point of view.

What factors, then, could account for the large productivity gap observed between the two groups? Several other studies suggest that managerial practices and strategies, and technological know-how might come into play. Martin (1999) shows that, in terms of company operations and strategy, Canada ranks sixth among the G-7 countries, just ahead of Italy. According to the Global Competitiveness Report (1998), Canada is also significantly falling behind its major competitor, the United States, in both technology and management. In addition, "[Canadian firms] are not as good as U.S. firms at developing and marketing new products" (Trefler, 1999). These results, in turn, suggest that the superior management practices and strategies, and technological know-how of foreign-controlled firms may have been largely responsible for the productivity gap between the two sets of firms.

In short, our research findings strongly suggest that a greater orientation towards foreign investment was not responsible for the poor productivity performance of the Canadian manufacturing sector in the 1990s. On the contrary, the Canada-U.S. productivity gap would have been larger, had that orientation not increased. A policy implication of our results is that Canada needs to rethink foreign ownership restrictions in several sectors where such restrictions are currently applied.

NOTES

1 GRV use the cost of fuel and electricity per production employee as a proxy for capital intensity.

2 GRV use the following definitions:
labour intensity = (wages and salaries)/(manufacturing value-added minus wages and salaries);
energy intensity = (cost of heat and power)/(wages and salaries) or (cost of heat and power)/(cost of production materials);
labour quality = (salaried workers/total employment) or (non-production workers)/(total employment);
R&D intensity = (R&D expenditures in industry)/(total shipments in industry).

3 Note, however, that many of these variables are not included in the above mentioned studies.

4 GRV only use micro data in 1986. BD and CW base their analysis on industry-level data.

5 R&D is excluded here because it is biased against foreign affiliates as a result of the "headquarters" effect.

6 New technology is often embodied in new capital, and new capital is more productive than old capital; this is generally referred to as the "vintage effect" (see Wolff, 1996).

7 The introduction of firm-size dummies has no effect on the returns-to-scale parameter. As a matter fact, our estimation results indicate that the firms' production is characterized by constant returns to scale.

8 A Cobb-Douglas production function is used because it enables us to clearly define MFP as the ratio of output to a weighted sum of capital, labour, and intermediate inputs. Because of its simplicity, this functional form has been commonly used in productivity analysis; see, for example, Bernard and Jones (1996), Ehrlich *et al* (1994), Griliches (1986), and Wolff (1991). Moreover, an MFP gap derived from a translog production function also takes a Cobb-Douglas form, as in equation (2); see Jorgenson (1995).

9 We divide our sample period into three sub-periods (1985-88, 1989-92, and 1993-95) to capture productivity changes over time. Note that Canada was in recession during 1989-92.

10 All financial data are in Canadian dollars.

11 A firm is ultimately foreign-controlled if a majority of its voting rights are either held by foreign citizens or are held by one or more Canadian companies that are themselves foreign-controlled. Foreign ownership here is measured in discrete terms: Canadian-controlled or foreign-controlled. The data do not allow us to measure this variable in a more continuous fashion.

12 Three caveats are associated with the data. First, the average number of observations per firm in our sample is three. This may raise some difficulty in attempting to correct for potential autocorrelation. However, given that the sample is very unbalanced, autocorrelation is unlikely to be a big issue. Second, cross-ownership among some firms in our database causes them to be counted twice. However, this overlap problem is expected to have a minimal effect on our results since these firms represent a small share of our data sample. Another issue emerges from the fact

that some firms entered the market by acquisition or merger, whereas others were entirely new. We have tried to eliminate this problem by tracing a company's merger or acquisition record and using the earliest year of incorporation of firms involved in mergers or acquisitions. Although this process is by no means exhaustive, we expect the problem caused by acquisitions and mergers to be minor.

13 The reported results assume homoskedasticity. Different specifications of heteroskedasticity were considered, but the results they generated were not significantly different and have not been reported here.

14 To check the sensitivity of parameter estimates, we estimated equation (2) without industry dummies and reported those results in column (ii). They indicate that the influence of the labour-quality and export-orientation variables is correlated with industry-specific impacts. The influence of labour quality is much stronger than before, implying that certain industries tend to have more employees with above-average education and skills. The coefficient of the export-orientation variable has the expected positive sign and is significant at the 10 percent confidence level, in sharp contrast to the estimation results obtained with industry dummies. It is interesting to note also that the exclusion of industry dummies does not significantly change the magnitude of the coefficient on the ownership dummy. The first implication of that observation is that industry structure is not responsible for the productivity difference between Canadian-controlled firms and their foreign-controlled counterparts.

15 The largest productivity gap is observed in the transportation equipment industry, as indicated below (section 5). The regression is designed to determine if any other industries contribute to the productivity gap between Canadian- and foreign-controlled firms in the manufacturing sector.

16 On the surface, it is surprising that Canadian-controlled firms lag so far behind their foreign-controlled counterparts in the transportation equipment industry, given the close integration of the North American motor vehicles and parts sector. Two reasons explain this phenomenon. First, foreign-controlled firms dominate the industry, especially its motor vehicles component. Second, the production of the industry is very heterogeneous, with foreign-controlled firms specializing in motor vehicles, while Canadian-controlled firms are concentrating in other transportation equipment (such as aircraft).

BIBLIOGRAPHY

Baily, Martin Neil and Hans Gersbach. "Efficiency in Manufacturing and the Need for Global Competition." *Brookings Papers: Microeconomics,* 4 (1995):307-58.

Baldwin, John and Naginder Dhaliwal. "Labour Productivity Differences Between Domestic and Foreign-controlled Firms In the Canadian Manufacturing Sector." Ottawa: Statistics Canada, and Agriculture and Agri-Food Canada, 1998 (mimeo).

Baldwin, John. "Were Small Producers the Engines of Growth in the Canadian Manufacturing Sector in the 1980's?" Research Paper No. 88. Ottawa: Statistics Canada, 1996.

Bernard, Andrew B. and Charles I. Jones. "Comparing Apples to Oranges: Productivity Convergence and Measurement across Industries and Countries." *American Economic Review,* 86 (1996):1216-38.

Brown, C. and J.L. Medoff. "Trade Unions in the Production Process." *Journal of Political Economy,* 86 (1978):355-78.

Clark, Kim B. "Unionization and Productivity: Micro-Econometric Evidence." *Quarterly Journal of Economics,* 95 (1980):613-39.

Corvari, Ronald and Robert Wisner. "Foreign Multinationals and Canada's International Competitiveness." Working Paper No. 16. Ottawa: Investment Canada, 1993.

Ehrlich, Isaac, Georges Gallais-Hamonno, Zhiqiang Liu and Randall Lutter. "Productivity Growth and Firm Ownership: An Analytical and Empirical Investigation." *Journal of Political Economy*, 102 (1994):1006-38.

Englander, A. Steven and Andrew Gurney. "Medium-term Determinants of OECD Productivity." *OECD Economic Studies,* 22 (1994):49-109.

Gera, Surendra, Wulong Gu and Frank C. Lee. "The Effect of Foreign Direct Investment on Productivity Growth in Canada." Ottawa: Industry Canada, 1999.

Globerman, Steven, John C. Ries and Ilan Vertinsky. "The Economic Performance of Foreign Affiliates in Canada." *Canadian Journal of Economics,* 27 (1994):141-56.

Griliches, Zvi. "Productivity, R&D, and Basic Research at the Firm Level in the 1970s." *American Economic Review,* 76 (1986):141-54.

Hoxby, Caroline Minter. "How Teachers' Unions Affect Education Production." *Quarterly Journal of Economics,* 111 (1996):671-718.

Jorgenson, Dale W. *Productivity: Volume 2 – International Comparisons of Economic Growth*. Cambridge, Mass.: MIT Press, 1995.

Kuhn, Peter. "Unions and the Economy: What We Know; What We Should Know." *Canadian Journal of Economics,* 31 (1998):5.

Machin, Stephen J. “The Productivity Effects of Unionization and Firm Size in British Engineering Firms.” *Economica,* 58 (1991):479-90.

Martin, Roger L. “Canadian Competitiveness: The Managerial Foundations of Productivity.” Toronto: University of Toronto, Rotman School of Management, 1999.

McFetridge, Donald G. “Intellectual Property, Technology Diffusion, and Growth in the Canadian Economy,” in *Competition Policy and Intellectual Property Rights in the Knowledge-Based Economy*. Edited by Robert D. Anderson and Nancy T. Gallini, Calgary: University of Calgary Press, 1998, pp. 65-103.

Nickell, Stephen J. “Competition and Corporate Performance.” *Journal of Political Economy,* 104 (1996):724-46.

Pilat, Dirk. “Competition, Productivity and Efficiency.” *OECD Economic Studies,* 27 (1996):107-46.

Rao, Someshwar and Ashfaq Ahmad. “Canadian Small and Medium-sized Enterprises: Opportunities and Challenges in the Asia Pacific Region,” in *The Asia Pacific Region in the Global Economy: A Canadian Perspective*. Edited by Richard G. Harris, Calgary: University of Calgary Press, 1996, pp. 395-455.

Rao, Someshwar, Marc Legault and Ashfaq Ahmad. “Canadian-based Multinationals: An Analysis of Activities and Performances,” in *Canadian-based Multinationals*. Edited by Steven Globerman, Calgary: University of Calgary Press, 1994, pp. 63-126.

Trefler, Daniel. “Does Canada Need a Productivity Budget?” *Policy Options,* July-August 1999.

Van Ark, Bart and Dirk Pilat. “Productivity Levels in Germany, Japan and the United States: Differences and Causes.” *Brookings Papers: Microeconomics,* 2 (1993):1-69.

Wolff, Edward N. “Capital Formation and Productivity Convergence over the Long Term.” *American Economic Review,* 81 (1991):565-79.

Wolff, Edward N. “The Productivity Slowdown: The Culprit at Last? Follow-up on Hulten and Wolff.” *American Economic Review,* 86 (1996):1239-52.

World Economic Forum . *The Global Competitiveness Report 1998*, Geneva, 1998).

APPENDIX A
DESCRIPTION OF DATA SOURCES

Table A1
List of Variables and Parameters

Variables	Description	Sources
S	Net sales ($ current)	Compustat/Compact Disclosure
I	Inventory change ($ current)	Compustat/Compact Disclosure
YN	Gross output ($ current)	$= S - I$
KN	Net PPE (property, plant and equipment, in $ current)	Compustat/Compact Disclosure
MN	Cost of goods sold, net of total labour compensation ($ current)	Compustat/Compact Disclosure
L	Total number of employees	Compustat/Compact Disclosure[1]
PY	Gross output deflator (19 industries)	Statistics Canada
PK	Capital deflator (19 industries)	Statistics Canada
PM	Intermediate goods deflator (19 industries)	Statistics Canada's KLEMS database
Y	Gross output ($ real)	$= YN/PY$
K	Capital stock ($ real)	$= KN/PK$
M	Intermediate inputs ($ real)	$= MN/PM$
Q	Employment share of white-collar workers	Compact Disclosure; Micromedia's "Profile Canada"
V	Year of incorporation	Compact Disclosure; Micromedia's "Profile Canada"; Moody's International
U	Unionization	Compact Disclosure; Micromedia's "Profile Canada";
E	Exporting dummy	Compact Disclosure; Micromedia's "Profile Canada"; Canadian Trade Index of Alliance of Manufacturers and Exporters Canada
D	Ownership dummy	Compact Disclosure; Micromedia's "Profile Canada"; Inter-corporate Ownership
P_1	Period dummy for 1985-88	
P_2	Period dummy for 1989-92	
P_3	Period dummy for 1993-95	
S_1	Size dummy for firms with capital of less than $30 million	
S_2	Size dummy for firms with capital greater than $30 million but less than $150 million	
S_3	Size dummy for firms with capital greater than $150 million	

1 Net PPE (property, plant and equipment) is used because it takes depreciation into account, thus allowing for technological obsolescence; gross PPE does not depreciate old capital and thus tends to exaggerate the capital stock of firms.

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