ROYAL COMMISSION ON FARM MACHINERY

PRODUCTIVITY IN THE FARM MACHINERY INDUSTRY

Christopher J. Maule

Study No. 3

ACMR

CANADA

ROYAL COMMISSION ON FARM MACHINERY

PRODUCTIVITY IN THE FARM MACHINERY INDUSTRY

A COMPARATIVE ANALYSIS BETWEEN CANADA AND THE UNITED STATES

by

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While this study was prepared independently for the Royal Commission on Farm Machinery and is being published under its auspices, the views expressed herein are those of the author and not necessarily those of the Commissioner.

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Price subject to change without notice

Information Canada
Ottawa 1970
Reprint 1971

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ACKNOWLEDGEMENTS

The author is indebted to Dr. C.L. Barber, Mr. N.B. MacDonald, Professor D. Schwartzman and others on the Commission staff who commented on earlier drafts of the study. In particular, Mr. Donald Martinusen worked closely with the author, and without his assistance and advice the study would have been difficult to complete. It is for this reason that the title page shows that the study was undertaken in collaboration with Mr. Martinusen. However, the author alone is responsible for the views expressed.

The author wishes to thank all the members of the Commission staff who provided the services necessary to undertake and to complete the study.

1. INTRODUCTION AND SUMMARY

The purpose of this study is to compare labour productivity in the farm machinery industry in Canada and the United States. Although labour productivity is only a partial measure of productivity and efficiency, in that it does not take into account the contribution of capital to efficiency, nevertheless it does provide a strong indication of the cost competitiveness of the industry.

One reason for undertaking the study was the Commission's desire to re-evaluate the findings of previous studies,[1/] which have indicated that labour productivity in the farm machinery industry is substantially lower in Canada than in the United States. In addition, it may be possible to throw light on Canada's generally unfavourable labour productivity performance relative to the United States, which has been commented upon both in official sources and by academic economists.[2/] Thirdly, the study will provide one criterion for assessing the potential effects of wage parity between Canada and the United States in this industry. Finally, the measurement of labour productivity in this industry is of particular interest in Canada, since there has been free trade in farm equipment between Canada and the United States since 1944. Some idea of the prospects for the future expansion of the industry in Canada can be gained from such a study.

1/ D.H. Fullerton and H.A. Hampson, Canadian Secondary Manufacturing Industry, Royal Commission on Canada's Economic Prospects, Ottawa, Queen's Printer, 1957, p. 263; and J.D. Woods and Gordon Limited, The Canadian Agricultural Machinery Industry, Royal Commission on Canada's Economic Prospects, Ottawa, Queen's Printer, 1956, p. 23.

2/ Economic Council of Canada, Second Annual Review, Ch. 3, and Fourth Annual Review, Ch. 6, Ottawa, Queen's Printer, 1965 and 1967 respectively; N.H. Lithwick, Prices, Productivity and Canada's Competitive Position, for Canadian Trade Committee, Montreal, 1967; N.H. Lithwick, G. Post, T.K. Rymes, "Postwar Production Relationships in Canada" in The Theory and Empirical Analysis of Production, National Bureau of Economic Research, New York, 1967, pp. 190-200; D. Slater, "Economic Policy and Economic Research in Canada Since 1950" Queen's Quarterly, Vol. 74, No. 1, 1967, p. 4.

Two major problems were encountered in the study: the first arose from the nature of the industry, and the second concerned the comparison of Canadian and U.S. published statistics. The farm machinery industry produces a wide range of products, from ploughs to combines and tractors. The industry's common feature is that its products are sold to one occupational group -- farmers. Because the product "mix" in the industry differs between the two countries, comparisons are difficult to make. Statistics on individual establishments in Canada were made available to the Commission staff, but no such U.S. data were available. Thus it was impossible to compare similar plants in the two countries. Comparison of labour productivity was therefore based on *aggregate* published data for the industry, and herein lies the second problem.

The major finding of the study is that part of the publicized labour-productivity gap in the farm machinery industry between Canada and the United States is a statistical illusion. Instead of labour productivity in Canada being about 68% of that in the United States,[3/] it was found to be 80% to 85% of that in the United States. The difference between the findings of this and earlier studies is due to differences in the way in which shipments are valued when they are reported by the companies to the Dominion Bureau of Statistics in Ottawa and the Bureau of the Census in the United States. In brief, reported shipments are valued at a level lower in Canada than in the United States, thus value added tends to be lower in Canada also. When the Canadian data are adjusted to a basis comparable to the U.S. data, Canadian value added increases, and where value added is used to calculate productivity, the level of labour productivity increases.

The reason for the difference in the valuation procedure in the two countries is dealt with, in detail, in Chapter 2. Suffice it to say at this point that the problem arises because substantial amounts of the shipments from establishments in the farm machinery industry are to the wholesale distribution divisions (in both Canada and the United States) of the same companies owning the manufacturing establishments. These intra-company shipments do not involve arm's length transactions and the transfer prices used to value these shipments tend to be those that are most convenient to

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3/ Fullerton, op. cit., p. 263.

the company. Detailed inquiry into this problem revealed that the level of transfer prices used in each country was such as to understate Canadian relative to U.S. shipments. Further, it was found that within each country there were differences in the transfer-pricing procedure used by firms reporting to the government agencies.

A word of caution is in order. It should not be assumed that the findings of this study imply that the labour productivity gap between *other* Canadian and U.S. industries is narrower than has been shown previously. The statistical problem noted above is likely to be found only in those industries in which intra-firm shipments are made. However, the findings do suggest that considerable care must be taken when using published statistics for international comparisons of productivity and of other industrial characteristics.

The remainder of the study is organized as follows. Chapter 2 discusses the meaning and measurement of labour productivity. Statistics describing certain salient features of the farm machinery industry in Canada and the United States are contained in Chapter 3. Inter-country comparisons of both the level and the rate of growth of labour productivity in the industry are included in Chapter 4, and material from Chapter 3 is used to analyze comparative productivity. The Appendix contains a detailed examination of the sources of statistics used in the study.

2. LABOUR PRODUCTIVITY -- MEANING AND MEASUREMENT

Meaning

The term "labour productivity" refers to the output produced per unit of labour input. This ratio is used to evaluate the efficiency with which manpower is used in a production process, and to provide an approximation of the overall efficiency of the process. It is well recognized that labour productivity is a partial productivity measure, in that it ignores the contribution of capital to overall efficiency, and that labour productivity is affected by the amount of capital with which labour works. The omission of a discussion in this study of the contribution of capital to efficiency is due to the fact that no statistics of capital stock for the farm machinery industry are available.

Labour productivity can be measured for an industry over time to indicate changes in efficiency; between the same industry in two or more countries to provide international comparisons of efficiency; and between industries in the same country to indicate the relative efficiency of different industries. The emphasis of this study is on comparing labour productivity for the farm machinery industry in Canada and the United States. Both the gap and the changes in labour productivity between the two countries will be examined.

The results of such a study have implications for the international cost competitiveness of the Canadian industry, for issues of wage parity that have arisen in this industry, and for a general understanding of differences in the economic environment between the two countries, assuming that elements of this environment affect labour productivity. In addition, the study was commissioned to take a second look at the productivity gap that had been reported in two studies for the Royal Commission on Canada's Economic Prospects in 1955. One study showed that in 1953, for the agricultural implements industry, excluding tractors,

value added per man-hour in Canada was 68.1% of that in the United States.[4] The second study stated that

> ...the rate of productivity in the industry as a whole is usually higher in the United States than it is in Canada. This is the result of the greater investment in specialized machinery per worker in the large plants in the United States which is warranted by their longer manufacturing runs.[5]

Measurement

Since labour productivity is a ratio, its value can be altered by changes in the values of the numerator and/or denominator. These changes can be due to real changes in the units measured, to changes in the statistical concepts used to measure the units, and to problems associated with measuring the units. The real changes, of course, are the pertinent ones for evaluating labour productivity. However, statistical problems often distort these actual changes. These problems of measurement will be examined in two parts: (1) the choice of an appropriate measure of productivity; and (2) the adjustments required to units measured in the case of international productivity comparisons.

1. Choice of measure

In devising a measure of labour productivity that can be used for purposes of inter-firm or inter-plant comparisons, two output measures are commonly used -- gross output or value of shipments (VOS), and net output or value added (VA). If it is the productivity of direct labour in man-hours (L_D) that is being measured, then the two productivity ratios would be VOS/L_D and VA/L_D, and the question is which is the appropriate measure to use? Assuming that both output and labour are identical in the plants being compared, the main criticism of VOS/L_D is that it does not take into account differences in the degree to which plants are integrated vertically. For example, two plants could have similar gross outputs, but if one undertook fabricating and assembly and the other assembly only, the former would have more direct labour and thus a lower labour productivity than the latter. It would not, however, be meaningful to say that direct labour productivity was higher in the second plant than in the first, since the two plants are not comparable, and in this situation differences in labour productivity merely reflect differences in the use of labour in relation to capital.

4/ Fullerton, op. cit., p. 263.

5/ Woods, op. cit., p. 23.

In an attempt to overcome this problem it has been suggested that VA/L_D is a more suitable measure of productivity. However, this ratio also has shortcomings, and there are particular difficulties in its use in the farm machinery industry. The criticism of VOS/L_D is that it does not take into account the degree of vertical integration, i.e. the amount of manufacturing activity performed. A similar criticism applies to VA/L_D; although it *does* take into account the amount of manufacturing activity performed, this does not mean that the same kind of manufacturing activity is being undertaken in the plants being compared (say, plant "A" and plant "B"). Plants "A" and "B" may have equal VA, but if in "A" it is due to fabricating activity and in "B" due to assembling activity, the direct labour requirements for each activity may be different.[6/] Therefore, if VA/L_D was the same in plants "A" and "B", it need not mean that direct labour productivity was the same, because non-equivalent plants are being compared.[7/] Even in the case where both plants being compared undertook the same activity (i.e. both fabricated parts or both undertook assembly), productivity differences might occur due to differences in the product mix. The only way to ensure adequate comparability of a VA/L_D measure is to compare plants that undertake not just the same amount of manufacturing activity, but the same *kind* of manufacturing activity, preferably for the same products.

In the farm machinery industry, productivity comparisons are made between plants whose product mix differs. Despite these problems, value added presents less difficulties as a measure of output than a gross output measure, and value added will be used in measuring labour productivity in this study. Labour input will be measured in terms of production workers, total employees and man-hours of production workers. Six productivity comparisons will be made, three using value added in current dollars and three in constant dollars. Comparative levels of productivity can be measured in current just as well as in constant dollars, since the

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6/ L_D required to produce a unit of VA (the reciprocal of VA/L_D) may depend on the kind of manufacturing activity being undertaken.

7/ It might be argued that in the example given, "A" and "B" would be plants in different industries in which case the comparison would not be made in the first place. However, it is known that mainly fabricating, mainly assembly and fabricating plus assembly plants are included in the farm machinery industry.

farm machinery industries in Canada and the United States are basically selling into the same market, and have access to materials at about the same prices. However, changes in productivity in each country over time can only be undertaken using value added in constant dollars because of the effects of price changes on the measure.

2. Adjustments to statistics

A number of serious difficulties arise in using published sources of statistics for productivity comparisons both within and between countries. First of all, the concepts used to measure industrial inputs and outputs may differ between countries, or the concepts used within a country may change over time. Also, where inputs or outputs are measured in dollar terms, the pricing procedure used may differ. And thirdly, there is the problem of ensuring that inputs are matched against the relevant output in calculating productivity, and that the output represents production and not merely the resale of items. Because of these difficulties, a detailed study was made of the sources of statistics to be used, and is to be found in the Appendix.

The main difference between Canadian and U.S. statistics concerns the pricing procedure used to value shipments of farm machinery, as reported to the Dominion Bureau of Statistics in Ottawa and the Bureau of the Census in Washington. The outputs of the major manufacturing establishments in both countries are shipped mainly to the wholesale distribution divisions of the same companies and are, therefore, intra-firm shipments. The price used by a particular company to value its factory shipments in these circumstances is somewhat arbitrary and can fall between total factory cost (42% to 61% of "suggested retail price" (SRP), depending upon establishment and year) and the net price to dealers of approximately 72% of SRP. The Bureau of the Census instructs respondents operating establishments with intra-firm shipments to report such shipments at prices that include allocations of overall company overhead costs and profit,[8/] but appears to leave to

8/ Instructions for the 1963, 1964 census contained the following requirement:

"E. How Should Multiple Establishment Companies Determine Transfer Values of Products and Materials from One Establishment to Another ("Interplant Transfers")?

One of the important statistical measures of manufacturing activity is "value added by manufacture", which is derived by the Census Bureau from the figures reported for value of shipments, cost of materials and inventories.

(Continued on p. 9.)

individual respondents the choice of the precise level of such price. The Dominion Bureau of Statistics, on the other hand, although currently reviewing its requirements concerning the valuation of intra-firm shipments, explicitly allows total factory cost (materials, direct labour and factory overhead) as a legitimate basis for reporting the value of such intra-firm shipments.[9/]

In the case of the major Canadian manufacturing establishments the valuation of such intra-firm shipments was found to vary from factory cost to net selling price to dealers, with large volumes at total factory cost. In the United States, major firms were found to report intra-firm shipments at values that ranged from 53% to 80% of SRP. Different transfer pricing procedures will obviously upset productivity comparisons.

(Continued from p. 8.)

In order for statistics on value added and other subjects to be comparable from industry to industry or area to area, it is necessary that the operations of each establishment of a multiple establishment organization be reported as though the establishment was a separate "economic" unit. This means that the value of interplant transfers within a company should include, in addition to direct costs of production, a reasonable proportion of "all other costs (including company overhead) and profits". The establishments receiving such transfers should report them as materials consumed (or inventories of materials, etc.) at the same value plus costs of freight and other direct handling charges. (See Item 5.)"

Instructions for Completing the Annual Survey of Manufactures Report 1963, 1964, U.S. Department of Commerce, Bureau of the Census, Washington, D.C. 20233.

9/ The reporting instructions for the 1965 census of manufactures contained the following instructions concerning intra-firm shipments:

"5. Valuation of shipments (for the guidance of MULTI-UNIT FIRMS) -- Section 12 of Schedule

Special problems are frequently encountered in statistical reporting by multi-unit firms. It is planned to review all such cases on an individual basis. Pending completion of this review, however, the following notes indicate the procedures which should be followed in the most common cases, WHERE ALL OR PART OF PLANT SHIPMENTS ARE IN THE FORM OF TRANSFERS TO OTHER UNITS OF THE FIRM.

(a) If your firm operates one manufacturing plant plus one or more stock or storage warehouses at other locations (including rented space in public warehouses), shipments should consist of ex-warehouse shipments plus direct plant shipments to customers. Do not include plant shipments to warehouse. Include warehouse inventory with plant inventory (Section 7).

(Continued on p. 10.)

With these difficulties in mind, the following adjustments were made to the Canadian data on value of shipments (VOS) to make them comparable to the U.S. data.

VOS measures the output of a plant at the point at which it leaves the factory (factory door) and before any warehousing and selling activities are undertaken; factory profit is included in VOS. In the case of a firm that produces a good and sells it to some buyer in an arm's length transaction, the transaction price will provide a satisfactory measure of the factory-door price (assuming that the firm performs little or no warehousing or selling activity). However, when the good is transferred from one branch of a firm to another branch of the same firm, no arm's

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(Continued from p. 9.)

(b) If you ship goods to other manufacturing establishments of your firm for sale or further processing these shipments should be reported in Section 12 at book transfer value.

The transfer values should in general be high enough to cover at least materials, direct labour and factory overhead. The value reported by the receiving units (as materials or goods for resale) should equal the transfer value plus transportation costs if any.

If transfer shipments as described are not available from your records, and special arrangements have not been made for separate reporting, you may submit a consolidated report for the manufacturing units concerned.

(c) If you ship goods to separate sales branches or selling warehouses of your firm these shipments should be reported in Section 12 at book transfer value as described in (b) above.

If such transfer shipments are not available from your records, and special arrangements have not been made to report otherwise, you may report final sales in Section 12. Section 12 then will include direct shipments to customers, if any, from the plant plus final sales from sales branches or selling warehouses, all at sales value levels. In these cases operational data such as employment, payroll, inventory, supplies, etc. of such sales units should be included in the appropriate sections of the plant report.

Where sales outlets serve more than one of the manufacturing plants of your firm, and transfer values as described in (b) above are not available from your records, you may value plant shipments to sales outlets at outlet selling prices. (Operating costs, including

(Continued on p. 11.)

length transaction occurs, and therefore the factory-door price is an artificial price that is estimated in various ways by different firms. Much of the VOS in the farm machinery industry involves intra-firm transactions.[10/]

In both Canada and the United States, the factory-door price, as officially reported, is estimated by different firms in different ways. This presents two sets of problems. First, within each country, the differing methods of estimation mean that VOS is not comparable between firms, and VOS for the industry is not comparable over time if each firm's share of VOS varies year by year. Secondly, between countries, industry VOS is not comparable, and thus direct productivity-ratio comparisons cannot be made using VOS or value added (VA) in the numerator.

Information made available to the Commission permitted an adjustment of Canadian VOS (as reported to the Dominion Bureau of Statistics) to the same basis used by the U.S. Bureau of the Census. The procedure was as follows. U.S. VOS of final goods is reported on the basis of 66% of suggested retail price (SRP).[11/] The 66% is an unweighted average figure of the deduction from SRP made by 10 leading companies in the industry in 1965; 8 of the 10 accounted for 55% of total industry VOS in 1965. The percentage of SRP varied from 53% to 80% for the 10 companies. Using published information and industry knowledge about the relative sizes of these companies, it was estimated that a weighted average would result in VOS for these companies being 65% of SRP. This estimate is probably accurate to within plus or minus two percentage points. The remainder of the industry output would probably come from

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(Continued from p. 10.)

employment and payrolls of such sales outlets should be reported in the "Head Office" schedule.) See also note following Section 12(E)."

Reporting Instructions 1965 Census of Manufactures, Dominion Bureau of Statistics, Ottawa, Canada.

10/ For a theoretical treatment of the problem, see J. Hirshleifer, "On the Economics of Transfer Pricing", Journal of Business, Vol. 29, July 1956.

11/ The actual retail sales of over half of the new machines purchases by farmers in both Canada and the United States probably involve discounts from SRP, usually by way of overvaluation of trade-ins. However, there is no reason to believe that the difference between SRP and the actual prices paid by farmers would be any different between Canada and the United States. Therefore, the use of SRP as a proxy for a market price is probably legitimate.

companies selling on the basis of arm's length transactions, and thus the transaction price would be the one reported to the Census. This factory-door price would represent the desired measure. While fully realizing that 65% of SRP is only an estimate for one year, it was decided that this was the best estimate that could be made, and was the most appropriate basis to which the Canadian figures should be adjusted.[12/] Note that the adjustment is only needed for firms whose VOS involves intra-firm transactions; these are mainly large firms and the adjustment procedure was applied only to the larger firms in Canada whose VOS in aggregate accounted for more than 80% of published Canadian VOS in 1965.

Using similar techniques, the reporting of shipments of repair parts by the U.S. industry was found to be, on the basis of approximately 51% of SRP, some 14 percentage points lower than that used in the case of end items (whole machines). The Canadian shipments of parts were adjusted accordingly.

Total Canadian shipments include sizable amounts of inter-plant transfers of production components or "primaries" from establishments in Canada to other establishments of the same firm elsewhere in Canada or in the United States, for further processing or assembly into completed machines. It is extremely difficult to develop transfer prices for such shipments that will serve as proxies for arm's length or market prices. In the case of completed machines, the procedure used was to relate the transfer price to SRP which is, in effect, a market price. In the case of inter-works shipments of components, however, no such reference to SRP was possible. The procedure adopted in the case of such components was to use total factory cost plus 11%, the transfer-price basis allowed by the taxing authorities in both the United States and Canada on inter-works transfers of such items between the two countries. Where shipments of components were to other establishments of the same company within Canada, the relevant material input values of the receiving establishment were increased an equal amount, thus causing the addition of the 11% to cancel out on net measures of

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12/ Actually, the really important consideration is that the *same* level of transfer price be used in each of the two countries. The exact *level* of transfer price -- somewhere between total factory cost and price to the dealer -- is a somewhat arbitrary matter in any event.

output (value added). On inter-works shipments to the United States, the addition of the 11% will increase VA an equivalent amount, and the volume of inter-works shipments to the United States was sufficient to necessitate a revaluation of such shipments (by the addition of 11%) to a basis intended to reflect an arm's length situation.

The difference in the productivity findings between this study and earlier studies is due to these adjustments which have been made so as to provide comparable statistics. These adjustments could be made because the Royal Commission staff was given permission by the firms to view their individual returns made to DBS, and because certain confidential information was made available to the Royal Commission on Farm Machinery by industry sources, concerning valuation practices for reporting purposes in the United States.

In reviewing these returns, it was noted that annual swings in the values of certain items reported by the companies were wider than would normally be anticipated. This may explain rather large fluctuations in productivity between certain years. It also raises questions about the accuracy of the reporting of certain items.

3. THE FARM MACHINERY INDUSTRY IN CANADA AND THE UNITED STATES

The purpose of this chapter is briefly to describe in words and with statistics, rather than to analyze, some salient features of the farm machinery industry in Canada and the United States. The material in this chapter will be used to explain the productivity differences presented in Chapter 4.

The farm machinery industry in North America consists of a relatively small number of large firms that tend to have establishments in both the United States and Canada -- firms such as Massey-Ferguson, International Harvester, Cockshutt, and John Deere. Some of these firms also have operations in other countries. Other large U.S. companies sell farm machinery in Canada, but undertake none of their production of these items here, e.g. Ford and Allis-Chalmers. In 1965, the eight largest firms in the United States accounted for 55% of the value of shipments of farm machinery, while in the same year, in Canada, 77% of the value of shipments was accounted for by four firms with seven plants. The balance of the output of farm machinery in Canada is produced in about 90 single-plant firms. In analysing the aggregate statistics for this industry in Canada, it should be realized that the activities of a few large firms will have a significant impact on the values of these aggregates.

The output of the firms that have plants in Canada and the United States tends to be rationalized so that the production of certain items tends to be concentrated in certain plants. As a result, almost no farm tractors are produced in Canada. In addition, as outlined in Chapter 2, the overwhelming portion of factory shipments were intra-company (i.e. mainly to company-owned wholesale distribution operations) which were reported to the Dominion Bureau of Statistics at widely different valuation bases. It was as a result of adjusting for problems associated with the reported values of inter-works shipments that the findings on labour productivity in this study differ from those of earlier studies.

The farm machinery industry is a somewhat unique manufacturing industry in Canada, in that there has been virtual free trade in farm machinery between Canada and the United States since 1944. Free trade and the common ownership of plants in the two countries have been responsible for the partial rationalization of production in the industry. Thus any comparison of this to other manufacturing industries should take these factors into account. The farm machinery industry does provide some indication of what happens to a Canadian industry when tariff barriers are removed.

Two major changes have occurred in the Canadian farm machinery industry since 1960 -- the acquisition in 1962 of the production assets and distribution system of Cockshutt Farm Equipment Limited by the White Motor Corporation, and the opening in 1963 of the North American combine plant of Massey-Ferguson in Brantford. Both of these changes have implications for an assessment of labour productivity in the industry.

Prior to its acquisition by White Motor, Cockshutt had been operating as a full-line supplier of farm equipment. Under White Motors management, duplication in product manufacturing was largely eliminated. In its 1962 Annual Report, White Motor states:

> The acquisition of Cockshutt has also improved our manufacturing efficiency. The 430 and 431 combines are being made for both Oliver and Cockshutt in the latter's plant at Brantford, Ontario, while tractors for both companies are being produced in Oliver's Charles City, Iowa, plant. Other products for both companies have been concentrated in our Shelbyville, Illinois, and South Bend, Indiana, plants. This consolidation of manufacturing operations into the three Oliver U.S. plants and the one Cockshutt Canadian plant has enabled us to shut down our older plant at Battle Creek, Michigan, and to increase production and efficiency at other plants.

And in the 1963 Annual Report, the following was noted:

> Further steps were taken to consolidate and streamline our farm equipment manufacturing facilities. Minneapolis-Moline moved all manufacturing to its Minneapolis plant, using the Hopkins, Minnesota, facility for a warehousing parts depot, and engineering and general offices. A 75,000-square-foot extension was added to the combine plant at Brantford, Ontario, to enable this plant to better meet its increasing production requirements and to increase efficiency.

> The rearrangement and concentration of farm equipment manufacturing, completed this year, in the four U.S. plants and one Canadian facility, have made it possible to operate these plants at near-capacity levels throughout the year with improved earnings.

The effect at Cockshutt of the rationalization program was for a broad product line to be replaced by a single product line, namely combines, with some machining activity (manufacturing components) being retained. This resulted in a more streamlined manufacturing process, fewer scheduling problems, a great reduction in congestion, and an overall improvement in productivity.

All Massey-Ferguson's North American combine assembly activity is centred in its new Brantford plant. The opening of this plant had two implications for the present study. First, combine production was removed from Massey's Toronto works, which also contained machining and stamping activities, as well as baler and swather assembly operations. Removal of combine production from the Toronto works almost certainly led to an improvement in productivity through a reduction of congestion in the plant and the opportunity for greater specialization of production. Second, the physical removal of the combine assembly activities from the Toronto works resulted in an increase in the value of shipments of the total industry due to the fact that manufactured components (machined and stamped items), which formerly remained intra-plant, henceforth were shipped from the Toronto establishment to the North American combine plant in Brantford. Formerly, such components were not reported as shipments; after the opening of the combine plant, they were reported as shipments. Such shipments of components would not affect figures published or computed for value added (the shipments of the Toronto works would be included as material inputs at the combine plant and hence would cancel out) but would affect value of shipments.

The following tables contain statistics that outline some of the dimensions of the farm machinery industry in Canada and the United States.

The Size of the Canadian and U.S. Industry Relative to the Size of the Economy (Tables 1 and 2)

During this period (1947-66) in both countries, 20% to 25% of the total labour force was employed in manufacturing, with about 1% of total manufacturing employees employed in the farm machinery

TABLE 1

THE FARM MACHINERY INDUSTRY AND THE ECONOMY OF CANADA, 1947-66, SELECTED YEARS

	1947	1950	1954	1959	1964	1966
Total civilian labour force (thousands)	4,954	5,198	5,476	6,242	6,933	7,420
Employees in manufacturing (thousands)	1,131	1,183	1,268	1,304	1,491	1,619
Employees in manufacturing as % total civilian labour force	22.8	22.8	23.2	20.9	21.5	21.8
GDP ($ million) 1/	11,857	16,458	22,213	31,175	41,702	50,501
GDP ($ million) 1/ in manufacturing	3,310	4,714	6,291	8,286	11,053	13,019
GDP manufacturing as % total GDP	27.9	28.6	28.3	26.6	26.5	25.8
Value added in farm machinery industry ($ million)	49	88	64	98	136	172
Value added in farm machinery industry as % GDP in manufacturing	1.5	1.9	1.0	1.2	1.2	1.3
Employees in farm machinery industry	16,013	16,223	11,805	13,056	12,474	14,498
Employees in farm machinery industry as % employees in manufacturing	1.4	1.4	0.9	1.0	0.8	0.9

1/ GDP = Gross Domestic Product at factor cost.

Source: Historical Statistics of Canada, eds., M.C. Urquhart, and K.A.H. Buckley, Toronto, Macmillan, 1964. National Accounts, DBS 13-201, various years. Canada Year Book, Ottawa, various years. Appendix Table A5.

TABLE 2

THE FARM MACHINERY INDUSTRY AND THE ECONOMY OF THE UNITED STATES, 1947-66, SELECTED YEARS

	1947	1950	1954	1959	1964	1966
Total civilian labour force (thousands)	60,168	63,099	64,468	69,394	73,091	75,770
Employees in manufacturing (thousands)	15,290	14,967	15,995	16,675	17,274	19,186
Employees in manufacturing as % total civilian labour force	25.4	23.7	24.8	24.0	23.6	25.3
National income ($ billion)	198.2	241.9	301.8	400.5	518.1	616.7
National income from manufacturing ($ billion)	58.7	74.4	91.1	119.9	155.6	192.1
National income from manufacturing as % total national income	29.6	30.8	30.2	29.9	30.0	31.1
Value added in farm machinery industry ($ million)	633.8	877.4	763.0	1,172.2	1,526.1	2,057.1
Value added in farm machinery industry as % national income in manufacturing	1.1	1.2	0.8	1.0	1.0	1.1
Employees in farm machinery industry (thousands)	143.4	137.8	104.4	113.2	118.6	137.3
Employees in farm machinery industry as % employees in manufacturing	0.9	0.9	0.7	0.7	0.7	0.7

Source: Historical Statistics of the United States. Colonial Times to 1957, U.S. Dept. of Commerce, 1960 Statistical Abstract of the United States, U.S. Bureau of the Census, various years. Appendix Tables A3 and A6.

industry. In terms of employment, the Canadian industry has become a less important source of manufacturing employment.

The income generated by the industry in Canada in 1966 was 1.3% of the income generated by manufacturing as a whole; the comparable figure for the United States was 1.1%. In terms of this measure, the Canadian and U.S. industries have been of unchanged importance since 1959.

The general picture that emerges is that the farm machinery industry employs a small proportion of the total labour force and contributes a small proportion to the income generated in manufacturing in both countries. Despite the expansion of output, the total number of employees in the industry has declined by about 10% in Canada and 4% in the United States since 1947.[13/]

The Relative Size of the Two Industries (Table 3)

The size of the Canadian farm machinery industry relative to the American industry has remained fairly constant since 1947, measured in terms of total employees, payroll, and current-dollar value added and value of shipments. However, in terms of constant-dollar value added and value of shipments since 1956, the Canadian share reveals an increase from about 7% to 9% of the total North American industry.[14/] It can therefore be said that the Canadian industry has at least held its own and may even have increased its share of the industry during the period studied.

If the Canadian and American parts of the total North American industry were similar, then one might expect that the Canadian share of the total, in terms of employees, payroll, value of shipments and value added, would be roughly the same. However, this is not the case since the Canadian share of total employees has been about 10%, payroll 7% to 9%, value of shipments 6% to 8%, and

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13/ Some idea of the rank position of farm machinery production can be given by relating the agricultural implements industry to the 40 leading industries (ranked by selling value of factory shipments) in Canada in 1961. These 40 industries accounted for 63% of the total employees and 66% of the value added in manufacturing. The agricultural implements industry is not one of these 40 industries, although if these industries had been ranked by total employees or by total wages and salaries, this industry would have ranked 32nd and 30th respectively. See General Review of the Manufacturing Industries of Canada, 1961, DBS 31-201, Ottawa, Queen's Printer, pp. 126-127.

14/ Calculated from Appendix Tables A5 and A6.

value added 7% to 9%. The smaller share of payroll than employees is in line with the lower wages paid in Canada; and the smaller share of production (value added) than employees probably also results from lower Canadian wages leading to the concentration on labour-intensive production in Canada.

Vertical Integration

The ratio of value added to value of shipments provides an indication of the degree of vertical integration in an industry. There are some problems in interpreting this measure when applied to the farm machinery industry in North America, since shipments often involve inter-works shipments of components as well as shipments of final products and replacement parts. Moreover, inter-works shipments may take place between two plants of the same firm, one located in Canada and the other in the United States. The transfer pricing procedure used will affect the size of the value of shipments.

With these reservations in mind, the extent of vertical integration is shown in Table 3 to have been higher in Canada than in the United States: the averages for all the years from 1947 to 1965 was about 50% for Canada, as compared to 46% for the United States.[15/]

This ratio might be interpreted loosely as the payment to labour and capital per dollar of output, or the amount of production activity per dollar of output undertaken in farm machinery establishments. The difference in the ratio between the two countries could be due to the decision by the large international firms as to how their production will be rationalized, as well as to differences in output mix, scale of production and productivity. Differences in the output mix are discussed in the following section; differences in the scale of production are reported in Table 4.

The size distribution of establishments is shown by number of employees per establishment for 1963. In Canada, 4.9% of the establishments have 500 or more employees, whereas the comparable figure in the United States is 2.6%. In terms of the number of employees, wages, value added and value of shipments in these large establishments, the percentage is higher in Canada than in the United States; conversely, Canada tends to have lower percentages in the smaller classes. Thus, in the United States, a larger

15/ Calculated from Appendix Tables A5 and A6.

TABLE 3

THE CANADIAN AND UNITED STATES FARM MACHINERY INDUSTRIES, 1947-65, SELECTED YEARS: A COMPARISON OF CERTAIN KEY VARIABLES

	1947	1950	1955	1960	1965
Total employees					
Canada	16,013	16,223	11,753	10,924	13,721
U.S.	143,446	137,807	114,001	99,115	123,241
Canada as % of U.S. & Can.	(10.0)	(10.5)	(9.3)	(9.9)	(10.0)
Payroll (wages & salaries)($M)					
Canada	31.2	43.3	41.9	52.7	75.6
U.S.[n]	412.3	507.6	504.1	524.0	819.0
Canada as % of U.S. & Can.	(7.0)	(7.9)	(7.7)	(9.1)	(8.5)
Value of shipments ($M)					
Canada	102.0	170.6	130.0	181.0	316.1
U.S.[n]	1,457.3	2,062.1	1,886.3	2,097.7	3,812.0
Canada as % of U.S. & Can.	(6.5)	(7.6)	(6.4)	(7.9)	(7.7)
Value added ($M)					
Canada	49.4	88.4	70.5	89.5	152.9
U.S.[n]	633.8	956.4	898.2	912.8	1,816.9
Canada as % of U.S. & Can.	(7.2)	(8.5)	(7.3)	(8.9)	(7.8)
Vertical Integration (VA + VoS)					
Canada	48.4	51.8	54.2	49.4	48.4
U.S.	43.5	46.4	47.6	43.5	47.7

n - In Canadian Dollars.
$M - In Millions of Dollars.
Source: Appendix Tables A5 and A6.

TABLE 4

SIZE DISTRIBUTION OF ESTABLISHMENTS IN CANADA AND THE UNITED STATES, 1963, BY NUMBER OF EMPLOYEES

Number of Employees	Establishments		Employees		Wages		Value Added		Value of Shipments	
	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.
	(Per cent)									
1-4	25.6	33.6	0.3	0.7	0.2	0.6	0.4	0.5	0.4	0.7
5-49	51.2	47.7	6.3	11.6	4.3	9.2	5.8	9.7	6.0	9.5
50-99	9.8	9.1	5.4	8.9	4.1	7.3	6.3	8.1	7.6	7.8
100-499	8.5	7.0	14.1	20.5	12.1	18.5	18.1	19.2	16.6	20.5
500 +	4.9	2.6	73.9	58.2	79.4	64.4	69.4	62.6	69.4	61.4

Source: Canada - Agricultural Implement Industry, DBS 42-202, 1964, Table 5, p. 7.
United States - Census of Manufactures, 1963, 35A-11.

proportion of farm machinery output comes from establishments with less than 500 employees than is the case in Canada; also, these smaller establishments in the United States employ 41.8% of the industry's employees as opposed to 26.1% in Canada.[16/]

Composition of Output[17/]

A description of the types of products produced by establishments in the industry is contained in Table 5. Since the coverage ratios in both countries have been 90% or more since 1947, most of the farm machinery produced is considered in this description.[18/]

In summarizing the output comparison of the two countries, it can be said that:

-- In the United States, tractors are the most important single item produced by the industry, but their percentage share of the industry's output has declined. In terms of value of shipments, however, tractor production has increased since 1947.

-- In Canada, harvesting machinery, especially combines, has been the most important item produced and its importance has been increasing both relatively and absolutely. The production of haying machinery has also been of increasing importance over time.

-- The residual category for farm machinery is an important one in each country, but its contents differ between countries. In view of this difference, and the emphasis on tractors in the United States and combines in Canada, there are substantial differences between the outputs of the farm machinery industry in the two countries. This fact tends to undermine comparisons of other characteristics of the industry in Canada and the United States, in particular at an aggregate level. The common feature of the farm machinery industry is that the output is used by a common occupational group, farmers. The industry has been defined more with this feature in mind than with attempting to include only products that compete with each other.

16/ A further breakdown of establishments with 500 or more employees is published in the United States; i.e. 500-999, 1,000-2,499 and 2,500 or more employees. Information made available to the Commission for these size classes indicated that such a comparison would support the conclusions stated above.

17/ The discussion in this section is based on the use of Canadian value-of-shipments data, as published by the Dominion Bureau of Statistics; i.e. without any adjustments being made.

18/ The coverage ratio refers to the proportion of all farm machinery that is produced in establishments allocated to the farm machinery industry. See next section for a discussion of this ratio.

TABLE 5

DISTRIBUTION OF FARM MACHINERY PRODUCTION BY PRODUCT GROUPS IN CANADA AND UNITED STATES, 1947-63, SELECTED YEARS

Product Group Description	Percentage Distribution							
	1947		1954		1958		1963 3/	
	Can.	U.S.	Can.	U.S.	Can.	U.S.	Can.	U.S.
	(Per cent)							
Tractors	0.6	33.8	0.1	31.4	4/	26.6	4/	27.0
Plows, Tilling and Cultivating 1/ Machinery	16.2	10.1	11.3	7.9	11.2	6.5	11.9	6.7
Planting, Seeding and Fertilizing Machinery	5.7	5.1	8.3	5.4	5.6	3.8	6.7	3.9
Harvesting Machinery	31.7	14.2	37.3	15.6	36.1	13.1	37.9	13.7
Haying Machinery	4.1	6.9	7.2	9.0	14.8	7.5	11.4	4.7
Dairy Machinery and Equipment	5.3	2.0	2.4	1.3	1.7	4/	4/	4/
Other Farm Machinery 2/	25.9	19.7	25.1	20.8	25.1	27.0	13.8	28.9
Other Products -- non-Farm Machinery	3.5	7.2	4.4	7.7	5.4	9.1	18.4	10.8
Miscellaneous Receipts	7.1	0.9	4.0	1.0	0.1	6.4	4/	4.3
Total Value $ millions	89.3	1,343.7	118.9	1,596.9	133.5	2,421.9	182.8	2,842.2

1/ Can. - Plows, harrows, cultivators, soil packers, weeders.
U.S. - Plows, listers, harrows, rollers, stalk cutters.

2/ Can. - Includes such items as machines for preparing crops for market and use, spraying and dusting equipment, farm wagons, trucks, and sleighs.
U.S. - Includes such items as lawn mowers, spraying and dusting equipment.

3/ After 1961 full product breakdowns are not available in Canada for combines and dairy equipment. These items are included in the miscellaneous farm implements and machinery category. An estimate of combines produced in 1963 was therefore made.

4/ These statistics are omitted either because the value is less than $100,000 or because the product group has been merged with some other group.

Source: Canada - Farm Implements and Machinery, DBS various years. Agricultural Implement Industry, DBS 42-202, various years.
United States - Census of Manufactures, 1947, 1954, 1958, and 1963.

-- There appears to have been some attempt to rationalize production of individual products within the industry. The concentration of tractor production in the United States and combine production in Canada provides some evidence of this. However, although combines are an important part of Canada's output, the United States by far exceeds Canada in total combines produced. For example, in 1958, the United States produced 47,137 combines compared with Canada's 14,636, a ratio of more than three to one.[19]

-- In both countries, the share of non-farm machinery items has increased markedly since 1947, reaching 18.4% in Canada and 10.8% in the United States in 1963. It appears that production in farm machinery establishments is becoming more diversified in non-farm items, or that farm items have lent themselves to adaptation and use outside the farm, e.g. the use of the modified farm tractor as an industrial tractor.

Coverage and Specialization Ratios (Table 6)

Canada -- The coverage ratio indicates the proportion of farm machinery, by value of shipments, that is produced in establishments allocated to the agricultural implements industry (SIC 311). In other words, it indicates the share of farm machinery production that is carried on inside the industry. Since 1947 the coverage ratio for Canada has never been less than 90%, and usually more than 96%. Therefore, practically all farm machinery items are produced in establishments in SIC 311.

On the other hand, farm machinery establishments do produce products (i.e. secondary products) that are not farm machinery. The "purity" of the industry, or the proportion of the industry's output that is farm machinery, is the meaning of the specialization ratio. This ratio was low during the war when the industry produced armaments as well as farm machinery. However, by 1947, the ratio had climbed to almost 90% and remained above 90% until 1959; it has since shown a definite downward trend to 1966. Therefore, it appears that the industry is becoming more diversified in its output -- it is, to an increasing extent, producing products that

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19/ U.S. Census of Manufactures, 1958, p. 35A-15, Agricultural Implement Industry, DBS 42-202-1958, p. 8. This is the last date for which this ratio can be calculated accurately from published sources. The Dominion Bureau of Statistics stopped publishing information on the number of combines produced after 1961 for reasons of confidentiality. In the United States, the details are available in the 1958 Census.

TABLE 6

SPECIALIZATION AND COVERAGE RATIOS,
CANADA AND THE UNITED STATES
1947-66

Year	Specialization Ratio		Coverage Ratio	
	Can.	U.S. 1/	Can.	U.S. 1/
1947	89.9	87.0	95.2	91.5
1948	90.5		95.7	
1949	93.2		97.1	
1950	92.0		97.2	
1951	93.0		98.1	
1952	91.3		96.4	
1953	91.2		97.5	
1954	91.6	85.2	96.5	93.7
1955	93.9		97.2	
1956	93.5		97.5	
1957	93.5		97.5	
1958	94.7	84.5	97.7	94.2
1959	87.1		98.0	
1960	90.1		97.2	
1961	84.8		96.7	
1962	79.4		91.1	
1963	81.4	84.9	96.1	94.9
1964	75.0		95.8	
1965	74.0		95.9	
1966	75.0		95.3	

1/ Adjustments have been made to include farm tractors in 1947 and 1954.

Source: Canada - Agricultural Implement Industry, DBS 42-202, various years.
United States - Census of Manufactures, 1947, 1954, 1958, and 1963.

are not farm machinery. Firms in the industry do produce light industrial equipment, and it appears that this equipment is produced in establishments whose major output is farm machinery.[20/]

United States -- In the United States, the coverage ratio has been in excess of 90% while the specialization ratio has declined since 1947. Therefore, like Canada, most farm machinery is produced in the farm machinery industry (SIC 3522), and the degree of specialization by establishments in the industry has remained fairly high, although there is some indication that firms in the U.S. industry have diversified also, probably into light industrial equipment.

In summary, industry coverage and specialization ratios are similar in Canada and the United States. In both countries, diversification is being undertaken in establishments that produce mainly farm machinery. If this is the case, then the North American industry is becoming less rationalized by producing a greater variety of products. This may result in higher costs arising from a decrease in specialization and shorter production runs. However, the effect on costs will be determined by how closely the non-farm items are related to the farm items. For example, engines built for industrial and for farm tractors are very similar, and such diversification may promote economies of scale.

Labour and Capital Intensity

It is often suggested that Canadian industry as a whole is more labour-intensive than U.S. industry because labour is cheaper in Canada than in the United States, and that this accounts for output per worker being lower in Canada than in the United States. However, recent studies have shown that in the total manufacturing sectors of the two economies, capital per worker is higher in Canada, while output per worker is higher in the United States. In the case of the Canadian and U.S. farm machinery industry, some limited evidence suggests that capital per worker is higher in the United States than in Canada.[21/]

20/ If these firms were producing light industrial equipment in establishments that specialized in this equipment and not in farm machinery, then these establishments would appear in industries other than SIC 311.

21/ This evidence is based on a written reply by Massey-Ferguson to a question raised by the Commission during the public hearings. The reply shows that assets per worker in manufacturing were two to three times greater in the U.S. than in the Canadian plants of Massey-Ferguson.

The comparison of capital per worker was estimated by calculating the difference between value added per man-hour and wages per man-hour. It was assumed that the larger the difference, the more capital-intensive the industry. The U.S. industry was found to be more capital-intensive according to this measure, with the average Canadian figure about 80% of that in the United States.[22/] A second calculation comparing value added (less wages) per man-hour gave closely similar results.

22/ Calculated from Appendix Tables A5 and A6. This measure was suggested to me by Professor D. Schwartzman.

4. COMPARISON OF LABOUR PRODUCTIVITY

Two aspects of productivity in the farm machinery industry are reported in this chapter -- the difference in labour productivity between Canada and the United States, and the rate of change of labour productivity in the two countries. Ratios of value added per production worker, total employees and man-hours paid are presented. In total, six ratios are calculated since value added is used in terms of constant as well as current dollars. Only constant-dollar value added can be used to estimate productivity changes over time because of the distortion created by price changes. However, both constant- and current-dollar value added are used to estimate productivity differences, on the assumption that the industry in each country is basically selling into the same market and has access to materials at about the same prices, such that the effect of price changes will be very similar in both countries.

In interpreting the following data, it should be noted that the intercountry comparison is felt to be much more reliable for the period 1960 to 1966 than for 1947 to 1959, because of the inability to make a comprehensive adjustment to the data for the earlier period. Therefore, in the case of each productivity ratio using current-dollar value added, averages will be reported for 1947-51, 1952-59, 1960-66, and 1952-66, and in the case of each ratio using constant-dollar value added, averages will be reported for 1952-59, 1960-66 and 1952-66. The deflation of the Canadian data prior to 1952 was not considered to be reliable and thus the constant-dollar comparison was omitted for the period 1947-51.

The productivity comparison will be presented as follows: (1) adjustments made to the data for this study, and (2) presentation and analysis of the productivity ratios.

Adjustments Made to Published Data

The earlier study by Fullerton and Hampson found that Canadian labour productivity in the farm machinery industry in

one year, 1953, was 68.1% of that in the United States.[23/] The present study differs from the earlier one in that (a) tractors are now included in the farm machinery industry, whereas previously they were excluded; (b) Canadian value added is adjusted upwards to a basis comparable to U.S. value added; and (c) the time period for comparison is extended.

In the United States, up to and including 1957, farm tractors were included with other tractors in the Standard Industrial Classification (SIC) industry category SIC 3521, while all other farm machinery was included in SIC 3522. In 1958, SIC 3521 was discontinued and its constituent products were allocated to other industries. Tractors for agricultural use were included with other farm machinery in SIC 3522. From 1958 to the present, SIC 3522 gives a more complete picture of farm machinery production. The problem that arises is that for the period prior to 1958 farm tractors have to be extracted from SIC 3521 and included with other farm machinery in such a way as to construct statistics for SIC 3522 for the years prior to 1958 on a basis comparable to the statistics included in the industry after 1957.

In the tractor industry, SIC 3521 farm tractors and other products were produced. It is necessary, therefore, to calculate the proportion of farm tractors to total production. This will provide the percentage in which inputs are divided between farm tractors and other products in SIC 3521. However, the ratio of farm tractors to total production in SIC 3521 can only be calculated in census years, because value of shipments of farm tractors from SIC 3521 in intercensal years is not published. Hence, to estimate such a ratio for each non-census year, published product statistics are used. Product statistics of farm tractors produced by all industries are used in the numerator of the above ratio. The assumption is that nearly all farm tractors are produced in SIC 3521; thus the product statistics act as a good proxy for the output of farm tractors in SIC 3521. An examination of two census years reveals that for 1947, 94.2%, and for 1954, 97.8% of farm tractors were produced in SIC 3521. A check on this procedure was made by comparing it with data published by the U.S. Bureau of the Census for 1958. For this year only, the Bureau indicates

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23/ Fullerton, op. cit., p. 263.

that 47.6% of the value added for SIC 3521 was allocated to SIC 3522.[24/] The present procedure estimated that in 1957, 44.7% of the value added of SIC 3521 was allocated to SIC 3522. The procedure adopted probably provides a reasonable estimate of farm tractor inputs and outputs prior to 1958, but obviously makes the productivity comparison from 1947 to 1957 less reliable than for the remaining years.

The method employed to estimate U.S. value of shipments and value added for farm machinery and tractors is shown in Appendix Table A3.

The procedure used to adjust upwards Canadian value of shipments and value added to the same basis as U.S. statistics was described in Chapter 2. Using the reports made by individual firms to the Dominion Bureau of Statistics, it was possible to make the adjustments for the years 1960 to 1966. Adjustments for 1947 to 1959 were estimated on the basis of the average change that occurred in the 1960 to 1966 period. As a result of this procedure, the productivity comparison from 1947 to 1959 was less reliable than that for 1960 to 1966. The average upward adjustment for value added, 1960 to 1966, was 29.3%. A complete listing of the pre- and post-adjusted figures is shown in Appendix Table A2.

Labour Productivity Ratios

The three ratios that use value added in current dollars show labour productivity in Canada about 78% of that in the United States for the period 1960-66, and about 80% for the longer period, 1952-66. Labour productivity in Canada measured in constant dollars is about 81% and 83% of that in the United States for 1960-66 and 1952-66, respectively. The small discrepancy between these two sets of figures is due to differences between the two countries in the rates of price increase, shown in Table A4.[25/] However, even if the lower figure is accepted, the productivity gap is considerably narrower than the 68.1% figure quoted in the earlier study.[26/] The productivity gap shows a fairly high degree of

24/ U.S. Census of Manufactures, 1958, p. 35A-6.

25/ The difference is somewhat arbitrary since it depends on the year chosen as the base for the index, which in this case was 1956.

26/ Fullerton, op. cit., p. 263.

TABLE 7

LABOUR PRODUCTIVITY IN THE FARM MACHINERY INDUSTRY, CANADA AND UNITED STATES, AND CANADA AS PERCENTAGE OF UNITED STATES, 1947-66

Year	Numerator / Denominator:	Value Added (current dollars)									Value Added (constant dollars)								
		Production Workers			Total Employees			Man-Hours Paid			Production Workers			Total Employees			Man-Hours Paid		
		Can.	U.S.	Can. U.S.	Can.	U.S.	Can. U.S.	Can.	U.S.	Can. U.S.	Can.	U.S.	Can. U.S.	Can.	U.S.	Can. U.S.	Can.	U.S.	Can. U.S.
1947		3.61	4.42	81.67	3.09	4.42	69.9	--	2.56	--									
1948		5.29	--	--	4.37	--	--	2.42	--	--									
1949		7.39	7.60	97.23	6.00	6.07	98.84	3.46	3.72	93.01									
1950		6.72	8.78	76.53	5.45	6.94	78.53	3.29	4.21	78.14									
1951		6.70	9.02	74.27	5.45	7.17	76.01	3.27	4.26	76.76									
1952		8.22	9.33	88.10	6.72	7.24	92.81	4.01	4.50	89.11	9.55	9.79	97.54	7.81	7.59	102.89	4.66	4.71	98.93
1953		9.31	9.63	96.67	7.22	7.33	98.49	4.60	4.65	98.92	9.60	10.04	95.61	7.45	7.65	97.38	4.75	4.85	97.93
1954		7.11	9.37	75.88	5.39	7.09	76.02	3.47	4.56	76.09	8.26	9.78	84.45	6.26	7.40	84.59	4.03	4.76	84.66
1955		7.88	10.23	77.02	6.00	7.88	76.14	3.81	4.86	78.39	8.22	10.59	77.62	6.26	8.16	76.71	3.98	5.03	79.12
1956		9.16	10.50	87.23	6.77	7.98	84.83	4.43	5.05	87.72	9.16	10.50	87.23	6.77	7.98	84.83	4.43	5.05	87.72
1957		10.29	10.79	95.36	7.74	8.11	95.43	4.53	5.23	86.61	9.91	10.31	96.12	7.45	7.75	91.12	4.36	4.99	87.37
1958		9.43	13.20	71.43	7.15	9.72	73.55	4.33	6.43	67.34	8.71	12.11	71.92	6.61	8.92	74.10	4.00	5.90	67.79
1959		9.65	13.27	72.72	7.51	9.94	75.55	4.59	6.30	72.85	8.76	11.81	74.17	6.82	8.85	77.06	4.17	5.61	74.33
1960		11.36	12.84	88.47	8.19	9.21	88.92	5.54	6.20	89.35	10.22	11.20	91.25	7.37	8.04	91.66	4.99	5.41	92.23
1961		11.74	13.98	83.97	8.15	10.41	78.29	5.73	6.70	85.52	10.36	11.98	86.47	7.20	8.92	80.71	5.06	5.74	88.15
1962		11.59	16.73	69.27	8.54	12.15	70.28	5.60	7.92	70.70	10.07	14.06	71.62	7.42	10.21	72.67	4.86	6.66	72.97
1963		13.32	16.95	78.58	10.30	12.74	80.84	6.26	8.01	78.15	11.38	14.03	81.11	8.79	10.55	83.31	5.34	6.63	80.54
1964		14.23	18.27	78.88	10.92	13.89	78.61	6.65	8.49	78.32	12.19	14.89	81.86	9.35	11.32	82.59	5.69	6.92	82.22
1965		14.43	19.34	74.61	11.14	14.74	75.57	6.85	8.98	76.28	12.28	15.46	79.43	9.49	11.78	80.56	5.84	7.18	81.33
1966		15.20	21.12	71.96	11.88	16.18	73.42	7.10	--	--	12.50	16.40	76.21	9.77	12.56	77.78	5.84	n.a.	n.a.
Averages																			
1947-51		5.94	7.45	82.42	4.87	6.15	80.82	3.11	3.69	82.64	--	--	--	--	--	--	--	--	--
1952-59		8.88	10.79	83.05	6.81	8.16	84.10	4.22	5.20	82.13	9.02	10.62	85.58	6.93	8.04	86.08	4.91	5.11	84.73
1960-66		13.12	17.03	77.96	9.87	12.76	77.99	6.25	7.72	79.72	11.29	14.00	81.14	8.48	10.48	81.33	5.37	6.42	82.91
1952-66		10.86	13.91	80.51	8.24	10.46	81.25	5.17	6.46	80.92	10.08	12.31	83.36	7.65	9.18	83.71	4.80	5.67	83.82

Source: Appendix Tables A5 and A6.

TABLE 8

ANNUAL PERCENTAGE CHANGE IN LABOUR PRODUCTIVITY IN THE FARM MACHINERY INDUSTRY, CANADA AND UNITED STATES 1952-66

Year	Numerator / Denominator: Value Added (constant $) / Production Workers		Total Employees		Man-Hours Paid	
	Can.	U.S.	Can.	U.S.	Can.	U.S.
1952	0.52	2.55	-4.60	0.79	1.93	2.97
1953	-13.95	-2.58	-15.97	-3.26	-15.15	-1.85
1954	-0.45	8.28	0	10.27	-1.24	5.67
1955	11.43	-0.84	8.14	-2.20	11.30	0.39
1956	8.18	-1.80	10.04	-2.88	-1.58	-1.18
1957	-12.10	17.45	-11.27	15.09	-8.25	18.23
1958	0.57	-2.47	3.17	-0.78	4.25	-4.91
1959	16.66	-5.16	8.06	-9.15	19.66	-3.56
1960	1.36	6.96	-2.30	10.94	1.40	6.09
1961	-2.79	17.36	3.05	14.46	-3.95	16.02
1962	13.00	-0.21	18.46	3.33	9.87	-0.45
1963	7.11	6.12	6.37	7.29	6.55	4.37
1964	0.73	3.82	1.49	4.06	2.63	3.75
1965	1.79	6.08	2.95	6.62	0	n.a.
Averages						
1952-59	1.36	1.93	-0.30	0.98	1.36	1.97
1960-65	3.53	6.69	5.00	7.78	2.75	5.96
1952-65	2.29	3.97	1.97	3.90	2.11	3.50

Source: Table 7.

variation from year to year, and this is, of course, due to annual variations in labour productivity within each country. One reason for this is that productivity growth has varied between countries. However, it must also be mentioned that the returns made by individual firms to the Dominion Bureau of Statistics showed considerable year-to-year variations. At times these variations appear to have been due to changes in the bases used by the firms to report statistics, and some doubt exists about the consistency and accuracy of these reports when, for example, it is found that the closing inventory reported by a firm one year is not the opening inventory reported in the subsequent year. Because the industry is highly concentrated, lack of consistency by one or two large firms can have a marked impact on the aggregate statistics.

The average annual percentage increase in labour productivity was lower in Canada than in the United States for both the period 1960-66, and for the longer period 1952-66. The higher rate of productivity increase in Canada in recent years is probably due to the changes which took place in Massey-Ferguson and Cockshutt -- the opening of the North American combine plant by Massey at Brantford, and the rationalization of the Cockshutt plant after the firm was taken over by the White Motor Company.[27/]

A number of serious problems have already been noted concerning both the comparability of the Canadian and U.S. statistics, as well as the consistency of statistics within each country over time. A detailed examination of the definitions and concepts used in connection with published data is made in the Appendix, and apart from the aforementioned problems, no other significant differences occur that would undermine the findings. However, it must be emphasized that the productivity comparison is an estimate only.

Although the statistics reveal that the productivity gap in the farm machinery industry is narrower than was previously estimated, there still appears to be a gap, so that two questions are in order. First, is it likely to become larger or smaller? And secondly, what accounts for it?

27/ See Chapter 3.

The answer to the first question depends on the assumption made about productivity change. Assuming the average annual rate of productivity change per worker experienced from 1960 to 1966, then the gap (Canada 80% of the United States) would widen: assuming the productivity change conditions which prevailed from 1947 to 1966, then the gap would also widen, but at a slower rate. The exceptionally high rate of productivity change in Canada from 1960 to 1966 was probably due to developments in two companies -- Massey-Ferguson and Cockshutt -- which it would be unwise to assume would be repeated for these or other companies in Canada. Indeed, the demand by Canadian farm machinery workers for wage parity with comparable U.S. workers has led a large farm machinery firm to indicate[28/] that it will concentrate future expansion in the United States rather than in Canada.

The reasons for the productivity gap are examined below in terms of differences in (1) the output of the industry, including certain general characteristics of the industry; and (2) the inputs used by the industry. The discussion in Chapter 3 is the basis for the discussion in this section.

1. Differences in industry output and related factors

The industry in Canada is much smaller than that in the United States, although its relative position in the manufacturing sector of each economy is very similar. Larger absolute industry size may permit more firms to produce at optimum (technologically efficient) scale and thus permit greater productivity.[29/] However, Canada has a larger proportion of its output emanating from large establishments, and assuming that economies of scale are important, this should boost productivity in Canada.[30/] Data on the size distribution of establishments do not therefore suggest a useful explanation of the productivity gap.

The degree of vertical integration in the industry is slightly higher in Canada.[31/] If this relates to the production of the same type of goods in both countries, vertical integration might provide a useful explanation of productivity differences. However,

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28/ Massey-Ferguson Industries Limited, Brief to the Royal Commission on Farm Machinery, 1967, pp. 44-45.

29/ See Tables 1 and 2.

30/ See Table 4.

31/ See Table 3.

the distribution of goods produced differs between Canada and the United States, the main difference being that there is an emphasis on harvesting machinery, especially combine harvesters, in Canada, and on tractors in the United States.[32/] This difference in the composition of output could give rise to lower labour productivity in Canada providing that more labour-intensive operations and products are produced in Canada than in the United States. For the industry as a whole, we would therefore expect that combine production was more labour-intensive than tractor production; that certain types of manufacturing operation were more labour-intensive; and that these operations tended to be concentrated in Canada.[33/] This last characteristic should be reflected in differences in the degree of vertical integration between the two countries, but the data do not support this expectation.[34/]

If the industry in each country differs, either in the extent to which the production of farm machinery takes place in establishments other than those included in the farm machinery industry, or in the extent to which products other than farm machinery are produced in farm machinery establishments -- i.e. differences in the coverage and specialization ratios -- then these differences may account for the productivity gap. However, such differences as do exist do not appear to be very significant.[35/]

In summary, of the observed differences noted above, the only one that can help explain the productivity gap is the difference in the composition of output between the two countries. Another difference -- the proportion of output from large establishments -- suggests that, for this reason, labour productivity should be higher in Canada.

32/ See Table 5.

33/ For example, if "assembly" is more labour-intensive than "processing", "assembly" operations would tend to be concentrated in Canada, and the degree of vertical integration of the Canadian industry would be less than that of the U.S. industry.

34/ See Table 3. The reliability of the measure of vertical integration is discussed in Chapter 3.

35/ See Table 6.

2. Differences in industry inputs

Capital -- One reason for the productivity gap is likely to be the differences in capital per worker in the two countries, a factor that strongly influences labour productivity. Unfortunately, no data are available for comparing the capital stock of the industry in the two countries. However, data are available for investment in the industry in each country, i.e. for *additions* to the capital stock. Gross investment per worker will provide a rough indication of both the need to replace worn-out capital and the desire to add new capital. If investment per worker has been consistently higher in one country, then it is likely that either the stock of capital per worker was larger to begin with, or there has been an attempt to modernize the industry by increasing capital per worker and thus increasing labour productivity. Thus higher investment per worker in one country is not conclusive evidence that capital per worker is also higher in that country, since higher investment per worker may indicate a drive to modernization.[36/]

Gross investment per production worker in Canada was, on the average, about 100% of that in the United States for the period 1949 to 1966, while the comparable percentages for 1960 to 1966, and 1949 to 1959 were 134.6% and 79.2%, respectively (Table 9). If we assume that the stock of capital per worker, throughout this period, has been higher in the United States, then the improved investment performance by the Canadian industry in recent years may have been due to attempts to modernize the industry in Canada, such as the developments at Massey-Ferguson and Cockshutt.[37/] This conclusion would be consistent with the findings that there is a productivity gap, but that the gap has been widening at a lower rate in recent years.[38/]

36/ This estimation procedure has been used by J.B. Heath in "British and Canadian Industrial Productivity", Economic Journal, Vol. 67, 1957, pp. 674-678.

37/ See Chapter 3. John Deere spent $2.5 million on its Welland factory in 1965 and International Harvester $4.5 million on its Hamilton works in 1967.

38/ Professor David Schwartzman commented to the author that the difference in capital per worker between European industry as a whole and U.S. industry as a whole does not contribute a large part of the difference in total productivity between the two countries, despite the large difference in capital per worker, and that the same is likely to be true for the farm machinery industry between Canada and the United States.

TABLE 9

GROSS INVESTMENT[1/] PER PRODUCTION WORKER IN THE FARM MACHINERY INDUSTRY, CANADA AND UNITED STATES 1947-66

Year	Canada	United States	Year	Canada	United States
	$	$		$	$
1947	n.a.	709.4	1957	555.3	495.2
1948	397.8	n.a.	1958	662.2	604.2
1949	305.7	382.2	1959	352.7	515.6
1950	253.9	359.1	1960	758.5	755.9
1951	303.9	407.3	1961	1,113.9	607.6
1952	421.8	461.8	1962	411.0	596.4
1953	384.6	590.3	1963	1,665.3	822.0
1954	335.8	596.5	1964	1,956.8	1,000.7
1955	268.3	559.1	1965	1,180.0	1,076.6
1956	475.2	499.5	1966	994.4	1,208.0

1/ Gross investment measured in current dollars.

Source: Appendix Tables A5 and A6.

Labour -- Considerable research has been undertaken into the characteristics of the Canadian labour force, and comparisons of these characteristics have been made with the U.S. labour force. Some of the differences in labour productivity may be accounted for by differences in the quality of labour. If, for example, a worker's performance is affected by the extent of formal education that he received before he entered the labour force, then the fact that the educational attainment of the labour force in Canada is lower than that in the United States may be a relevant consideration.

Research based on questionnaires and interviews suggests that there is no fundamental difference between a Canadian and a U.S. worker, and that each is as productive as the other in the same set of circumstances,[39/] i.e. given the same process equipment and the same input materials to produce the same input. This is a somewhat

39/ See J.H. Young, "Some Aspects of Canadian Economic Development", (Unpub. diss., Cambridge University, 1955); M.E. Kreinin, "Comparative Labor Effectiveness and the Leontief Scarce-Factor Paradox", American Economic Review, Vol. 55, March 1965, pp. 131-139; National Industrial Conference Board, Costs and Competition: American Experience Abroad, New York, 1961, p. 54.

surprising result, given the differences in educational attainment mentioned above, and given some peripheral evidence based on research in psychology, which suggests that educational level may be a determinant of work effectiveness and thus productivity.[40/]

For 1965, it has been shown that for the population aged 17 and over, 52.1% had completed high school or better in the United States as opposed to 25.4% in Canada;[41/] also, in the 15 to 19 and 20 to 24 age groups, the percentage of the total male population still enrolled in educational institutions was markedly higher in the United States than in Canada in 1960-61 and has been since 1930-31.[42/] The fact that the United States devotes greater attention to formal education than does Canada may help to explain differences in productivity between the two countries.

An indication of the lower skills of the Canadian labour force is provided by a comparison of the job-content of the Canadian and American economies. In this study, jobs are rated according to the skill required for their performance. In the United States, a larger proportion of the labour force performs highly skilled jobs than in Canada. Since this could be due to differences in the structure of the two economies, further analysis was undertaken, and it was found that within any particular class of occupations, such as administration or vehicle operation, there is greater employment in Canada in jobs requiring lower levels of skill. Therefore, in the case where the same occupation is performed in the two countries it is performed by people with lesser skills in Canada.[43/]

40/ See Psychological Abstracts, Vol. 42, p. 113; N.E. Bergstrom, "Job Performance of Young Workers in Relation to School Background", Vol. 40, p. 565; J.A. Plag and J.E. Hardacre, "Age, Years of Schooling and Intelligence as Predictors of Military Effectiveness for Naval Enlistees", Vol. 39, p. 972; C.J. Judy, "Contribution of Education to the Rated Effectiveness of Weather Officers", Vol. 38, p. 339; C.J. Judy, "Contribution of Education to the Rated Effectiveness of Officers in Scientific and Engineering Assignments".

41/ Educational Attainment of the Canadian Population and Labour Force 1960/65, Special Labour Force Studies No. 1, DBS 71-505, Occasional, Ottawa, Queen's Printer, p. 18.

42/ Economic Council of Canada, Second Annual Review, Ottawa, Queen's Printer, 1965, p. 83.

43/ The Job Content of the Canadian Economy/1941-61, Special Labour Force Studies No. 3, DBS 71-507, Occasional, Ottawa, Queen's Printer, 1967.

It is not possible to determine whether these characteristics of the aggregate population and labour force apply to the farm machinery industry in Canada and the United States, nor whether these characteristics actually influence labour productivity. However, it is not unreasonable to suggest that the skill and educational attainment of the labour force is a relevant consideration in explaining differences in labour productivity, and that labour in the farm machinery industry in Canada and the United States displays characteristics similar to those for the total labour force in each country.

Management -- A major unknown factor is the effect of management on productivity. On *a priori* grounds, it would seem that management might play a crucial role in affecting productivity. In particular, management's role as a co-ordinator of activities, as a provider of incentives to work, and as a transmitter of new technology from outside the firm to its use in the firm, could have a strong bearing on productivity performance. The only empirical evidence to support this view is statements made by management consultants, stressing both the importance of management to a firm's performance and the great need in Canada for upgrading the managerial input.

The quality of management might be judged by the formal qualifications of management in the two countries, such as differences in the educational attainment of Canadian and U.S. managers. Only very indirect evidence is available to assess this question. There does appear to be, in Canada, a shortage of university facilities for graduate work in commerce, which is an important training ground for managers, since the largest single group of Canadian students undertaking graduate work in the United States are students studying commerce.

In addition, Professor D. Armstrong of McGill has noted that Canadian universities produce only one-seventh the number of M.B.A.'s per thousand of population turned out in the United States.[44/] A recent study in Canada also emphasizes the lack of educational training given to Canadian managers.[45/]

44/ Information obtained in correspondence with Professor Armstrong.

45/ Foreign Ownership and the Structure of Canadian Industry, Ottawa, Queen's Printer, 1968, pp. 19, 78, 102, 226.

However, more evidence is required as to whether Canadian universities emphasize training in commerce as much as U.S. universities and, since not all managers are commerce-trained, whether Canadian managers have as much formal education and as many university degrees as managers in the United States. The question of whether management uses labour as carefully when labour is cheap also needs to be examined.

3. Productivity between Canadian firms

As a result of detailed information of the Canadian farm machinery companies collected for the Commission, it is possible to compare the variations in productivity by size of company in Canada.[46/] For purposes of comparison, 17 companies were divided into two groups: large companies (4) and small companies (13). The large companies dominate the scene, accounting for 80% of production in 1966.

The following observations can be made:

(1) From 1960 to 1966, direct labour costs as a percentage of total costs were lower for the larger than for the smaller companies, indicating that labour productivity is probably higher in the larger companies. This finding may not be reliable since it is not known whether all companies make a uniform distinction between direct and indirect labour.

(2) From 1962 to 1966, the large companies had about 97% of the physical plant of the reporting companies; physical plant per dollar of sales was three times as great in the large companies as in the small, thus suggesting higher capital intensity in the large companies.

(3) From 1960 to 1966, net fixed assets per production worker and per employee were triple and double respectively, in the large companies; capital expenditures per dollar of gross assets were also higher in the large companies.

In sum, the superior labour productivity of the large companies is likely due to their greater use of capital. Moreover, the large companies are undertaking more investment per dollar of

46/ Although the information is detailed where reported, a number of companies did not report certain information for all years requested, and thus the observations made are tentative ones only.

assets than the small companies, and thus it is the large companies that are the main contributors to increasing productivity. (It has been noted above that the rate of productivity change is greater in Canada than in the United States.) Thus Canadian industry has a dual aspect -- a capital-intensive sector and a labour-intensive sector. It is the few firms in the capital-intensive sector that produce most of the output, while the fringe of labour-intensive firms is of lesser importance in this respect.

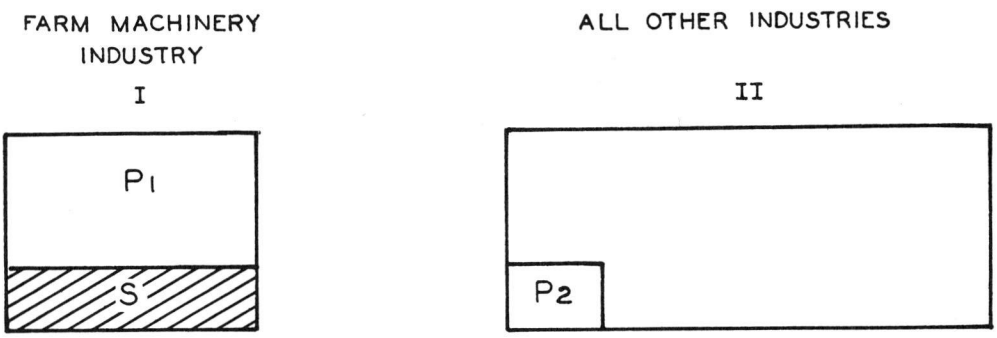
APPENDIX

DATA SOURCES

Sources of Published Industry Statistics

Industry statistics published by official agencies in Canada and the United States refer to the input and output of products by industries and the output of products by type of product. An example will be used to explain exactly what the data refer to.

The "farm machinery" industry in each country contains all those establishments whose "primary" production is farm machinery. However, these establishments will produce "secondary" (i.e. non-farm machinery) products, and establishments in other industries will produce farm machinery as "secondary" products.



I -- Contains all establishments whose "primary" production is farm machinery (P^1) but which produce "secondary" products (S)

II -- Contains all other establishments in all other industries, some of which produce farm machinery as "secondary" products (P^2).

(1) Total shipments of I = $P^1 + S$

(2) Total shipments of farm machinery from I = P^1

(3) Total shipments of farm machinery (from I and II) = $P^1 + P^2$

(4) Specialization ratio = $\frac{P^1}{S + P^1}$

(5) Coverage ratio = $\frac{P^1}{P^1 + P^2}$

The above information refers to industry and product outputs. It is generally possible to obtain inputs by industry but not by products. Thus one can obtain data on inputs for $P^1 + S$ but not for $P^1 + P^2$ nor for P^1 alone. Therefore, in discussing the "farm machinery" industry it must be recognized that not all farm machinery production is included; that the industry produces other than farm machines; and that inputs for the "farm machinery" industry are used to produce goods other than farm machines. The extent to which one can generalize about the "farm machinery" industry will therefore depend on the specialization and coverage ratios.

1. Canadian statistics

The main official sources of industry and product statistics in Canada are as follows:

(1) "The Agricultural Implement Industry", Annual Census of Manufactures, DBS 42-202. This contains:
   (a) Shipments of primary and secondary products from the industry ($P^1 + S$).
   (b) Shipments of farm machinery from other industries (P^2). (Sometimes P^2 is quoted in the introductory notes but in recent years it has had to be calculated from information in Tables 7 and 8-K.)
   (c) Inputs (such as labour, materials, fuel and electricity) used to produce for $P^1 + S$ but *not* inputs used for $P^1 + P^2$ or for P^1 alone.

(2) Farm Implement and Equipment Sales, DBS 65-203. This contains:

Total sales of farm machinery produced domestically and abroad. Sales figures refer to products used by farmers as farm machinery. In some cases these products may not be produced by establishments in the agricultural implement industry. For example, irrigation equipment is included in "sales" but is not produced in the "industry". The valuation of sales (retail units sold times wholesale prices) is not the same as the valuation of producers' shipments (shipments times f.o.b. plant price) where f.o.b. price is less than wholesale price.

Reports by establishments are made to the Dominion Bureau of Statistics on a fiscal-year basis, which is usually around October 31st. It appears that the reports have been made at this time for a number of years, so that the data are comparable over time.

2. U.S. statistics

The main official sources of industry and product statistics in the United States are as follows:

Census of Manufactures -- 1947, 1954, 1958 and 1963.
Annual Survey of Manufactures -- Annual
Current Industrial Reports -- Annual

(1) The Census of Manufactures contains the most complete information on inputs and outputs at the industry level, and information on outputs by products (although not inputs by products). Therefore, from the Census it is possible to obtain the following type of information (all table references are to 1958 Census):

(a) Shipments of "primary" products (P^1) and "secondary" products (S) from establishments in the industry. Some breakdown of P^1 can be obtained (Table 5A 35A-9 and Table 5B 35A-10).

(b) Inputs required for total shipments (P^1 + S) but *not* for P^1 only (Table 8 35A-29).

(c) Shipments by products (5- and 7-digit level) of farm machinery from establishments in *all* industries (P^1 + P^2) but *not* inputs for these shipments (Table 5B 35A-10, also Table 6A 35A-13).

(2) The Annual Survey of Manufactures is based on a sample of manufacturing establishments in each industry. It contains statistics of inputs and outputs by industry (P^1 + S), and details of outputs only by products from all industries (P^1 + P^2).

The following type of information can be obtained (all table references are to 1957 Annual Survey):

(a) Total shipments from the Farm Machinery Industry (SIC 3522) -- (P^1 + S). Also employees and value added for total shipments (and materials in later years) -- (Table 1, pp. 24-5). Total shipments can then be divided into two categories (P^1 and S) by use of the specialization ratio. "Primary" products produced outside the industry (P^2) can be calculated by use of the coverage ratio (Table 2, p. 31). In the Census the primary products at the 5-digit level are individually specified, whereas in the Annual Survey they appear in one group.

(b) Individual "primary" product shipments are shown (at the 5-digit level) as they relate to *all* industries only (P^1 + P^2); i.e. it is not possible from the Annual Survey to state the proportion of "harvesting machinery" that is produced outside and inside SIC 3522 (table on p. 105), but it is possible to state the proportion of all farm machinery that is produced inside and outside SIC 3522 -- see (a) above.

(c) Expenditures for new plant and equipment by industry -- 4-digit (P^1 + S) -- (Table 3, p. 118).

(d) Fuel and Electric Energy by industry group -- 2-digit only (P^1 + S) -- (Table 1, p. 121).

(e) Value of Manufacturers' Inventories by industry -- 4-digit (P^1 + S) -- (table on pp. 140-1).

(f) Production and Shipments of *selected* products by all industries -- 5- and 7-digit level (P^1 + P^2) -- (table on p. 192).

(3) The Current Industrial Reports (earlier entitled Facts for Industry) report product statistics from *all* manufacturing establishments (P^1 + P^2). The product categories are not as comprehensive as those reported in the Census. No input data are reported.

Comparability of Canadian and U.S. Data

The purpose of this section is to examine the comparability of Canadian and U.S. published statistics of the farm machinery industry from 1947 to 1966.

Comparability can be affected by the different use of concepts in the two countries, and by changes in the concepts within each country over time. For example, does a "production worker" include a "working" foreman in both countries, and has the definition of a "production worker" remained the same within each country? Differences that arise for either of these reasons can lead to faulty conclusions being derived from the use of published data. A number of differences do exist. They are discussed below and an attempt is made to show the direction in which they will affect the comparisons that are made.

Each statistical series that is used is examined and the differences are noted. However, there were some changes that took place in each country that affect all the statistics in that country. These changes are discussed for (a) Canada and (b) the United States. This is followed by (c), an examination of any further changes that may have affected the comparability of particular statistical series used in the study.

1. Canada

Changes in the methods of gathering industrial statistics in Canada have occurred from time to time, and these changes are published under "Explanatory Notes" and "Concepts and Definitions" in the annual industry reports (e.g. DBS 42-202 for the Agricultural Implements Industry).

These "notes" and "definitions" are of a very general nature, and the same notes and definitions are published in most industry reports. Thus changes in the method of recording statistics, which is noted from time to time, may be much more significant for some industries than for others. The only way to assess the impact of the changes for a particular industry is to consult with the Dominion Bureau of Statistics. Such consultations were held with members of the staff of the Dominion Bureau of Statistics who were familiar with the agricultural implements industry. The changes discussed here deal only with the consistency of the statistics from 1947 to 1966.

The main changes in the method of collecting industrial statistics occurred in 1960, 1961 and 1962. The changes that took place in each of these years, respectively, were:

- the adoption of the new Standard Industrial Classification (SIC)
- the adoption of the new establishment concept
- the adoption of the "total activity" concept for each establishment.

Together, these changes can be viewed as altering the basis on which all data are collected for each industry.

The changes and their effects on the statistics can be shown, since for a number of years the statistics are available on both the pre-change and post-change basis. After the changes were made, the Dominion Bureau of Statistics calculated the data back to 1957 on the new basis (Table A1).

The change to the new SIC eliminated some establishments from the agricultural implements industry. The number of establishments decreased by less than 10 and this had the effect of decreasing the value of shipments by about 3% and the total employed by about 4%. Therefore, value added per employee rose only slightly as a result of this change.

The further change to the new establishment concept[47/] made only minor changes (downwards) to the effect of the new SIC (Table A1, columns B and C) on value added.

For purposes of historical analysis, using the time-series data of value of shipments, employees, and value added, there is a break in the data at 1956-57, with the data from 1957 onwards being 3% to 4% lower than that for the earlier period.

The effect of the adoption of the "total activity" concept[48/] can be shown for 1961 only, when the data are available on both bases (i.e. the new SIC and new establishment concept base -- Base I, and the new SIC, new establishment and total activity base -- Base II).

47/ The new establishment concept and the total activity concept are explained in detail in DBS 42-202 - 1962, pp. 15-21. These changes affected value of shipments, inventories, head office activities and total employees -- only the net effects of these changes are discussed in the text.

48/ Ibid., pp. 15-21.

TABLE A1

COMPARABILITY OF STATISTICS AS A RESULT OF CHANGE TO NEW S.I.C.
AND CHANGE TO NEW ESTABLISHMENT CONCEPT FOR
FARM MACHINERY INDUSTRY IN CANADA

Year	Number of Establishments			Value of Shipments $'000			Total Employees			Value Added $'000		
	A	B	C	A	B	C	A	B	C	A	B	C
1957	70	64	63	122,529	118,077	118,044	10,271	9,736	9,725	58,174	n.a.	n.a.
1958	71	63	62	133,145	129,202	129,176	11,011	10,535	10,526	60,537	n.a.	58,240
1959	71	64	63	170,743	166,197	166,192	13,579	13,062	13,056	78,007	n.a.	75,901

Notes: A-Columns show data before either change was made.
B-Columns show data after change to new S.I.C.
C-Columns show data after change to new S.I.C. and change to new establishment concept.

Source: A-Columns DBS 42-202, 1958 and 1959.
B-Columns DBS 42-202, 1960.
C-Columns DBS 42-202, 1961.

The number of establishments was the same on both bases; the value of shipments increased by 0.7% with Base II; total employees declined 4% with Base II; and value added increased 0.1% with Base II.[49/] The effect of this change does not appear to be large, but it creates a break in the time series at 1960-61.

In sum, for the agricultural implements industry the impact of the new SIC resulted in the data being 3% to 4% lower from 1957 on. The further impact of the new establishment concept and the total activity concept appears to have been slight. This conclusion was confirmed in discussion with members of the Dominion Bureau of Statistics.

2. United States

In 1958 a new Standard Industrial Classification was introduced. Prior to 1958, farm machinery and farm tractors were in separate industry classifications. From 1958 on, farm tractors were included with farm machinery.[50/] In order to obtain a consistent series for the industry in the United States, farm tractors were added to farm machinery in the pre-1958 period. The procedure used for obtaining this new series is shown in Tables A1 and A2, and discussed in Chapter 4. This adjustment resulted in the industrial classification for farm machinery in Canada being similar to that in the United States.

3. Other Changes

(1) Establishment

The concept of the establishment appears to be very similar in both countries.[51/] The main difference that exists is as follows. In the United States only establishments employing one or more persons are included in the Census and Annual Survey. In 1958, in all industries, there were 50,000 establishments with no employees, i.e. one-man operations, and these produced 0.25% of the value of shipments.[52/]

49/ DBS 42-202 - 1962, p. 4.

50/ U.S. Census of Manufactures, 1958.

51/ U.S. Census of Manufactures, 1963, p. 7; DBS 42-202 - 1963, p. 17.

52/ U.S. Census of Manufactures, 1958, p. 5.

In Canada, there is no cut-off limit for small enterprises. The criterion for inclusion or non-inclusion is whether the operating entity is capable of reporting the principal statistics.[53/] It is not felt that this difference affects the comparability of the series significantly.

(2) Employees

In both countries total employees can be divided between "production and related" and "all other" employees. The content of these two sub-categories is very similar.[54/]

Differences do exist in the date and the number of times each year at which establishments in each country were asked to report their employees for the census. And in the United States the reporting dates have changed over time.[55/] It is not felt that these differences or changes would seriously affect the comparability of the data.

In Canada prior to 1961, total employees = production workers + administrative and office employees; in the latter category "working owners and partners" were included. From 1961 on, "working owners and partners" are excluded from total employees. This change means that the "total employees" definition is in line with that of "employees" in the DBS monthly employment survey. For purposes of historical comparison, the number of "working owners and partners" should be added to total employees from 1961 on.[56/]

(3) Salaries and Wages

In both countries "salaries and wages" refer to gross earnings and include commissions and compensation in kind.[57/]

In the United States, the salaries of corporate officers are included, but payments to working owners and partners are excluded. In Canada, withdrawals by working owners or partners for normal living expenses for self and family are included with salaries up

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53/ DBS 42-202 - 1963, p. 17.

54/ U.S. Census of Manufactures, 1963, pp. 15-16; DBS 42-202 - 1963, pp. 18-19.

55/ U.S. Census of Manufactures, 1963, pp. 15-16.

56/ DBS 42-202 - 1962, p. 18. In order to obtain the number of administrative and office employees from 1961, subtract the number of production and related workers from total employees; e.g., in 1961, 10,058 - 6,986 = 3,072, ibid., p. 4.

57/ U.S. Census of Manufactures, 1963, p. 16; DBS 42-202 - 1963, p. 19.

to 1961, but after 1961 they are shown separately. The "salaries and wages" of total employees are only exactly comparable between the two countries after 1961; however, withdrawals of "working owners and partners" in Canada represented less than 0.2% of the total of withdrawals, salaries and wages.[58/] Thus the degree of non-comparability is insignificant.

(4) Materials

The cost of materials include most of the same items in both countries. Fuel and electricity are included in the total cost of materials in the United States, but are specified separately in Canada. Therefore, to obtain a comparable series in both countries, it is necessary, for Canada, to add fuel and electricity to cost of materials.[59/]

In the United States, the cost of products purchased for resale without further processing was excluded from material costs prior to 1958, and included from 1958 on.[60/] In Canada, cost of materials relates to manufacturing activity only and not to reselling activity. Non-comparability therefore exists from 1958 on.

In the United States, cost of resales represented less than 5% of total cost of materials in 1963 and about 8% in 1958. These two years are census years in the United States. Cost of resales is recorded in the Census, but not in the Annual Survey of Manufactures so that for the other years since 1958, data are not available. A rough estimate would be that, from 1958 on, cost of materials in the United States is biased upwards by about 5% to 10%, relative to the basis on which cost of materials data are collected in Canada. The impact of this difference on value added is described in Section (7) below.

(5) Inventories

In examining the data submitted by individual firms to the Dominion Bureau of Statistics, it was found that, from time to time, there were discrepancies between the closing inventory for one year and the opening inventory for the next year, e.g. for

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58/ DBS, ibid., p. 8.

59/ U.S. Census of Manufactures, 1963, p. 17; DBS 42-202 - 1963, p. 19.

60/ U.S. Census of Manufactures, 1958, p. 10; DBS 42-202 - 1963, p. 19.

raw materials and finished goods inventories. In one case a discrepancy exceeding $1.4M occurred. Such discrepancies will affect the calculation of value added, although it is not felt the distortion will be significant.

The Dominion Bureau of Statistics appears to have assumed that firms reported the value of material inputs actually *consumed* during a given year. In fact, certain firms advised the Commission that they actually reported value of materials *purchased* during the year. Thus, to arrive at materials *consumed* from materials purchased, it is necessary to make an adjustment for inventory changes. Failure to make such an adjustment will also affect value added. A check made by the Commission revealed that value added would be affected by less than plus or minus 2%.[61/]

(6) Value of shipments (VOS)

Shipments are valued f.o.b. plant, after discounts and allowances and excluding taxes in both countries.[62/] In the United States, VOS excludes resales, i.e. goods purchased and sold without further processing prior to 1958, and includes resales from 1958 on.[63/] Therefore, the exclusion of resales in VOS is offset by their exclusion in cost of materials, and when resales are included in VOS, they are included in costs and materials as well. In Canada, resales are excluded from VOS, but after 1961 they are recorded as a separate item, "shipments of goods not of own manufacture".[64/]

VOS is comparable between Canada and the United States up to 1957; after 1957, the U.S. VOS includes resales that in 1958 and 1963 were 3% to 5% of total sales -- these are the only two years in which this percentage can be calculated.[65/] Therefore, it is probable that the U.S. basis for VOS is 3% to 5% higher than the Canadian base after 1957.

61/ The companies gave permission to the Royal Commission to examine their individual returns to the Dominion Bureau of Statistics.

62/ U.S. Census of Manufactures, 1963, p. 18; DBS 42-202 - 1963, p. 20.

63/ U.S. Census of Manufactures, 1958, p. 11.

64/ DBS 42-202 - 1962, Table 2, p. 7. For 1958, 1959, 1960 and 1961, "resales" are not recorded in Canada, so it is not possible to obtain a series comparable to the United States.

65/ U.S. Census of Manufactures, 1958, Table 3, p. 35A-8; U.S. Census of Manufactures, 1963, Table 3, p. 35A-10.

The procedure used to value shipments, as reported to the U.S. Bureau of the Census and the Canadian Dominion Bureau of Statistics, is examined in Chapter 2.

(7) Value added (VA)

VA is, in general, calculated by subtracting cost of materials from VOS. It will therefore be affected by changes in these items as well as differences between these items in the two countries. The following changes occurred in the calculation of VA in Canada:

1947-51 -- Industry output was measured by value of production, and VA = value of production minus cost of materials, fuel and electricity used.

1952-53 -- Industry output was measured by value of shipments, and VA = VOS minus cost of materials, fuel and electricity used.

1954-55 -- VOS was adjusted for changes in inventory of final goods before it was used to calculate VA as for 1952 and 1953.

1956-66 -- VOS was further adjusted for changes in inventory of goods in process before VA was calculated.

Thus, from 1947 to 1951 and 1956 to 1966, VA was calculated by subtracting materials, fuel and electricity used from the production that was undertaken. That is to say, inputs were matched against the relevant output. For 1954 and 1955 this matching of inputs with output was partially undertaken by the adjustment made to VOS for final goods inventories (but not inventories of goods in process). In 1952 and 1953 inputs were not matched against output.[66/]

The following changes occurred in the calculation of VA in the United States:[67/]

1947-63 -- VA_u = VOS (excluding resales) minus cost of materials, fuel, electricity and contract work (excluding cost of resales). This is known as unadjusted VA, i.e. VA_u.

66/ See DBS 42-202 - 1954, p. B3. The Dominion Bureau of Statistics indicated that even after the official change from "production" to "shipments", some firms still reported "production" not "shipments" and still do report production statistics for this industry. It is thought that value of production and value of shipments in any one year is very similar.

67/ U.S. Census of Manufactures, 1958, p. 13.

1954-66 -- VA_a = VOS (including resales) minus cost of materials (including cost of resales), fuel, electricity and contract work. Adjustments are also made using this concept of VA for changes in inventories of goods in process and final goods. This is known as adjusted VA, i.e. VA_a.[68/]

4. Summary of the Comparability of Statistics

It should be noted that there is a break in all the Canadian statistical series for the agricultural implements industry between 1956 and 1957 due to the change in the procedure for collecting data (see Sec. 1).

Establishments, Employees, Payroll -- These items are sufficiently comparable between Canada and the United States. The treatment of "working partners" in Canada is not significant for the study because there are so few of them. An adjustment was made to the published industry total of production workers, from 1961 to 1966, by excluding workers at an establishment of one of the companies for reasons of maintaining consistency over the years.

Materials, Fuel and Electricity -- Fuel and electricity are added to cost of materials in Canada to achieve comparability with the United States. Cost of resales, from 1958, are included in cost of materials in the United States but not in Canada.

Value of Shipments -- These are not comparable from 1958 to 1965, since, in the United States, VOS includes resales, and, in Canada, resales are not included, and because of the different method for valuing shipments (see Chapter 2).

Value Added -- From 1954 to 1966, in Canada and the United States, the concept of VA used relates to production undertaken each year. In Canada, this same concept of VA applies for 1947 to 1951, but in the United States, VA, prior to 1954, is calculated using VOS unadjusted for inventory changes.

However, the differing methods of valuing shipments, mentioned above, in the two countries make the direct comparison of VA invalid even for the years 1954 to 1966. A correction of this valuation procedure was made to the Canadian data for the period 1960 to 1966, and estimates were made so as to extend the productivity comparison back to 1947.

68/ VA from 1954 to 1957 was published in both the adjusted and

From 1958 on, in the United States, value of shipments and cost of materials included "resales" and "cost of resales" respectively, which was not the case in Canada.

Therefore, the VA concept in Canada relates to the production of goods of own manufacture, and in the United States to both production and to their reselling activity. This reselling activity contributed to value added 1.7% in 1958 and 1.3% in 1963.[69/] This is a sufficiently small difference so that the series can be used for comparative purposes without creating undue bias.

Development of VOS and VA Series -- The procedure used to develop the VOS and VA series in each country is discussed in Chapter 2 and shown in Tables A2 and A3.

In brief, Table A2 shows that for value shipments, columns 1, 2, and 3 show the data as published by the Dominion Bureau of Statistics using different concepts; column 4 selects observations from the first three columns to provide a series from 1947 to 1966, with the breaks in the series shown by lines; column 5 is the result of adjustments made to column 4 on the basis of information provided by the companies, so as to make the Canadian data comparable to the U.S. data, and column 6 contains the deflated values for column 5. Columns 7 to 12 present similar information for the value added series. Columns 5, 6, 11 and 12 appear in Table A5.

Summary

This somewhat bewildering account of changes and differences in the relevant concepts attests to the caution that must be taken when using published data both for intra country and for international comparisons. At times it appears that some gremlin has deliberately attempted to confuse the researcher.

The main points to note about the statistics used in this study are:

(a) Comparisons of absolute productivity levels between the two countries are only estimates.

(b) The adjustments made to "value added" in both countries have resulted in fairly comparable use of the term.

69/ U.S. Census of Manufactures, 1958, p. 35A-8; U.S. Census of Manufactures, 1963, p. 35A-10.

TABLE A2

THE DERIVATION OF SERIES FOR VALUE OF SHIPMENTS AND VALUE ADDED FOR THE FARM MACHINERY INDUSTRY, CANADA, 1947-66

	Value of Shipments						Value Added					
Year	$M	$M	$M	$M	$M	$M	$M	$M	$M	$M	$M	$M
	1	2	3	4	5	6	7	8	9	10	11	12
1947	89.4			89.4	102.0	197.7	38.2			38.2	49.4	95.7
1948	147.0			147.0	167.7	278.1	63.4			63.4	82.0	136.0
1949	177.0			177.0	202.0	294.5	79.2			79.2	102.4	149.3
1950	149.5			149.5	170.6	237.3	68.4			68.4	88.4	122.9
1951	171.2			171.2	195.3	265.4	72.7			72.7	94.0	127.7
1952	205.8			205.8	234.8	272.7	93.8			93.8	121.3	140.9
1953	171.3			171.3	195.5	201.5	79.1			79.1	102.3	105.5
1954	119.0			119.0	135.8	157.7	49.2			49.2	63.6	73.9
1955	113.9			113.9	130.0	135.7	54.5			54.5	70.5	73.6
1956	122.7			122.7	140.0	140.0	51.5			51.5	66.6	66.6
1957	122.5	118.0		122.5	139.8	134.7	58.2	n.a.		58.2	75.3	72.5
1958	133.1	129.2		129.2	147.4	136.2	60.5	58.2		58.2	75.3	69.6
1959	170.7	166.2		166.2	189.6	172.2	78.0	75.9		75.9	98.1	89.1
1960		152.1		152.1	181.0	162.8		61.7		61.7	89.5	80.5
1961		138.0	139.0	139.0	160.6	141.7		60.1	61.2	61.2	82.0	72.4
1962			140.8	140.8	162.1	140.7			64.7	64.7	85.0	73.8
1963			182.8	182.8	211.7	180.8			87.3	87.3	114.9	98.1
1964			244.0	244.0	272.2	233.0			114.0	114.0	136.2	116.6
1965			285.1	285.1	316.1	269.3			126.7	126.7	152.9	130.2
1966			328.3	328.3	364.3	299.8			140.6	140.6	172.2	141.7

Notes:

Col. 1 Based on pre-1960 SIC; 1947-51 VOS = Value of Production, 1952-59 VOS = VOS.

Col. 2 Based on revised SIC and new establishment concept, VOS = VOS.

Col. 3 Based on revised SIC, new establishment concept and new activity concept, VOS = VOS.

Col. 4 Composite series for VOS showing where breaks in the series occur.

Col. 5 For 1960 to 1966 Col. 4 adjusted to U.S. basis of valuation on the basis of information provided by the companies. For 1947 to 1959 similar adjustment made using the average percentage increase for 1960 to 1966 period.

Col. 6 Col. 5 deflated by index in Table A4.

Col. 7 Same basis as for Col. 1.
1947-51 VA = Value of Production less materials, fuel and electricity (MFE).
1952-53 VA = VOS unadjusted for inventory change less MFE.
1954-59 VA = VOS adjusted for inventory change less MFE.

Col. 8 Same basis as for Col. 2.
VA = VOS adjusted for inventory change less MFE.

Col. 9 Same basis as for Col. 3, but VA = VOS adjusted for inventory change less MFE.

Col.10 Composite series for VA showing where breaks in the series occur.

Col.11 Col. 10 adjusted to U.S. basis of valuation as for Col. 5.

Col.12 Col. 11 deflated by index in Table A4.

Source: DBS 42-202, various years.

TABLE A3

THE DERIVATION OF SERIES FOR VALUE OF SHIPMENTS AND VALUE ADDED FOR THE FARM MACHINERY INDUSTRY, UNITED STATES, 1947-66

	Value of Shipments							Value Added					
	All Tractors	Farm Tractors	Farm Machinery	Farm Tractors plus Farm Machinery			Farm Tractors All Tractors	All Tractors	Farm Tractors	Farm Machinery	Farm Tractors and Farm Machinery		
		1 x 7		2 + 3					8 x 7		9 + 10		
Year	U.S. $M	U.S. $M	U.S. $M	U.S. $M	Cdn. $M	Constant Cdn. $M	%	U.S. $M	U.S. $M	U.S. $M	U.S. $M	Cdn. $M	Constant Cdn. $M
	1	2	3	4	5	6	7	8	9	10	11	12	13
1947	890.8	568.3	889.0	1,457.3	1,457.3	2,055.4	63.8	332.1	211.9	421.9	633.8	633.8	893.9
1948	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1949	1,172.2	795.9	1,105.3	1,901.2	1,958.2	2,306.5	67.9	478.4	324.8	533.0	857.8	883.5	1,040.6
1950	1,242.6	797.7	1,094.1	1,891.8	2,062.1	2,378.4	64.2	540.2	346.8	530.6	877.4	956.4	1,103.1
1951	1,609.4	1,055.8	1,314.9	2,370.7	2,489.2	2,645.3	65.6	659.3	432.5	612.3	1,044.8	1,097.0	1,165.8
1952	1,641.2	981.4	1,351.7	2,331.1	2,284.5	2,397.2	59.8	683.1	408.5	644.5	1,053.0	1,031.9	1,082.8
1953	1,625.4	929.7	1,253.3	2,183.0	2,139.3	2,230.8	57.2	677.8	387.7	581.8	969.5	950.1	990.7
1954	1,178.0	546.6	1,095.7	1,642.3	1,593.0	1,662.8	46.4	509.4	236.4	526.6	763.0	740.1	772.6
1955	1,485.1	715.8	1,189.6	1,905.4	1,886.3	1,952.7	48.2	669.9	322.9	584.4	907.3	898.2	929.8
1956	1,610.1	586.1	1,196.0	1,782.1	1,746.5	1,746.5	36.4	758.0	275.9	575.4	851.3	834.3	834.3
1957	1,604.2	717.1	1,260.4	1,977.5	1,898.4	1,813.2	44.7	741.0	331.2	584.6	915.8	879.2	839.7
1958				2,421.9	2,349.2	2,155.2					1,087.8	1,055.2	968.1
1959				2,559.5	2,457.1	2,186.0					1,172.2	1,125.3	1,001.2
1960				2,162.6	2,097.7	1,830.5					941.0	912.8	796.5
1961				2,339.5	2,362.9	2,024.8					1,057.1	1,067.7	914.9
1962				2,482.0	2,655.7	2,231.7					1,205.9	1,290.3	1,084.3
1963				2,842.2	3,069.6	2,541.1					1,328.4	1,434.7	1,187.7
1964				3,204.1	3,460.4	2,820.2					1,526.1	1,648.2	1,343.3
1965				3,529.6	3,812.0	3,047.2					1,682.3	1,816.9	1,452.4
1966				4,332.0	4,678.6	3,632.5					2,057.1	2,221.7	1,724.9

Notes:

Col. 1 VOS, all tractors - SIC 3521.

Col. 2 VOS of farm tractors in SIC 3521 - see Note for Col. 7.

Col. 3 VOS, all farm machinery - SIC 3522.

Col. 4 1947-57 Cols. 2 plus 3;1958-66, VOS of new SIC 3522 which includes farm tractors.

Col. 5 Col. 4 converted to Canadian dollars.

Col. 6 Col. 4 deflated by price index in Table A4 and converted to Canadian dollars by exchange rate in Appendix Table A6: Example of calculation in 1966, 4332.0 x 108 ÷ 128.8 = 3632.5.

Col. 7 Percentage farm tractors/all tractors as recorded in Annual Survey of Manufactures, various years.

Cols. 8 to 13 From 1947 to 1953 VA was calculated without adjusting VOS for inventory changes of final goods and goods in process. From 1954 to 1966 this adjustment was made in calculating VA. Calculations for these columns are otherwise based on the same factors as for Cols. 1 to 6.

Table A3 describes how an adjustment was made to include farm tractors with farm machinery for the years 1947 to 1957.

Columns 5, 6, 12 and 13 appear in Appendix Table A6.

Source: U.S. Census of Manufactures and Annual Survey of Manufactures, various years.

(c) Comparability of all series is better after 1956, due to the substantial changes made in the collection of data in Canada.

(d) The basis for valuing value of shipments from 1958 to 1965 is lower in Canada than in the United States.

(e) The procedure for the valuation of shipments differs between the two countries, and therefore requires adjustment.

TABLE A4

PRICE INDICES USED TO DEFLATE VALUE OF SHIPMENTS AND VALUE ADDED IN CANADA AND UNITED STATES

Year	Canada		United States	
	Index	Annual Percentage Change	Index	Annual Percentage Change
1947	51.6	--	70.9	--
1948	60.3	16.9	79.5	12.1
1949	68.6	13.8	84.9	6.8
1950	71.9	4.8	86.7	2.1
1951	73.6	2.4	94.1	8.5
1952	86.1	17.0	95.3	1.3
1953	97.0	12.7	95.9	0.6
1954	86.1	-11.2	95.8	-0.1
1955	95.8	11.3	96.6	0.8
1956	100.0	4.4	100.0	3.5
1957	103.8	3.8	104.7	4.7
1958	108.2	4.2	109.0	4.1
1959	110.1	1.8	112.4	3.1
1960	111.2	1.0	114.6	2.0
1961	113.3	1.9	116.7	1.8
1962	115.2	1.7	119.0	2.0
1963	117.1	1.6	120.8	1.5
1964	116.8	-0.3	122.7	1.6
1965	117.4	0.5	125.1	2.0
1966	121.5	3.5	128.8	3.0
	Average		Average	
	1947-51	9.5	1947-51	7.4
	1952-59	5.5	1952-59	2.3
	1960-66	1.4	1960-66	2.0
	1952-66	3.6	1952-66	2.1

Source: Canada, 1956 to 1966: This index was taken from Industry Selling Price Index 1956-1959, DBS 62-515, p. 34, and from Prices and Price Indexes, DBS 62-002.

1947 to 1955: The Industry Selling Price Index has been projected backwards on the basis of data of the Index of Net Real Production of Agricultural Machinery as published in Indexes of Real Domestic Product by Industry, DBS 61-506, p.39, and 61-505, p. 110.

United States: Price Index 11-1 in Handbook of Labour Statistics, U.S. Department of Labour, 1968, p. 272.

TABLE A5

FARM MACHINERY INDUSTRY,
CANADA, 1947-66

Year	Value of Shipments $ Million		Value Added $ Million		Production Workers	Total Employees	Wages	Wages & Salaries	Cost of Materials, Fuel & Electricity	Capital Expenditures	Paid Man-Hours of Production Workers
	$	Constant $	$	Constant $	Numbers	Numbers	$ Million	$ Million	$ Million	$'000	$'000
1	2	3	4	5	6	7	8	9	10	11	12
1947	102.0	197.7	49.4	95.7	13,688	16,013	26.0	31.2	51.3	n.a.	n.a.
1948	167.7	278.1	82.0	136.0	15,510	18,747	36.3	45.3	83.6	6,170	33,874
1949	202.0	294.5	102.4	149.3	13,860	17,074	34.7	44.2	97.8	4,237	29,622
1950	170.6	237.3	88.4	122.9	13,161	16,223	33.9	43.3	81.1	3,341	26,896
1951	195.3	265.4	94.0	127.7	14,038	17,236	41.5	52.2	98.5	4,266	28,761
1952	234.8	272.7	121.3	140.9	14,753	18,046	49.7	62.4	111.9	6,223	30,226
1953	195.5	201.5	102.3	105.5	10,989	14,161	37.4	50.3	92.1	4,226	22,229
1954	135.8	157.7	63.6	73.9	8,949	11,805	28.5	40.2	68.4	3,005	18,335
1955	130.0	135.7	70.5	73.6	8,952	11,753	30.7	41.9	61.0	2,402	18,481
1956	140.0	140.0	66.6	66.6	7,271	9,838	25.9	36.7	66.7	3,455	15,031
1957	139.8	134.7	75.3	72.5	7,318	9,725	26.8	37.6	60.0	4,064	16,617
1958	147.4	136.2	75.3	69.6	7,989	10,526	33.1	45.8	77.7	5,290	17,380
1959	189.6	172.2	98.1	89.1	10,169	13,056	44.2	60.0	101.6	3,587	21,363
1960	181.0	162.8	89.5	80.5	7,879	10,924	35.2	52.7	80.4	5,976	16,142
1961	160.6	141.7	82.0	72.4	6,986	10,058	31.1	46.3	75.9	7,782	14,309
1962	162.1	140.7	85.0	73.8	7,331	9,949	34.9	48.9	78.5	3,013	15,182
1963	211.7	180.8	114.9	98.1	8,623	11,160	44.1	58.4	99.5	14,360	18,354
1964	272.2	233.0	136.2	116.6	9,569	12,474	51.5	68.5	137.7	18,725	20,488
1965	316.1	269.3	152.9	130.2	10,599	13,721	56.3	75.6	165.3	12,507	22,310
1966	364.3	299.8	172.2	141.7	11,332	14,498	64.2	85.3	193.3	11,269	24,248

Note: All dollar values are current dollars unless otherwise stated.

Source: Cols. 2 to 5, see Appendix Table A2.
Cols. 6 to 10, Agricultural Implement Industry, DBS 42-202, various years.
Col. 11, see E. Sievwright, "A Factual Picture of Developments in the Canadian Farm Machinery Manufacturing Industry, 1945-1965", Table 58, unpublished study for Royal Commission on Farm Machinery, and unpublished data supplied by DBS.
Col. 12, 1947-1960" Calculated from data for average weekly hours worked by production workers; 1960-1966 as published in DBS 42-202.

TABLE A6

FARM MACHINERY INDUSTRY, UNITED STATES, 1947-66
($ Canadian)1/

Year	Value of Shipments $ Million $	Value of Shipments $ Million Constant $	Value Added $ Million $	Value Added $ Million Constant $	Production Workers Numbers	Total Employees Numbers	Wages $ Million	Wages & Salaries $ Million	Costs of Materials Fuel & Electricity $ Million	Capital Expenditures $'000	Paid Man-hours of Production Workers '000	Exchange Rate Canadian Cents per U.S. Dollars
1	2	3	4	5	6	7	8	9	10	11	12	13
1947	1,457.3	2,055.4	633.8	893.9	116,871	143,446	317.2	412.3	823.7	82,904	247,346	100
1948	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	100
1949	1,958.2	2,306.5	883.5	1,040.6	116,273	145,499	371.8	505.7	1,073.8	44,441	237,616	103
1950	2,062.1	2,378.4	956.4	1,103.1	108,898	137,807	372.8	507.6	1,105.8	39,102	227,074	109
1951	2,489.2	2,645.3	1,097.0	1,165.8	121,680	152,957	459.3	610.6	1,392.2	49,556	257,524	105
1952	2,284.5	2,397.2	1,031.9	1,082.8	110,616	142,603	408.9	563.7	1,254.6	51,081	229,506	98
1953	2,139.3	2,230.8	950.1	990.7	98,708	129,565	387.7	543.4	1,189.2	58,272	204,286	98
1954	1,593.0	1,662.8	740.1	772.6	78,959	104,416	303.9	434.9	842.6	47,100	162,182	97
1955	1,886.3	1,952.7	898.2	929.8	87,836	114,001	358.3	504.1	1,029.0	49,108	184,983	99
1956	1,746.5	1,746.5	834.3	834.3	79,423	104,563	318.2	462.6	955.9	39,673	165,200	98
1957	1,898.4	1,813.2	879.2	839.7	81,462	108,368	338.7	492.8	1,061.6	40,344	168,170	96
1958	2,349.2	2,155.2	1,055.2	968.1	79,922	108,586	362.0	534.5	1,278.8	48,286	164,160	97
1959	2,457.1	2,186.0	1,125.3	1,001.2	84,803	113,153	407.0	593.1	1,392.7	43,727	178,595	96
1960	2,097.7	1,830.5	912.8	796.5	71,110	99,115	345.3	524.0	1,127.2	53,751	147,169	97
1961	2,362.9	2,204.8	1,067.7	914.9	76,371	102,538	385.8	585.1	1,264.1	46,405	159,249	101
1962	2,655.7	2,231.7	1,290.3	1,084.3	77,139	106,222	441.9	661.5	1,428.5	46,009	162,856	107
1963	3,069.6	2,541.1	1,434.7	1,187.7	84,650	112,614	514.9	744.2	1,659.7	69,585	179,153	108
1964	3,460.4	2,820.2	1,648.2	1,343.3	90,215	118,621	581.4	831.5	1,884.8	90,282	194,215	108
1965	3,812.0	3,047.2	1,816.9	1,452.4	93,941	123,241	618.9	819.0	2,017.2	101,127	202,236	108
1966	4,678.6	3,632.5	2,221.7	1,724.9	105,181	137,341	733.7	966.3	2,551.2	127,060	n.a.	108

1/ All U.S. dollar values have been converted to Canadian dollars by use of the exchange rate shown in col. 13.

Note: All dollar values are current dollars unless otherwise stated.

Source: Cols. 2-5, see Appendix Table A3.
Cols. 6-12, U.S. Census of Manufactures, 1947, 1954, 1958 and 1963 and Annual Survey of Manufactures for the U.S., various years: adjustments made to include farm tractors with farm machinery from 1947 to 1957.
Col. 12, estimated on the basis of data on Average Weekly Hours of production Workers supplied by the Bureau of Labour Statistics in Washington.
Col. 13, Bank of Canada Statistical Summary Supplement, Ottawa 1965, p. 11, and earlier issues.