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THE UNIVERSITY OF ALBERTA  
INTERNATIONAL PRICE MOVEMENTS AND  
THE CANADIAN AIR CONDITIONING INDUSTRY

BY

L.A. CHESTER

A THESIS

SUBMITTED TO THE FACILITY OF GRADUATE STUDIES AND RESEARCH  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE  
OF MASTER OF BUSINESS ADMINISTRATION

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## ABSTRACT

This thesis attempts to do three things:

1. Examine the purchasing power parity theory of exchange rate determination at the single-industry level to ascertain how exchange rate fluctuation affects the landed cost of imports.
2. Examine the effects of relative price change, due to exchange rate fluctuation, on import quantities.
3. Determine what other factors, in addition to relative price differences between imports and domestic supply, affect import quantities, and determine how significant these other factors are in determining market share.

The broad conclusions are that:

1. Over the long term (1967 to 1979), the ratio of wholesale price levels corresponded closely to the ratio of exchange rates.
2. In the short term, however, the rates of the change in exchange rate had a low correlation with the rates of change in price levels. There was a variation from the common trend line, which allowed a price differential between imports and domestic production in this industry.

3. This price differential between imports and domestic supply did not manifest itself in the expected manner. Price differentials in favor of imports did not necessarily result in import market share gains, and the amount of market share movement was not necessarily proportional to the absolute amount of the price differential.
4. A significant factor in explaining import quantities is the residual supplier factor. In the combined U.S./Canadian marketplace, Canadian production represents only 3-4% of overall capacity, in what is basically a cyclical market. The U.S. acts as a "flywheel", supplying more equipment when Canadian demand rises quickly, and supplying less when demand slumps.
5. Another significant explanatory factor appears to be the pricing strategies followed by oligopolistic air conditioning equipment distributors, who share approximately 80% of the market. They appear to aggressively maintain market share in all product groups, regardless of the origin of these products, or of their landed cost (and their effects on margins), at least in the short term.

These two factors, residual supplier and market share requirements, appear to be more significant than relative price in explaining respective market shares of imports and domestically-produced equipment.

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## CHAPTER I

### INTRODUCTION

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1. Examine the purchasing power parity theory of exchange rate determination at the single-industry level to ascertain how exchange rate fluctuation affects the landed cost of imports.
2. Examine the effects of relative price change, due to exchange rate fluctuation, on import quantities.
3. Determine what other factors, in addition to relative price differences between imports and domestic supply, affect import quantities, and determine how significant these other factors are in determining market share.

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3. This price differential between imports and domestic supply did not manifest itself in the expected manner. Price differentials in favor of imports did not necessarily result in import market share gains, and the amount of market share movement was not necessarily proportional to the absolute amount of the price differential.
4. A significant factor in explaining import quantities is the residual supplier factor. In the combined U.S./Canadian marketplace, Canadian production represents only 3-4% of overall capacity, in what is basically a cyclical market. The U.S. acts as a "flywheel", supplying more equipment when Canadian demand rises quickly, and supplying less when demand slumps.
5. Another significant explanatory factor appears to be the pricing strategies followed by oligopolistic air conditioning equipment distributors, who share approximately 80% of the market. They appear to aggressively maintain market share in all product groups, regardless of the origin of these products, or of their landed cost (and their effects on margins), at least in the short term.

These two factors, residual supplier and market share requirements, appear to be more significant than relative price in explaining respective market shares of imports and domestically-produced equipment.

## CHAPTER II

### THE THEORY OF PRICE FORMATION UNDER FLEXIBLE EXCHANGE RATE REGIMES

This chapter examines the underlying causes of exchange rate fluctuation, and the effects of this fluctuation on imports. More specifically, this chapter attempts to determine the impact of exchange rate change on the price of importables, and the subsequent effect on quantities imported. Any additional parameters thought to affect price during exchange rate movement will also be examined, with some indication of their significance determined.

#### A. An Historical Perspective

The mid-eighteenth century in Sweden and the early nineteenth century in England were very similar periods (and somewhat similar to the economic conditions confronting the U.S. during the early 1970s, conditions which also affected Canada since the two economies are inter-related):

1. Both countries were embroiled in a major foreign war requiring the exportation of large sums of money to maintain troops in the field.
2. Both countries experienced crop failures requiring the importation of large quantities of food.
3. Their paper money supplies had rapidly expanded (compared to previous periods) to pay for foreign wars and food imports.

4. Their domestic currencies were depreciating in the foreign currency exchanges and in the bullion exchanges.

The events were similar: exchange rates had fallen and prices were rising at a time when the money supply had rapidly expanded and the balance of payments deficit was large and negative, but there was no general consensus on how to interpret the situation.

In the resulting debates, the monetary approach was conceded to best explain the exchange rate devaluation and price level increase, i.e. the quantity of currency determines both price level and currency exchange rate. It had assumed a dominant role in economic thinking, but receded in importance during the latter part of the nineteenth century, a relatively stable period. The gold standard had been adopted by most major trading countries, resulting in relatively fixed exchange rates over long periods of time. There was no need for a theory to explain exchange rate fluctuation.

Not until the hyperinflationary period following World War I was the monetary approach resurrected, in a new guise called Purchasing Power Parity.

#### B. Theory of Purchasing Power Parity

The concept of Purchasing Power Parity, to predict exchange rates, was first expressed, and tested, by Gustav Cassel. He stated, that, "the rate of exchange is primarily and expression for the value in the

money of one country put upon the money of another country".<sup>1</sup>

For example, if we consider two separate countries, A and B, each with its paper currency, the money of country A can only have value in country B based on its buying power, or purchasing power, in country A. The price then, of currency A, when purchased in country B, will be directly proportional to its purchasing power in A. Now, if price levels rise in country A, the purchasing power of its currency will decline, and its price in country B will decline.

Similarly, the price of foreign currencies in country B will be affected by its internal price level. If prices rise in B, without a corresponding price increase in its trading partners, then country B's currency will decline in value.

The exchange rate then, between A and B, or between any two countries, will be determined primarily by the ratio of their general price levels, which, in turn, are in direct proportion to the quantity of money circulating in each country.

---

<sup>1</sup>Gustav Cassel, "The Present Situation of the Foreign Exchanges," Economic Journal 25 (March 1916) : 63.



While stating that the rate of exchange between two countries is primarily determined by the quotient between the general price levels in the two countries, Cassel acknowledged several limitations to purchasing power parity's ability to predict the exchange rate:

1. Trade restrictions.
2. Speculations in the foreign currency exchange markets.
3. Anticipation of greater inflation and/or depreciation.
4. Real changes in the structure of the economy.
5. Net capital movements due to interest rate differentials.
6. Government intervention in the exchange markets.

Cassel stated PPP Theory in both absolute and relative forms:

1. Absolute PPP:

$$PPP \text{ abs} = \frac{PL_B}{PL_A}$$

where PPP abs = number of units of country B's currency per unit of country A's currency.

$PL_i$  = price level in country i during the specified period.

## 2. Relative PPP:

$$\text{PPP rel} = \frac{P_B}{P_A} \cdot R_0$$

where PPP rel = number of units of country B's currency per  
unit of country A's currency.

$P_i$  = price index in country  $i$  at a specified time  
and common base period.

$R_0$  = actual rate of exchange during the base period.

The fundamental propositions of purchasing power parity theory are that:

- a. The short-run equilibrium exchange rate tends to approach the long-run equilibrium exchange rate.
- b. The PPP is either the long-run equilibrium exchange rate or its principal determinant.

Thus, PPP Theory in its most general form can be expressed by the following function:

$$R = f(\text{PPP}, \dots)$$

where  $R$  = short-run equilibrium exchange rate

$$\text{PPP} = \text{PPPsabs or PPPrel}$$

The implication of this theory is that real price levels in all countries tend to equality, and that only one price level can exist, the world price level. It is maintained through arbitrage. When goods

are undervalued in one country, after exchange rate is taken into account, they can be purchased and transported to higher demand areas, thereby causing prices to equalize.

If purchasing power parity does occur, then a country's overall exports and imports should not be affected in the longer term by revaluation or devaluation.

### C. Support for Purchasing Power Parity

Empirical testing of Cassel's theory was inhibited by a lack of adequate data on general price levels, by a return to the gold standard, and by disturbed world conditions in the thirties and forties. Following World War II, the regime of fixed exchange rates made the theory one of academic rather than practical interest. However, this situation clearly changed with the fluctuating exchange rate regimes of the seventies.

An overview of some selected current work on PPP was undertaken to survey empirical findings and determine if descriptive generalizations are possible.

Holmes (1967) used an interesting model to test the PPP Theory in which country A is small, compared to country B, i.e. Canada compared to the U.S. Under PPP Theory, the external value of country B's currency is adjusted to its internal value through changes in either its exchange rate, under a floating exchange rate regime, or in country A's price level, under a fixed exchange rate regime. This relationship takes

the form:

$$RP_A = F(P_B, \text{other variables})$$

where R = units of U.S. currency required to buy a unit of Canadian currency.

$P_A$  = price level in country A (Canada) as measured by CPI

$P_B$  = price level in country B (U.S.A.) as measured by CPI

NOTE: the "other variables" include: tariffs, capital flows, unilateral transfers to the small country, and government intervention in the exchange market (variables recognized by Cassel) plus real income and population (variables not considered by Cassel).

Holmes found that the most significant explanatory variable for  $RP_A$  was  $P_B$ , the U.S. price level, thus providing strong support for PPP over the period 1870-1960. Of course, given the strong dependence of the Canadian economy upon the U.S. economy, it can be inferred that there should be a strong correlation between the Canadian price level, measured in U.S. dollars, and the U.S. price level. These findings, thus, do not give as strong a support to PPP as the data might initially indicate.

Gaillot (1970) compares the relative degree of inflation and the relative change in exchange rate for each major U.S. trading partner between the two periods 1900-04 and 1963-67; periods characterized by relatively free trade, convertible currencies, gold or gold exchange standards, and a preceding interval of peace and prosperity. His price level indicator is the wholesale price level. Results of the analysis support Cassel's

theory, although Gaillot does acknowledge the existence of other factors which can cause large, but temporary deviations from the expected valuation of currencies. Gaillot acknowledges data problems, particularly with consistency of wholesale price indices between countries over this relatively long period of time.

The results, however, do lend support to the Purchasing Power Parity theory and are consistent with the long-run relationship between relative inflation and the exchange rate.

Jacob Frenkel (1976) re-examined the German hyperinflationary period during the 1920s to provide additional support for Purchasing Power Parity. He showed a high (.98) correlation between the German money supply and its exchange rate, and a similarly high (.98 plus) correlation between the exchange rate and internal price levels, when a number of alternative price indices were used for comparison. His research is particularly interesting, in that the prices of tradeables and non-tradeables, affected at consumer (retail) and wholesale price levels, are related to exchange rate change. With few exceptions, prices tend towards a common world price, when all prices are measured in a common currency.

Officer (1980) also found support for Purchasing Power Parity. In his work, he uses the GDP deflator as a measure of price change. He points out that other authors have used the consumer price index and/or wholesale price index, which are respectively biased towards non-tradeables and tradeables. The GDP deflator is a more comprehensive measure of price change. He also points out that most PPP tests compare

a given domestic country with the United States, which is the usual standard country. Such bilateral tests have the disadvantage of permitting tests of PPP in which price movements and exchange rates pertain only to the domestic/U.S. situation. Officer removes this disadvantage by employing the "effective exchange rate" in which the weighted exchange rate for major U.S. trading partners is compared to their weighted price indices.

Officer also attempted to select time periods that permit a fairer test of the efficacy of PPP. These represent periods of reasonable stability, without war or exchange controls. Periods of severe trade restrictions and highly unsettled international conditions were excluded. It is more probable, then, that exchange rate changes will pick up monetary (price level) effects more effectively.

Officer selected 1879 as his base period, when the gold standard existed worldwide, and 1975 (floating exchange rate period), plus 1963-66 (fixed exchange rate period) as his alternate current periods, when exchange rates were considered to be relatively stable.

Based on this selective testing of PPP, Officer concludes that:

- a. PPP is a relatively good predictor of the exchange rate.
- b. The closer the ties of a country to a major trading partner, the better that PPP predicts the exchange rate.

These conclusions are consistent with those reached by Holmes.

#### D. Criticisms of Purchasing Power Parity

Despite the above studies that lend empirical support to the one price doctrine, that any change in exchange rate would be offset by a price level change that keeps prices substantially equal in every country, other work has questioned the applicability of PPP at the industry or product level.

Among the critics are Kravis and Lipsey (1978). In their paper, they compare the actual price behavior of equivalent commodities in trading countries against the price predictions of monetary and elasticity theories respectively. As pointed out by Kravis and Lipsey, under the elasticity theory, exchange rate change can alter the price of one country's goods and services relative to those of another. These exchange rate-induced price changes result in quantity changes in imports and exports. Elasticity theory, then, allows the following behavior after exchange rate change:

- a. Prices of import and export goods measured in their own currency will rise in a depreciating country relative to non-traded goods.
- b. These price shifts between tradeables and non-tradeables induce increased net exports from the depreciating country.
- c. The terms of trade (ratio of export price index to import price index) are likely to deteriorate, dependent on import and export elasticities. (For a fuller explanation, see

Sohmen).<sup>2</sup>

The elasticity theory states that exchange rate change will produce changes in price structure that give rise to shifts in the overall volumes of imports and exports.

The monetary theory, in contrast, assigns the general price level a central role; it determines the value of all assets, including money. Since there is assumed to be a perfect international market for assets, any change in price level is offset by exchange rate changes, and "one price" holds in all countries. Relative prices have no permanent role, except a transitory one during exchange rate adjustment to the new level warranted by general price level relationships.

This law of one price, it is pointed out, applies particularly to traded goods amongst the industrialized countries, since their products are readily substitutable and subject to commodity arbitrage. Non-traded goods keep in line by substitutability among traded goods in consumption, and by substitutability among the inputs for traded and non-traded goods in production.

The monetary view assumes that prices will adjust quickly after exchange rate changes to maintain their worldwide equality, and that there will consequently be little opportunity for import or export quantity exchanges.

---

<sup>2</sup>Egon Sohmen, Flexible Exchange Rates, (Chicago: University of Chicago Press, 1969). Whenever devaluation occurs, the terms of trade worsen whenever the product of elasticities of supply for imports and exports is greater than the product of elasticities of demand for imports and exports.



Kravis and Lipsey focus on price levels after exchange rate fluctuation to determine if they changed rapidly to conform to the one-price doctrine, or whether changes in the price structure were more nearly consistent with predictions of the elasticity theory. Their findings are that prices deviated substantially from a common, worldwide price level over the short and long term. This deviation from the law of one price, they attribute to the following:

- a. Non-tradeables are not affected to the same degree as tradeables.
- b. Prices for tradeables and non-tradeables are strongly influenced by the relative wealth of the country, i.e. GDP per capita.
- c. Different elasticities are faced by oligopolistic firms in their domestic and foreign markets. Those markets with greater price elasticity tend to have the lowest prices.
- d. Product differentiation, i.e. appearance, performance, customer service, warranties, credit terms, and availability enabled manufacturers from some countries to charge higher prices.
- e. Oligopolistic pricing strategies may produce price discrimination in markets where the oligopolist wishes to maintain or improve his market share.

- f. Buyers may not react to price differences due to insufficient knowledge, uncertainty in using new suppliers, or commitments to certain manufacturers through training programs or parts stocking programs.

The monetary approach assumed "perfect competition" in international markets. With perfect competition, only one price can exist, a world price. Kravis and Lipsey conclude that where market structures depart from the purely competitive model, then substantial price differentials are possible, and may be sustained in an effective manner.

Richardson (1978) examines the "one price" or purchasing power parity model of commodity arbitrage between Canada and the U.S. To do so, he examines price change over time in a number of equivalent sectors of Canadian and American manufacturing. The following regression model is applied:

$$P_c = B_0 E^{B_1} P_{us}^{B_2} T^{B_3} R^{B_4}$$

where  $P_c$  = Canadian dollar price of the product

$E$  = Exchange rate

$P_{us}$  = U.S. dollar price of the product

•  $T$  = Transfer costs (transportation cost, duties, tariffs)

$R$  = Other residual reasons for different price levels

With perfect commodity arbitrage, the exponents  $B_0$ ,  $B_1$ ,  $B_2$ , and  $B_3$  would equal 1, and the equation would become:

$$P_c = E P_{us} \text{ (neglecting transfer costs and residual elements)}$$

The model is applied to 22 commodity groupings representing a spectrum of tradeability. His findings were as follow:

- a. That some commodity arbitrage exists for those commodities generally recognized as tradeables.
- b. That no "perfect" arbitrage exists in any commodity group.
- c. That Canadian prices generally react to both exchange rate and U.S. prices to the same degree. The exceptions, all of which he judged to be tradeables, either responded equally, or they responded more to exchange rates than to U.S. prices.

Dunn (1970) argues that under "perfect competition" prices between two countries (converted to the same currency) will vary only by transportation costs and tariffs. If the exchange rate changes, price levels in at least one country will have to change to maintain parity. Otherwise, arbitrageurs will capitalize on the price differential causing either price level or exchange rate movement to achieve parity. In Dunn's opinion, this provides a formidable argument against flexible exchange rates in an open economy; if a country faces high or infinite elasticities abroad, a high proportion of its internal prices will be in a continuous state of flux.

As Dunn demonstrates, prices are not in a continuous state of flux, nor do prices react in the manner predicted (by monetarists): They do not follow a one-price rule. He points out that, in reality, business firms have a variety of pricing goals and policies, most of which provide relative price stability in the face of exchange rate uncertainty. The


following reasons are advanced for price stability of imports during periods of fluctuating or changing exchange rates:

- a. Market share considerations make most firms cautious about raising prices and risking a market share loss. Market share requires capital to capture and maintain. No firm is prepared to "write-off" market share readily.
- b. Costs, both implicit and explicit, make it expensive to make frequent price changes. These costs range from printing and mailing costs for new price pages to customer uncertainty and loss of confidence. Business enterprises seek legitimacy by appearing solid, secure, and stable, regardless of price uncertainty caused by exchange rate fluctuation. They are reluctant to change prices too often and too substantially.
- c. The market has a high inertia against change, including price change. Firms, which generally resist price change in their domestic markets, will react in a similar manner in export markets. When exchange rates fluctuate, they resist making corresponding price changes, which could reduce their market share.

If these firms are oligopolistic, they can exert considerable pressure to maintain stable prices. Dunn's hypothesis is that they will use their market power to stabilize prices even when confronted with a rapidly changing exchange rate. Long-term exchange rate trends will be

reflected in price levels, but short-term perturbations about this trend will be absorbed in profit margins.

Dunn suggests that for this system to operate, there are other requirements in addition to an oligopolistic structure. These are:

- a. There must be sufficient profit margin to allow variations in the cost of imported goods (as the exchange rate fluctuates).
  - b. The range of currency fluctuation must be relatively small. If not, there will be an opportunity for arbitrage, which will not allow a differential pricing policy to be maintained indefinitely. If the currency fluctuation is sufficiently large, it will become profitable to buy the commodity in a low price market and transport it to a high price market. The range must be sufficiently narrow so that the slim profits will not be worth the attendant risk.
  - c. The foreign market must be sufficiently important. The exporting firm must have sufficient vested interest to maintain its market share in the second market in spite of rising landed costs due to exchange rate movement. If it is not sufficiently important, the firm will follow a one-price policy and allow its market share to fluctuate.
- 

There are two means by which the exporting firm can maintain this stable pricing policy in foreign markets:

- a. By selling directly and maintaining stable prices in foreign markets (fluctuating price in its own currency).
- b. By selling at a fixed cost in their own currency to a foreign subsidiary, which then resells at market price levels, absorbing exchange rate fluctuations in its profit margins.

In a study of six industries, Dunn found little relationship between the Canadian price levels and the U.S. - Canadian exchange rate or the U.S. price level, which tends to contradict the one-price doctrine, i.e. purchasing power parity.

## CHAPTER III

### THE AIR CONDITIONING INDUSTRY

This chapter describes the characteristics of the Canadian air conditioning industry including the present product cycle position of the industry; industry size and structure, equipment produced, price formation practices, and the distribution of the market between imports and domestic production.

#### A. Industry Definition

Air conditioning equipment is designed to provide a comfortable environment for people and/or equipment. It heats, cools, humidifies or dehumidifies, cleans, and distributes "conditioned" air to maintain specified interior climatic conditions.

The air conditioning industry has amorphous boundaries in that it includes some elements of the heating, ventilating, and refrigeration industries. For example, a rooftop-mounted air conditioning unit may contain gas-fired heat exchangers, fans, and refrigeration compressors, components which form part of an air conditioning unit, but which sold separately, are categorized as heating, ventilating, or refrigeration equipment.

For purposes of this thesis, air conditioning equipment will be characterized as equipment controlling environmental comfort conditions during all four seasons. Any equipment designed specifically for heating purposes such as furnaces or boilers, ventilating equipment such as fans, or commercial refrigeration equipment such as freezers or cold storage

equipment, will not be included in this analysis.

This qualification should not affect the validity of the results. Data published by Statistics Canada on imports, exports, and domestically-produced air conditioning and refrigeration equipment can be sufficiently disaggregated to correspond to this definition, which is the generally recognized definition used by the industry.

#### B. Industry Size and Scope

In 1979, the domestic industry<sup>1</sup> employed some 3069 production workers, plus an additional 1696 sales and administrative personnel. Total "value added" by these 4765 workers was \$153 million that year, or \$32,000 per worker. Salaries and wages contributed \$75 million, or \$15,700 per worker, which constituted 49% of total value added.

This relatively high labour content may partly confirm lower Canadian productivity levels in comparison to the U.S. Several reasons for a lower Canadian productivity level were cited<sup>2</sup>:

- a. Shorter production runs over which to distribute set up and fixed overhead costs.

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<sup>1</sup>Statistics Canada, Commercial Refrigeration and Air Conditioning Equipment Manufacturers, Catalog 42-215 Annual, (1979) : 11.

<sup>2</sup>Cited during industry survey by senior managers in the air conditioning industry.



- b. Less mechanization of the fabrication and assembly processes.
- c. Fewer component manufacturers (less competition) could result in higher input costs.

To minimize productivity problems, Canadian plants have attempted to locate market segments, or niches, in which they have an advantage, or at least, do not operate at a disadvantage. These areas might include:

- a. Products for which sufficient Canadian volume is available to operate at an efficient scale.
- b. Products which have a high freight content, giving the nearer Canadian plants a transportation cost advantage.
- c. Products which require special Canadian designs to meet harsh climatic conditions that standard American designs cannot.
- d. Custom-designed equipment for special applications that do not lend themselves to mechanization due to small quantities involved.

The industry is comprised of 6 major manufacturers<sup>3</sup>, who account for

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<sup>3</sup>Major companies include (not ranked by size): Carrier Air Conditioning Ltd.; Dunham-Bush of Canada Ltd.; Keepright Products Ltd.; Lennox Industries Ltd.; Trane Air Conditioning Ltd.; York, Division of Borg-Warner.

an estimated 80% of industry sales, plus several minor manufacturers/distributors, who produce and/or sell the remainder.

Five of the six firms cited are subsidiaries of U.S. parent firms. These subsidiaries can draw product from either U.S. or Canadian production facilities.

Historically, these larger firms manufactured the smaller, "packaged" product groups in Canada, where sufficient production volume was available. Larger equipment was produced in the U.S. Exceptions occurred when higher U.S. production volumes allowed U.S. equipment to be imported at a lower landed cost (after exchange rate, duty, and transportation costs were added).

Today, foreign and domestic-manufactured equipment each meet approximately half the total domestic demand.<sup>4</sup> U.S.-based manufacturers dominate the market, owning outright 5 of the 6 major Canadian-based producers, plus accounting for over 95% of all Canadian imports.<sup>5</sup>

The possible implication of this large U.S. influence, exerted through a small number of companies, is a high degree of oligopolistic power that can be directed towards maintaining market share, a form of investment, in a market that is important: it is relatively large, politically and economically stable, and thus capable of returning dividends on their investment, provided that their investment, i.e. market share, is secure.

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<sup>4</sup> See Table 4, Page 35

<sup>5</sup> See Table 2, Page 32

### C. Categories of Air Conditioning Equipment

The bulk of air conditioning equipment sold can be divided into 7 major categories (See Table 1), generally called "packaged" equipment.

RAC	PAC-R	PAC-C	YAC-R	YAC-C	SPL-R	SPL-C
-----	-------	-------	-------	-------	-------	-------

Total Product Range Produced in Canada (all manufacturers)

--	--	--	--	--	--	--

Manufacturer A

--	--	--	--	--	--	--

Manufacturer B

--	--	--	--	--	--	--

Manufacturer C

--	--	--	--	--	--	--

Manufacturer D

NOTES: Solid line : produced in Canada

Dotted line : produced in U.S.

No line : not sold in Canada by this company

Figure 1: Imports and Domestic Supply by Product Group and  
by Manufacturer.

TABLE 1  
MAJOR AIR CONDITIONING EQUIPMENT  
PRODUCT GROUPINGS

PRODUCT GROUP	DESCRIPTION	CAPACITY RANGE (tons)
R.A.C.	Room Air Conditioners	0.4 - 3.0
PAC-R	Packaged, cooling only, residential	5.0 max.
PAC-C	Packaged, cooling only, commercial	5.0 min.
YAC-R	Packaged, heating & cooling, res.	5.0 max.
YAC-C	Packaged, heating & cooling, comm.	5.0 min.
SPL-R	Split system, cooling only, res.	5.0 min.
SPL-C	Split system, cooling only, comm.	5.0 min.

NOTES:

- a. A "ton" of cooling capacity represents 12,000 British Thermal Units (Btu) per hour.
- b. Residential and commercial equipment are built to different design criteria.
- c. Canadian plants manufacture all 7 categories since these are high volume, standardized production categories, which constitute a majority of products sold.

Each of these 7 major equipment categories is produced in Canada by at least one of the 6 major companies. No one manufacturer; however, makes every product category in Canada; at least some portion of this overall product range is imported from the United States. Figure 1 illustrates these major equipment categories. It shows the actual equipment produced in Canada by the manufacturers on the interview dates (but may not reflect the current situation).

The products in each of these equipment categories are relatively undifferentiated. They are similar in basic unit design, have similar optional features available, are offered in the same discrete, nominal sizes over a comparable capacity range, and have similar basic selling features and benefits. The major differences amongst manufacturers are in perceived, if not actual, quality, ease of installation, warranty cost, sales aggressiveness, availability, and service backup.

Not only is air conditioning equipment relatively undifferentiated, but the market for it can be described as "mature". The market is well developed and firmly established; there is little untapped, virgin territory left. While demand does fluctuate from year to year, dependent upon weather for residential equipment, and upon construction activity for commercial and industrial equipment, there are no "new" markets from which growth can be sustained. Any growth beyond the relatively small long-term industry growth must come at the expense of competitors, from their market shares. Market share becomes more important in mature markets than in high-growth markets.

On the horizon; however, the industry will see increasing differentiation. More efficient equipment is being designed to meet imminent or existing government regulations. Larger manufacturers can accommodate redesign and retooling costs; small manufacturers do not have sufficient sales volume over which to spread these costs, and they could ultimately disappear.

#### D. Price Formation

Air conditioning equipment flows from the manufacturer through a distributor or agent to a contractor, who installs the equipment for the owner or end user. There are two distinct types of project involved:

- a. Negotiated projects, wherein the contractor designs the system, selects the equipment (usually based on his personal preference), and installs it. Other contractors may be involved, often with different designs and equipment selections. Lowest price, or best system for the price, usually gets the job.
- b. Plan and specification projects, wherein a consultant designs the system, sizes the equipment, and specifies which manufacturers can bid. Contractors bid on the project, select a manufacturer's equipment (usually based on price), and install it, if their price is acceptable (low!).

Both types of projects, particularly plan and specification, require "competitive" pricing from the shipment distributor. The usual difference between getting and losing a job is price, although other factors can dominate. These factors may include equipment availability, previous experience, operating cost differences, or owner or contractor preference.

The distributor then has to provide competitive prices to the contractor, based on a specified number and capacity of units. The same

pricing flexibility, however, is not normally available from the equipment manufacturer. Pricing from the manufacturer to the distributor or agent is characteristically determined by "formula". The distributor's cost is based on a "list price", revised at intervals, multiplied by a constant factor. When transportation cost, plus duty (constant from 1967 to 1979) and exchange on imported equipment<sup>7</sup> is added, a "landed" cost can be ascertained. It is the difference between this landed cost, determined by formula, and the selling price, negotiable between distributor and contractor, that determines the gross margin on any project, (see Figure 2).

When the exchange rate changes, the landed cost of goods imported from the U.S., invoiced in U.S. funds, undergoes a relative increase or decrease against Canadian-made products. During devaluation, when U.S. products experience relative cost increases, the importer is probably unable to set his selling prices higher without losing market share, but he cannot leave his price at the same level without sacrificing part of his gross margin.

The trade-off for the importer during devaluation is between profitability and market share, unless the U.S. manufacturer temporarily waives his standard pricing formula, to support beleaguered distributors.<sup>7</sup>

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<sup>7</sup> Manufacturers may lower their transfer price to the distributor, dependent on whether the distributor is independent or wholly-owned, and if wholly-owned, on where he wishes to declare any profits. See L.W. Copithorne, Canadian Journal of Economics. IV no. 3 (August 1971): 324-41.

U. S.-based manufacturers have marketed their products to these distributors through two different channels:

Distributor Gross Margin
Transportation (constant) Duty (constant) Exchange (variable)
Factory Gross Margin
Labor Raw Material Rents

Selling Price to Contractor  
(Negotiated)

Landed Cost to Distributor

Wholesale Price (determined by  
formula)

Factory Standard Cost

Figure 2: Relationship of Wholesale Price to Selling Price



- a. Direct sales to foreign markets at differing prices (in their own currency) depending on local exchange rates. This strategy has been followed by the smaller firms, typically without Canadian production facilities. When exchange rate movements are sufficiently large, these companies may voluntarily withdraw until the exchange rate again allows them to sell their products at a profit. Typically, the distributor will be independent, i.e. not owned or controlled by the manufacturer.
- b. Sell at fixed prices (in their own currency) to distributors, who absorb any short-term rate fluctuations in their own profit margins. Thus, exchange rate movement has no direct effect on the manufacturer's financial statements. This distribution channel is followed by the larger manufacturers, who usually have Canadian production facilities making a limited product range. Market share is important to these larger companies; they cannot easily withdraw and re-enter a market. They have a large investment in human capital and physical plant that must be protected. Typically, the distributor for their products is a wholly-owned subsidiary.

Since these larger manufacturers represent the majority of equipment sold in Canada, price from the manufacturer to the distributor is normally determined by formula pricing.

### E. The Role of Imports

Imports represent a significant product of the Canadian air conditioning market. This section examines the role and impact of foreign manufacturers in this market.

#### 1. U.S. Share of Imports

The U.S. share of imports exceeds 95% in most product groupings (see Table 2). The dominance of U.S. imports simplifies analysis in that the U.S./Canadian foreign exchange rate will outweigh the effects of all other exchange rates. Hence, all further mentions of imports, unless otherwise specified, are U.S. imports, acknowledging that a finite portion (less than 5%) originate elsewhere.

#### 2. Import Share of the Canadian Market

Data for imports, and domestic production are available for the air conditioning and commercial refrigeration industry in several categories. These categories are sufficiently disaggregated to allow a breakout of the air conditioning segment. Table 3 displays imports, domestic production, and exports for the years 1966 through 1979. This interval may be divided into a period of fixed exchange rates between 1966 and 1970, and one of managed float between 1970 and 1979.

TABLE 2

## TOTAL IMPORTS OF SPECIFIED CLASS OF AIR CONDITIONING EQUIPMENT

(in thousands of dollars)

YEAR	COMMODITY GROUP							
	Room Air Conditioners (655-06)		Air Conditioning Units (655-19)		Parts of Air Conditioning Units (655-28)		Misc. Equip. and Parts (655-99)	
	VALUE	U.S. SHARE	VALUE	U.S. SHARE	VALUE	U.S. SHARE	VALUE	U.S. SHARE
1979	4416	1.000	43213	.988	35948	.991	5002	.933
1978	3858	1.000	39235	.959	26994	.991	39389	.943
1977	7552	.984	33566	.998	24796	.993	29296	.955
1976	10477	.937	36023	.997	23082	.996	28641	.963
1975	6879	.999	30503	.997	19710	.999	27301	.954
1974	6380	.987	27643	.998	24950	.998	28503	.933
1973	4847	.937	21384	.996	15896	.998	22070	.943
1972	5612	.964	14747	.955	10747	.991	16460	.936
1971	896	1.000	11795	1.000	9113	.999	13125	.947
1970	5284	.997	10364	1.000	9045	.990	12771	.956

TABLE 3  
IMPORTS, EXPORTS, AND DOMESTIC MANUFACTURE  
OF AIR CONDITIONING PRODUCTS  
(in current Canadian dollars, x 1000)

YEAR	IMPORTS	DOMESTIC PRODUCTION	EXPORTS
1979	253028	290109	54688
1978	204854	206026	43179
1977	170754	204900	33779
1976	164775	201213	28339
1975	152184	164617	22625
1974	161817	154276	32817
1973	116919	118712	23520
1972	93044	101312	20420
1971	78217	88953	18464
1970	73713	81590	18512
1969	72104	73780	13482
1968	32109	63300	9987
1967	68705	56228	6732
1966	55314	55523	6423

SOURCES: Imports : Statistics Canada, Catalog 65-203

Domestic Production: Statistics Canada, Catalog 42-215

Exports : Statistics Canada, Catalog 65-202

Total domestic demand is defined as the total of domestic supply, which is domestic production less exports plus imports, as illustrated by Figure 3, (assuming that there are no differential inventory changes in any category).

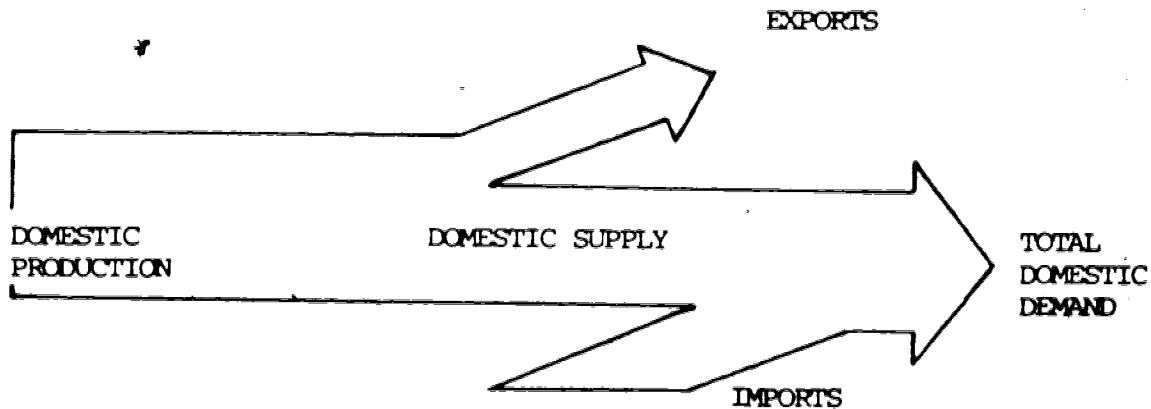


Figure 3: Relationship between Imports, Exports, Domestic Production, Domestic Supply, and Total Domestic Demand.

The information in Table 3 has been reassembled to show imports, domestic supply, total domestic demand, and the respective market shares of domestic and U.S. manufacturers (see Table 4). The average market share of imports over the 14 years studied was 54.1%. The highest import share was 60.6% in 1968; the lowest share of 48.9% was recorded in 1976.

TABLE 4  
MARKET SHARES OF IMPORTS AND DOMESTIC SUPPLY

YEAR	IMPORTS			DOMESTIC SUPPLY			TOTAL DOMESTIC DEMAND	
	VALUE	CHANGE %	MARKET SHARE	VALUE	CHANGE %	MARKET SHARE	VALUE	CHANGE %
1979	253028	23.3	.518	235421	44.6	.482	488449	32.8
1978	204854	20.0	.557	162847	- 4.8	.443	367701	16.8
1977	170754	3.6	.499	171121	- 1.0	.501	314875	- 6.5
1976	164775	8.3	.489	172874	21.7	.511	336649	14.3
1975	152184	- 6.0	.517	141992	16.9	.483	294176	3.8
1974	161817	38.4	.571	121459	27.6	.429	283276	33.6
1973	116919	25.7	.551	95192	17.7	.449	212111	21.9
1972	93044	19.0	.535	80892	14.8	.465	173936	17.0
1971	78217	6.1	.526	70489	11.7	.474	148706	8.7
1970	73713	2.2	.539	63078	4.6	.461	136791	3.3
1969	72104	-12.2	.545	60296	13.1	.455	132402	- 2.2
1968	82109	19.5	.606	53313	7.7	.394	135422	14.6
1967	68705	24.2	.581	49496	0.4	.419	118201	13.0
1966	55314	—	.529	49280	—	.471	104594	—

### F. Summary

An overview of the air conditioning industry offers several conclusions:

- a. There are relatively few manufacturers in this industry. This gives each manufacturer some oligopoly power over price levels and market shares.
- b. Most large firms are subsidiaries of U.S. parent firms. Manufacturing facilities are located in the U.S. and in Canada. Product origin, to some extent, is determined by landed costs, which includes wholesale price, transportation cost, and exchange rate. No one Canadian subsidiary makes the entire range of equipment product groupings or sizes; each imports some of its requirements from the U.S.
- c. Different brands of equipment are relatively undifferentiated. Therefore, elasticities of substitution are high. While other factors can occasionally dominate, the focus is on price. Firms wishing to maintain market share must also remain competitive. To increase market share, the firm will have to reduce its selling prices below current market levels, an action to which competitors will react to maintain their market shares.

- d. The majority of sales are based on a tendering process, wherein lowest price usually obtains the order. The accumulated history of this tendering process sets price levels for the industry. This process reinforces the importance of price implicit in readily substitutable products. Manufacturers who wish to maintain market share must accept the majority of their business at these market-determined price levels. Manufacturers have the option of reducing price levels to gain market share but few choose this option; it invariably invites a response in kind from competitors. Everyone would maintain market share, but at lower price and gross margin levels.
- e. Imports enjoy a large market share. They represent approximately half the total domestic market. Thus, a significant portion of the industry is directly affected by exchange rate movement. Since almost all imports are of U.S. origin, the relative movement of the U.S. and Canadian dollar is very important to the industry.
- f. The industry is relatively mature. It is not a growth industry with rapidly changing technology. Growth of any one company in this market is usually at the expense of its competitors, who view market share as an important objective to be maintained or improved.



## CHAPTER IV

### EMPIRICAL ANALYSIS

Import market share fluctuates yearly. Over the period analyzed, it varied from a low of 48.9% in 1977 to a high of 60.6% in 1966. This chapter examines the underlying forces which may cause import market share change. The examination follows this sequence:

1. Does relative purchasing power parity exist between the Canadian and U.S. air conditioning industries at the wholesale price level, i.e. the price that distributors pay to obtain the equipment?
2. If relative purchasing power parity does exist, what variables other than price explain yearly fluctuation in import market share?
3. If relative purchasing power parity does not exist, i.e. there is a price differential between U.S. and Canadian produced equipment, what is the relationship between import market share and its relative price?
4. If no relationship or a weak relationship exists between import market share and relative price, what other variables offer an explanation for import market share change?

### A. Purchasing Power Parity

The starting point is to determine the relationship between Canadian and U.S. prices at the wholesale level, i.e. the cost to the equipment distributor.

#### 1. Landed Cost

The "landed cost" of equipment to the distributor, i.e. the price he pays in his own currency to acquire his inventory, is related to the wholesale price index. This wholesale price index represents the average price at which the distributor buys equipment. When equipment is produced in Canada the relevant index is the Industry Selling Price Index (ISPI). When equipment is imported from the U.S. the relevant index becomes the Producer Price Index (PPI). Before importing the equipment, however, the distributor must pay duty (constant over the short term) and exchange (variable when the Canadian dollar is allowed to float).

We can therefore state that landed costs in Canada, i.e. wholesale costs, will vary as follows:

1. For Canadian manufactured equipment:

$$\text{Landed Cost} = f(\text{ISPI})$$

where ISPI = Industry Selling Price Index

2. For U.S. manufactured equipment:

$$\text{Landed Cost} = F(\text{PPI}, R) \text{ given that import duties were constant over the short term studied (1967-1979).}$$

where PPI = Producers Price Index

R = U.S./Canadian exchange rate (C\$/US\$).

Wholesale price indices have been prepared for most industries in Canada and in the United States. Statistics Canada publishes wholesale price statistics for Air Conditioning Equipment as well as related industries such as Heating Equipment. The U.S. Department of Labour, however, did not publish a Producers Price Index (PPI) for Air Conditioning Equipment until December 1977, although data is available for Heating Equipment. A regression of the Canadian Industry Selling Price Indices (ISPI) for Heating Equipment against Air Conditioning Equipment was calculated. The coefficient of correlation was very high at 0.9966 ( $r = .9933$ ). This high correlation might be expected in two industries that are closely related:

1. There is a wide overlap of common components such as fans, motors, v-belt drives, contactors, heat exchangers, gas valves, and sheet metal casings.
2. Both products are often made in the same factories, or, if not, use similar trades operating at common union scales. Labor input costs tend to rise at the same rate in both industries.

The lack of a specific Producers Price Index (PPI) for the air conditioning industry in the U.S., prior to December 1977, forces the use of Heating Equipment wholesale price indices. However, the use of a surrogate should not seriously affect the validity of this analysis.

The wholesale price indices for Canada and the U.S. at quarterly intervals, together with the price of a Canadian dollar per American dollar, are given in the Appendix for the period beginning January 1967 and ending January 1980. This permits comparison of the Canadian wholesale price level with the exchange rate adjusted U.S. wholesale price level.

If the relationship,  $ISPI = PPI.R$ , does hold, we have purchasing power parity in this industry, at least at the wholesale price level. With purchasing power parity, the distributor would not differentiate between U.S. and Canadian produced equipment when the exchange rate changed; they would maintain their same relative price levels.

## 2. Comparative Static Analysis

A comparative static analysis compares the price indices for imports and domestic supply to the exchange rate in base and current periods. This determines the relative change in price and the relative change in the exchange rate. If PPP is the only determinant of exchange rate, the Canadian/U.S. price ratio will equal the exchange rate ratio. Calculations are shown in Table 5.

TABLE 5  
RELATIVE PRICE CHANGES VS. EXCHANGE RATE CHANGE

YEAR	CANADIAN PRICE INDEX (ISPI) (annual average)	U.S. PRICE INDEX (PPI) (annual average)	CANADIAN/U.S. EXCHANGE RATE (R) (annual average)
1967 (base)	88.7	100.0	1.0787
1979 (current)	188.1	187.1	1.1715
Current/base	2.121	1.871	1.087

The Canadian to U.S. relative price change is  $2.121/1.871$ , or 1.134, which represents the Purchasing Power Parity, or PPP, in this industry. In other words, Canadian prices, measured in Canadian dollars, increased 13.4% more than U.S. prices, measured in U.S. dollars, over the study period.

The exchange rate ratio, however, increased by 8.6%, indicating that Canadian prices rose 4.8% faster than exchange rate adjusted U.S. prices over the 12-year period. This finding gives credence to the observation of several people<sup>1</sup> in the Canadian air conditioning industry that Canadian production was not as "competitive" as U.S. production.

<sup>1</sup> An informal observation by 3 out of 4 companies questioned during the industry survey.

This differential price increase can be attributed to two possible causes:

- a. U.S. production experienced relative productivity increases against Canadian production, possibly due to increased mechanization and/or increased economies of scale.
- b. Factor costs, particularly labor costs, had increased faster in Canada than in the U.S.

### 3. A Test of Exchange Rate Adjusted Price Levels in Air

#### Conditioning Equipment

Simple regression of Canadian wholesale prices (ISPI) against U.S. wholesale prices measured in Canadian funds (PPI.R), a test of relative PPP, gives a high correlation (see Table 6).

TABLE 6  
REGRESSION OF  
CANADIAN WHOLESALE PRICES VS. EXCHANGE RATE ADJUSTED  
U.S. WHOLESALE PRICES

$$(ISPI = C_0 + C_1(PPI.R))$$

Variable	Estimated Coefficient	Standard Error	t-statistic	Two-tailed probability
$C_0$	155.926	26.8108	5.81581	0.0000
PPI.R	0.321474	0.0766278	4.19526	0.0001
NOTE: $r^2 = .9968$ Standard error of regression = 2.14075 Durbin-Watson statistic = 1.6853 F - statistic = 272038 (Probability = 0.0)				

A cursory examination suggests that wholesale prices in the Canadian and U.S. air conditioning industries are closely related (significant at the 5% level) and that any devaluation of the Canadian dollar would be offset by concurrent relative price increases by Canadian producers. While this is theoretically possible for an entire economy, depending on which theory is cited, the very high correlation is somewhat surprising in a small industry, even when comprised of approximately 50% import content. Some similarity between PPI.R and ISPI, however, can be expected:

- a. The two economies are tied together; any inflationary factors inherent in the U.S. economy would be reflected in the Canadian economy. The high relationship between the ISPI and PPI.R may reflect the underlying inflation rate in the two economies.
- b. International trade unions, who represent workers in the air conditioning industries of both countries, generally seek wage parity, forcing labor input costs to a common trend line. (Note the apparent contradiction with point b. on page 43. While unions may generally seek parity it is possible that Canadian unions may have been marginally more successful by obtaining slightly larger increases over the period studied).
- c. World markets for raw materials, such as copper, aluminum, and galvanized sheet metal, suggest equal raw material input costs in all countries, when cost is measured in the same currency.

- d. Components such as compressors, motors, contactors, fans, and heat exchangers are often manufactured in one factory, usually U.S. based, then used in both countries to assemble air conditioning equipment.

Since the price component, PPI, may overwhelm the exchange component R, in the term  $PPI-R$ , (or vice versa), the two variables were regressed independently, but concurrently, against ISPI through multiple linear regression.

#### 4. A Test of Exchange Rate and U.S. Price Levels

Multiple regression of the exchange rate and U.S. wholesale prices against Canadian wholesale prices (see Table 7 for regression results) tends to support the general conclusion of the simple regression:

- using absolute data, purchasing power parity appears to exist at the wholesale price level in U.S. and Canadian air conditioning industries.
- using absolute data, however, we would normally expect the two countries to have similar price levels.

Additional information surfaces using multiple regression.

Canadian wholesale price levels appear to be more sensitive to exchange rate than to U.S. wholesale prices on the surface, but PPI is indexed to 100, while R is the ratio between U.S. and Canadian dollars, i.e. the exchange rate. If R were similarly indexed, the estimated coefficient would be approximately 0.48. Thus, ISPI is affected more



by PPI than by R, which does not support Richardson's finding that the Canadian prices of tradeables responded equally to U.S. prices and the exchange rate, or were affected more by the exchange rate (see page 16).

Absolute data may obscure the effects of the rates at which wholesale price levels and the exchange rate are changing. As we have seen from our overview of the air conditioning industry it is a very competitive industry. Relatively minor rates of change in price may give either imports or domestically-produced equipment sufficient price advantage to affect market shares. An analysis of rates of change in U.S. prices and the exchange rate will determine what effects they have on Canadian wholesale prices.

TABLE 7  
REGRESSION OF ISPI ON PPI AND R

$$(ISPI = C_0 + C_1 PPI + C_2 R)$$

Variable	Estimated Coefficient	Standard Error	t-statistic	Two-tailed probability
$C_0$	-70.0939	9.23529	- 7.58979	0.0000
PPI	1.06543	0.0217965	48.8806	0.0000
R	48.4949	9.60387	5.04951	0.0000
NOTE: $r^2$ = .9961 Standard error of regression = 2.06477 Durbin - Watson = 1.7712 F - statistic = 194954 (Probability = 0.0)				

### 5. A Test of Price Rates of Change

For this test, two regressors, the rates of change in the exchange rate and in the U.S. wholesale price index, were employed. The dependent variable was the rate of change in the Canadian wholesale price index. Each variable was generated using quarterly data annualized as a percent rate of change.

The regression results in Table 8 suggest that the percentage rate of change in the PPI is significant at the 5% level (two-tailed probability is 0.0137), but the percentage rate of change in the exchange rate is not significant at the 5% level (two-tailed probability is 0.4280).

TABLE 8  
REGRESSION OF RATES OF CHANGE OF ISPI AGAINST RATES  
OF CHANGE OF PPI AND R

$$\ln(\text{ISPI}) = C_0 + C_1 \ln(\text{PPI}) + C_2 \ln(\text{R})$$

Variable	Estimated Coefficient	Standard Error	t-statistic	Two-tailed probability
$C_0$	4.39162	2.05467	4.16399	.00001
PPI	0.358966	0.140261	2.55926	.0137
R	0.0867713	0.108549	0.799377	.4280
NOTE: $r^2$ = .1078 Standard error of regression = 5.47804 Durbin - Watson = 1.9973 F - statistic = 71.1052 (Probability = 0.000)				

Thus, while longer term price levels, measured in the same currency, tend to be equal, i.e. purchasing power parity holds, the relationship does not appear to hold in the short term when rates of change are used.

There may be a response lag in the rate of change in Canadian wholesale prices to the rate of change in U.S. wholesale prices and to rates of change in the exchange rate. Both regressors were lagged one quarter to determine if a larger correlation was evident (see Table 9).

Lagging rates of change in U.S. wholesale prices and the exchange rate by one quarter increases the coefficient of correlation for the regression equation. In addition, both regressors are now significant at the 5% level. Note, however, that the sum of the coefficients C1 and C2 are less than 1.0. While there appears to be an increased tendency towards purchasing power parity over time, the U.S. price change and the exchange rate change only explain about 20% of the change in ISPI, when each are lagged one quarter.

NOTE: That lagging exchange rate and U.S. wholesale prices by one quarter corresponds to the normal inventory turnover in this industry of approximately four turns per year. When either exchange rate or U.S. price changes, equipment in inventory is not affected for some 2-4 months.

Thus Canadian and exchange rate adjusted U.S. prices do not have parity over relative short periods of time. They deviate from each

other continually, but tend towards a common trend line. This relative movement, however, may be sufficient to cause import market share change.

TABLE 9  
REGRESSION OF RATES OF CHANGE OF ISPI AGAINST RATES OF  
CHANGE OF PPI AND R, LAGGED ONE QUARTER

Variable	Estimated Coefficient	Standard Error	t-statistic	Two-tailed probability
$C_0$	4.26481	1.00200	4.25630	.0001
PPI i-1	0.410959	0.133981	3.06728	.0036
R i-1	0.198859	0.101503	1.95914	.0560
NOTE: $r^2$ = 0.2072 Standard error of regression = 5.07945 Durbin - Watson = 1.9488 F - statistic = 87.5423 (Probability = 0.000)				

#### B. Relationship of Relative Price Change and Market Share

The previous section suggests that there is a short-term differential rate of change in Canadian and exchange rate adjusted U.S. price levels.

This section examines the effect of this relative price change on the market shares of domestic and imported equipment. (If U.S. whole-sale prices, adjusted for exchange rate, rise faster over a given

period than Canadian wholesale prices, we would expect imports to lose market share, ceteris paribus.)

In the analysis that follows, annual data is used to reduce the effects of inventory change that may be reflected in quarterly data. Two regressions have been calculated (from data in Table 10):

1. Market share against relative price change (Table 11)
2. Market share change against relative price change (Table 12)

Absolute market shares appear to be relatively unaffected by relative price change. The sign for RPC (relative price change) is negative as we would expect, indicating that the weak relationship is at least in the right direction; as the relative price of Canadian products rises, domestic market share drops.

The change in market share (see Table 12) has a very low correlation with price change. The sign for RPC is not even negative as would be normally expected, indicating that when Canadian products experience a relative price increase against U.S. products, their market share change is positive, i.e. their market share improves! However, no significance can be attached to this relationship.

Other factors appear to have more significance than wholesale price levels in determining respective market shares of imported and domestic equipment in this industry. Two factors identified, which

TABLE 10  
ANNUAL RELATIVE PRICE CHANGE AND MARKET SHARE CHANGE

YEAR	ISPI	% CHANGE ISPI	PPI	R	PPI.R	% CHANGE PPI.R	REL. PRICE CHANGE	DOMESTIC MARKET SHARE (%)	DOMESTIC MARKET SHARE CHG (%)
1966	86.7	--	99.9	1.0773	107.6	--	--	47.12	--
1967	88.7	2.31	100.0	1.0787	107.9	0.28	2.03	41.87	-5.25
1968	91.9	3.61	102.5	1.0775	110.4	2.32	1.29	39.37	-2.50
1969	94.6	2.94	105.4	1.0768	113.5	2.81	0.13	45.54	6.17
1970	97.7	3.28	110.6	1.0440	115.5	1.76	1.52	46.11	0.57
1971	100.0	2.35	115.5	1.0098	116.6	0.95	1.40	47.40	1.29
1972	104.0	4.00	118.2	.9905	117.1	0.43	3.57	46.51	-.089
1973	108.2	4.04	120.4	1.0001	120.4	2.82	1.22	44.88	-1.63
1974	121.9	12.66	135.0	.9780	132.0	9.63	3.03	42.88	-2.00
1975	137.3	12.63	150.7	1.0173	153.3	16.14	-3.51	48.27	5.39
1976	146.9	6.99	158.1	.9861	155.9	1.70	5.29	51.05	2.78
1977	156.6	6.54	165.9	1.0635	176.0	12.90	-6.36	50.05	-1.00
1978	169.3	8.43	174.4	1.1402	198.9	13.01	-4.58	44.29	-5.76
1979	188.1	10.78	187.1	1.1715	219.0	10.21	0.57	48.20	3.91

NOTE: RELATIVE PRICE CHANGE = Percent Change in ISPI - Percent Change in PPI.R  
 MARKET SHARE CHANGE = Change in Domestic Market Share from Previous Year  
 ISPI, PPI, and R are annual averages

TABLE 11

## REGRESSION OF MARKET SHARE AGAINST RELATIVE PRICE CHANGE

$$(DMS = C_0 + C_1 RPC)$$

Variable	Estimated Coefficient	Standard Error	t-statistic	Two-tailed probability
$C_0$	0.465548	0.0144216	32.2812	0.0000
RPC	-0.0000868	0.00235341	-0.03686	0.9713
NOTE: $r^2$ = 0.1754 Standard error of regression = 0.0303 Durbin - Watson = 2.0086 F - statistic = 1.21713 (Probability = 0.3364)				

TABLE 12

## REGRESSION OF MARKET SHARE CHANGE AGAINST RELATIVE PRICE CHANGE

$$(DDMS = C_0 + C_1 RPC)$$

Variable	Estimated Coefficient	Standard Error	t-statistic	Two-tailed probability
$C_0$	0.00756872	0.00903907	0.837334	0.4220
RPC	0.00212472	0.00303904	0.699142	0.5004
NOTE: $r^2$ = 0.1369 Standard error of regression = 0.03434 Durbin - Watson = 1.8588 F - statistic = 4175.76 (Probability = 0.0)				

will be examined further, are:

1. The ability and/or willingness of Canadian manufacturing plants to respond to large fluctuations in demand (Chapter IV, Section C).
2. The effect of oligopolistic firms maintaining market shares during exchange rate fluctuations (Chapter V).

C. Growth Rates: Total Domestic Demand, Domestic Supply,  
and Imports

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Growth rates for the total domestic market, domestic manufacturers, and imports using annual data are shown in Figure 4. These growth rates are compared to the relative price change experienced by Canadian-made equipment versus U.S.-made equipment at the wholesale level. U.S. and Canadian wholesale price levels have been converted to a common currency, i.e. Canadian dollars, to reflect their "landed" Canadian cost.

Examination of Figure 4 reveals some interesting information:

1. In only 3 years, 1975, 1977, and 1978 has the Canadian wholesale price increase been lower than the exchange rate adjusted price increase in the U.S. Productivity gains over the entire period studied may have been lower in Canada than in the United States, but other factors could account for this price performance.



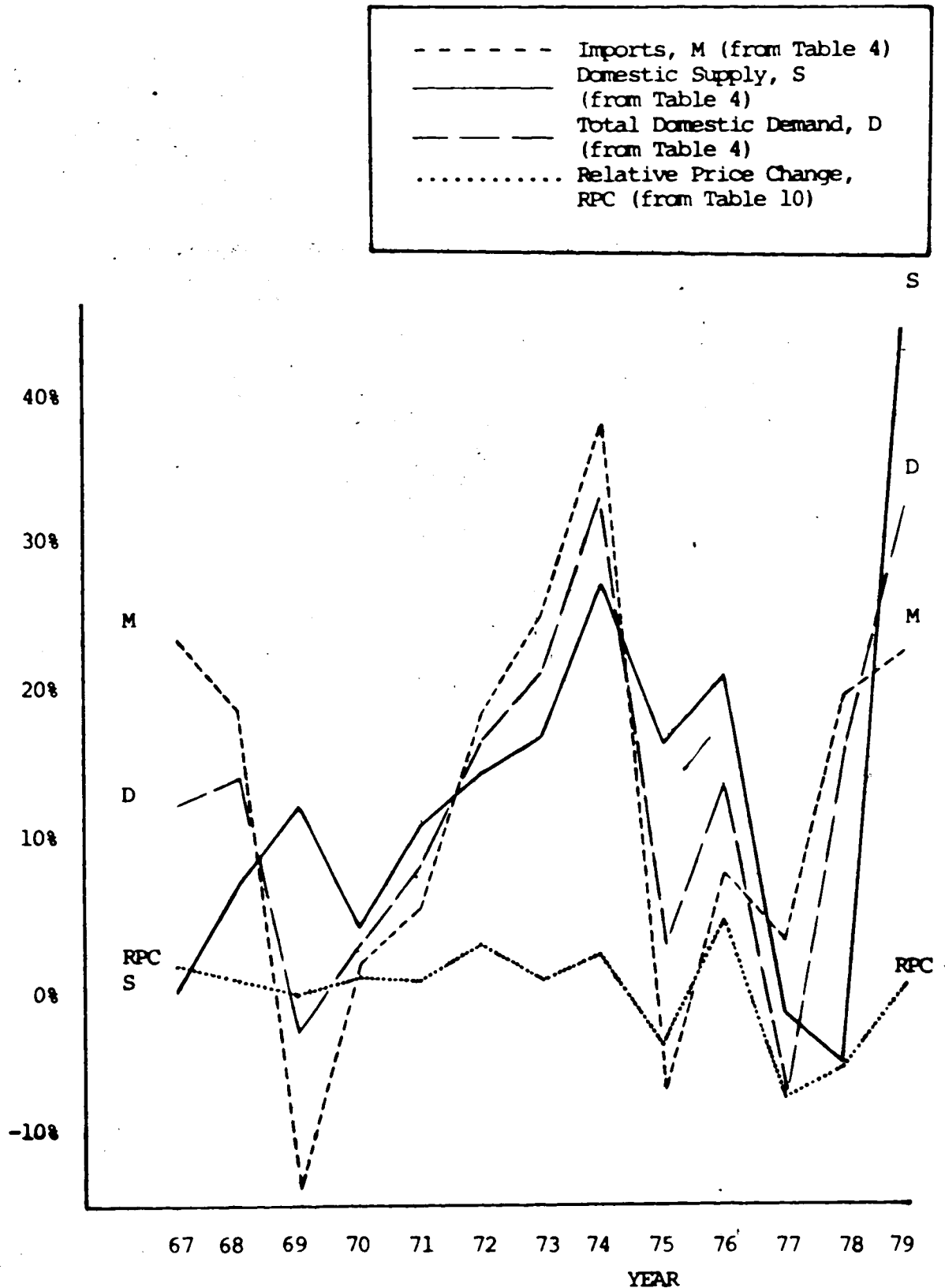


FIGURE 4: Annual market growth rates and relative price change

2. Total domestic demand decreased in 1969 by 2.2%. Import demand dropped even further, declining by 12.2%. Domestic supply, however, rose by 13.1% in a year when Canadian and U.S. wholesale price increases were almost identical. The management of Canadian manufacturing establishments appeared to have been reluctant to let imports retain their market share in a no-growth year. Note, that despite U.S. ownership of these plants, individual Canadian managers continually seek improved plant loading, i.e. they want their plants to operate at or near maximum possible output. In no-growth years, they can do this only at the expense of imports.
3. When total domestic demand in 1974 rose by 33.6% over the previous year, exchange rate adjusted American price did not rise as quickly as Canadian price, and import market share increased. The disproportionate increase in import market share suggests that imports may have behaved as "residual supplier", accommodating the high rate of increase in domestic demand. Canadian manufacturers may have been unable to increase production to meet the rapidly expanding market in the short interval available, and were probably unwilling to commit to expanded domestic capacity based on record demand increases that may not be sustainable.

4. Import market share dropped in 1975 by 6%, a low growth year for the industry. Domestic manufacturers increased their market share, aided by a higher import wholesale price increase that year. The year, although registering only a 3.8% growth in total demand, followed two high growth years in 1973 (21.9%) and 1974 (33.6%). The resulting increases in plant capacity, followed by a low growth year and a wholesale price advantage, may have offered sufficient impetus for the 16.9% increase in domestic supply during 1975.
5. Domestic prices increased 5.29% faster than U.S. prices in 1976, yet domestic production improved its market share by 2.8 percentage points. This was a relatively low growth year, however, total domestic demand grew by 14.8%, including inflation. Domestic producers may have had excess production capacity available that they wanted fully employed.
6. Other factors appeared to intrude in 1977. Total domestic demand had decreased by 6.5%, domestic manufacturers appeared to have had a lower wholesale price increase, yet importers enhanced their market share from 48.9% to 49.9%. The residual supplier theory, i.e. imports adjust to meet supply/demand shortfalls, appears to be rigid on the downside. Distributors will increase imports, and thus import market share, to meet unexpected demand increases beyond the willingness or ability to increase Canadian production capacity, but will resist decreasing imports in absolute terms (dollars) when demand

falls. They may accept a slight minor market share drop in low-growth years as long as dollar volume increases, but appear less willing to accept a market share drop in a declining market.

7. 1978 was an unusual year. Demand rebounded by 16.8% over 1977, and by 9.2% over 1976, the previous record year. Canadian domestic production dropped in dollar volume and in market share, in spite of lower price increases. A possible explanation is that Canadian manufacturers may have been pessimistic after the previous poor year, lowering production capacity by reducing overtime or dropping a shift. The large increase in demand, being unanticipated, may have given imports better equipment availability, and thus, improved market share, before Canadian production could respond.
8. Canadian production capacity appeared to have been increasing in 1979, however, in response to demand increases in both 1978 and 1979. Canadian suppliers had sufficient equipment availability, combined with negligible price increases over imports (after 2 years of lower increases), to improve their market share from 44.3% to 48.2%.

#### D. Conclusions

1. Purchasing Power Parity does not appear to exist in the air conditioning industry in the short term. In the longer term, however, the wholesale price levels in the U.S. and Canada, measured in the same currency, do tend to a common level.
2. In the short term, price differences occur between U.S. imports and Canadian domestic production. These price differences have an impact on domestic and import market shares, but the impact is not significant at the 5% level. Other factors, such as the ability and/or willingness of Canadian manufacturers to meet a sudden demand increase and the need to retain hard-won market share investments, were identified.
3. The residual supplier theory, based on imports accommodating excess demand beyond the ability or willingness of Canadian manufacturers to meet, has some power to explain unexpected market share fluctuations (with a different direction to the "expected" direction, i.e. when market share improves despite a relative price increase). But this theory does not satisfactorily explain all deviations from the expected.
4. To more fully explore market share retention strategies of oligopolistic firms, the other factor identified, various manufacturers were surveyed. Survey results appear in Chapter V.

CHAPTER V  
INDUSTRY SURVEY

The empirical results in Chapter IV suggested that:

1. Over the longer term wholesale prices in the U.S. and Canada tended to a common level.
2. In the short term, however, there were variations in wholesale prices between Canada and the U.S., when wholesale prices were measured in a common currency.
3. These variations in wholesale price only partially explained the market share fluctuation between imports and domestically-produced equipment.
4. Other factors identified as contributory were the "residual supplier" factor and market retention by oligopolistic firms.
5. While the residual supplier factor had some explanatory power, a fuller explanation warranted further investigation of market control by oligopolistic firms to ascertain the degree to which they would exert this control to maintain market share. If market share is sufficiently important, the actions of distributors to maintain market share in all product groupings, regardless of origin, would maintain import quantities during devaluation.

Four of the largest air conditioning firms in Canada were interviewed. These firms represent two-thirds of the major firms, who represent collectively, about 80% of total industry sales.

## A. Summary of Responses

The detailed survey questionnaire and individual responses appear in Appendix A. The responses are summarized in this section.

### 1. Equipment Distribution

Two companies distribute each of the 7 major product groups included in "packaged equipment", which is high volume, standardized, relatively undifferentiated air conditioning equipment. A third firm distributes all but one product grouping, which it considers to be a specialty market that does not affect its remaining business. The fourth company, the smallest of those interviewed, no longer imports several product groupings due to their high import cost, acknowledging the effects of the devalued Canadian dollar.

### 2. Effects of Devaluation

Each distributor emphasized that Canadian-produced equipment could now be sold for a higher profit, since it can be purchased at a lower price than U.S.-produced equipment. They all had at least one product group, however, presently being imported from the U.S., that was being produced in Canada by one or more competitors. The landed cost of this imported equipment was higher than Canadian-built equipment, and they were experiencing mild to acute margin pressures. Selling prices had risen slightly, but not as much as the exchange rate had. Costs of imports, however, had risen in direct proportion to the exchange rate.

### 3. Importance of Market Share

In a mature market, share of market translates almost directly into sales revenue. Firms are prepared to make a long-term investment in market share to ensure future revenue and profit. All distributors surveyed were very concerned about market share. They monitor it closely, and, if it drops, they react quickly. Even the smallest manufacturer, who expressed little interest in market share compared to profit margins, reacted quickly to market share change by dropping his price to stabilize his position. They do not like to lose profit margins, but they are prepared to trade off some profit margin to maintain market share.

Market share is monitored by product grouping. This information is readily available; it is prepared from data submitted by each distributor on a monthly basis.

Each product group is equally important in this overall market strategy (for 3 of the 4 firms interviewed). Distributors are not prepared to allow market share erosion of any product group, regardless of where this product group originates, its landed cost and the consequential effects on profits, at least in the short term.

### 4. Reaction to Market Share Decline

Every company reacts to market share decline. The reaction, however, varies. The immediate reaction is to reduce price to recoup market share losses until more effective strategies can be put in



place. These strategies may include:

- equipment redesign
- improvement of fabrication or assembly operations (higher productivity)
- more efficient distribution channels
- reducing overhead
- increased product differentiation through sales training, advertising, etc.
- freight equalization
- special concessions from the manufacturer
- increased Canadian production facilities

The first seven strategies can be effective for domestically-produced or imported equipment affected by low margin levels. The last strategy, increased Canadian production facilities, is being considered by several distributors to offset import margin pressures induced by exchange rate fluctuation.<sup>1</sup>

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<sup>1</sup>Note that this is at variance with Table 5, which suggests that exchange-rate adjusted Canadian wholesale prices rose 4.8% more over the period 1967-79 than U.S. prices. Note, however, that over the period 1976-79, exchange-rate adjusted U.S. prices rose by 40.5%, while Canadian prices rose by 28.0%. If price levels were relatively comparable in 1976, then it is easy to see why imports would be at a disadvantage in 1979.

These normal reactions of distributors to maintain market shares in all product groupings, regardless of origin, tend to stabilize import quantities in the short term. In the longer term, however, increased Canadian production, if implemented as planned by this industry, will erode import market share.

#### 5. Success of Market Share Maintenance Strategies

Three distributors were moderately pleased with the success of these measures. They match lower prices, where necessary, to maintain market positions in all product groupings, including those that are imported.

They are prepared to adopt these measures for the short term. In the longer term, however, if the present pricing differential is maintained, they are prepared to produce more equipment in Canada to take advantage of lower costs.

#### B. Conclusions

All four companies were vitally interested in their market shares in each and every product group. Market positions in a mature industry are difficult and costly to restore. Hence, hard-won positions will not be allowed to erode due to temporary exchange-rate induced pressures. This conclusion supports Dunn's earlier conclusions, cited in Chapter II.

In the short term, air conditioning firms are prepared to endure lower (or non-existent) profits, to maintain market position. This

strategy tends to stabilize the respective market shares of both domestically-produced and imported equipment. Only in the longer term will a devalued Canadian dollar erode the market share of imports as more Canadian-built equipment is produced to take advantage of a lower cost, due to a devalued Canadian dollar.

This strategy, and the ability of these oligopolistic firms to implement it, has kept import share of market at a relatively constant position in spite of the recent Canadian devaluation.

## APPENDIX A

### SURVEY QUESTIONS AND ANSWERS

#### A. Initial Letter of Inquiry

March 19, 1979

Attention:

Dear Sir:

RE: M.B.A. Thesis

I am preparing an M.B.A. thesis exploring the reaction of Canadian importers and producers of air conditioning equipment to the recent devaluation of the Canadian dollar. The theoretical response would be that prices of imported products rise in terms of Canadian dollars. Consequently, import quantities would fall, compared to overall Canadian demand, unless importers did not allow their market shares to decline, or if the demand for U.S. imports was relatively constant regardless of price levels.

As per our telephone conversation of last week, the product groups I would like to discuss with you are the following:

- 5 ton and smaller package cooling units
- 7 1/2 ton and larger package cooling units
- 5 ton and smaller condensing units
- 7 1/2 ton and larger condensing units
- 5 ton and smaller package heat/cool units
- 7 1/2 ton and larger package heat/cool units
- room air conditioners

These product groups were chosen since they are made and/or distributed by a majority of manufacturers, and are made in both Canada and the U.S.

M.B.A. Thesis  
March 19, 1979  
Page 2

Our discussions will center on how the Canadian dollar has affected your share of market and/or margin levels, how your firm has reacted to those pressures, and what long-term strategy you've formulated to deal with the situation.

All questions asked will be general in nature and will anticipate a general response. Specific responses are not required for this study.

All responses will be confidential to this survey. They will be aggregated or disguised to conceal the source.

Yours very truly,

(Mr.) L.A. Chester

### B. Survey Questions

1. Several product groupings were mentioned on the first page, product groups that are manufactured in Canada and the U.S. Does your company distribute all these product groupings? If not, are the missing product groups manufactured by your company? Are price levels a factor?
2. Which of these product groups do you manufacture in Canada? Are Canadian-made products more profitable this year than last year? How has the devalued Canadian dollar affected your profitability?
3. How important is "share of market" to your company? Of the three performance goals; profit, sales volume, and share of market, which is the most important?
4. Do you monitor share of market for each product group?
5. How does a fall in share of market affect your marketing decisions? How about a rise?
6. What margin pressures are you experiencing with U.S.-made equipment? Does the higher productivity in U.S. plants compensate for the lowered Canadian dollar plus import duty?
7. Do any of your competitors manufacture any of these product groups in Canada? Have any of them recently begun to manufacture in Canada? How has this affected your share of market? Your margin levels?
8. Are you considering manufacturing any more product groups in Canada? Which ones? Why? (is this meant to recoup margin levels or share of market or both?)
9. How has your company reacted to maintain share of market in U.S. imported products? Have you used:
  - lower transfer price from U.S. manufacturer
  - special pricing in specific market areas where margin pressures are highest
  - reduced margins (down to cost or lower) to meet competitive prices
  - greater product differentiation to justify higher prices
  - salesmen incentives

10. Have these measures been successful?
11. How long do you intend to use them?
12. Have Canadian-built units been lowered in price as the Canadian dollar deflated, i.e. lowered with respect to U.S.-made equipment? Which product groups have been most affected? Are the Canadian-built units getting an increased market share, or are these prices being matched by U.S.-built equipment?
13. How long do you expect the Canadian dollar to remain at its present level? Where do you expect the new level to be?
14. How will the new level (or same level if remaining constant for long term) affect your longer term strategy? Can you continue your present strategy indefinitely? Will you?

### C. Survey Responses

#### 1. Company 'A' (Sales Vice President)

1. This company distributes product groups SPL-R and SPL-C only. These were the only product groups manufactured by this company or its U.S. parent. Other units were manufactured in the U.S. and imported, but the low volumes in comparison with other manufacturers made them uneconomic (uncompetitive).
2. The SPL-C group was manufactured in Canada. (SPL-R equipment was brought from the U.S.) This equipment was no more profitable since major competitors were also manufacturing in Canada.
3. Share of market was relatively unimportant. This company wanted to keep its sales volume up (but a concession was made to share of market needing to be maintained to accomplish this). Profit was most important goal.
4. Market share was not monitored on a continuing basis but if it went down they became concerned. Note that the respondent was more concerned about specific locales and product group share in that locale. Their measure was capture ratio, i.e. the ratio of sales gained over total jobs quoted which is not quite the same as market share. Share of market per se across Canada was not of prime concern.
5. Fall in market share was not too important unless it was falling drastically. Then they wondered where they were missing something. All costs were about the same (?) and if somebody had a lower price, they did a study to see where they were inefficient.
6. Their SPL-R offering was virtually wiped out of the market place. Their landed cost was too high. The U.S. parent company made no price concessions and they (the Canadian company) were not willing to sacrifice profitability. Consequently, their market share declined. This was not a large sales volume product anyway. They did not mind losing whatever market share they had. Higher productivity in the U.S. was not sufficient to keep their costs in line.
7. More product groups will be manufactured in Canada but none of those listed. Larger package chilling units would be made in Canada to avoid cost of U.S. made product.
8. (We are considering Canadian manufacture of) U.S. products, where cost pressures were growing. This company intended to let that market go. They view the situation as improving when U.S. dollar regains its par relationship with Canadian dollar. Note that



one product group imported from the U.S. could be combined with a special high pressure fan coil. This "system" maintained its market position because of its uniqueness (product differentiation that was inherent, not requiring additional promotion). This system has an extremely small market share (they believed) and was not subject to much fluctuation.

9. No measures taken. (U.S. parent would not give price break even if requested.)
10. Not applicable.
11. Only area that applies is in SPL-R. No great effect on this company due to unique product offering.
12. The dollar will not rise to par for some time, if ever. Perhaps it might rise to .90 U.S.
13. If it stays down, some larger equipment will be made in Canada from U.S. components (compressors, evaporators), instead of being imported. Note that in intermediate sizes, some market share improvements were gained at same price levels against competitors who mainly import.

## 2. Company 'B' (Sales Vice President)

1. This company distributes all product groupings except RAC. This is an appliance-type of business dependent on large volume and extensive advertising/promotion.
2. The following groups are manufactured in Canada: SPL-R; they are getting a better share of market. The market is being essentially divided among Canadian manufacturers, who have a slight (10-15%) price advantage over American product importers.
3. Share of market is very important. They closely monitor their shares in all 6 product groupings mentioned plus 2 other groupings not specified. For a short term, they will allow profitability to erode if their market share declines more than a few points. (Up to a few points, they do not register concern).
4. Yes, monitor market shares closely.
5. A fall in market share is viewed seriously. The market has matured. Only means of growth is to hold and increase market shares at expense of competitors in a slow growth industry. Before reacting to a share loss in a particular area, they would study to see if price was the reason. But they would drop prices to keep their market share intact pending a price rise.
6. Not too much fat (margin) in equipment prices. Margin pressures are experienced in U.S. made products except some volume products made in very large production runs. Higher productivity in U.S. is almost sufficient to offset the lowered Canadian dollar. This is in 5-10 ton package units (PAC-C and YAC-C). In other products, there is no alternative but to let prices slide to meet the competition. Note that this company tries to have a few extra goodies on their products to justify a price premium.
7. Competition is two-fold. We (Company 'B') have a very expensive design. It is costly to build. And, other companies are building these products in Canada. The cost of importing components (duty and exchange must still be paid on them) plus lower productivity to assemble in Canada would keep us competitive, but only if our design was less expensive. We are going through a redesign in our U.S. plant. But our share of market has slid and our margins are much tighter than they were a year or two ago.
8. In the next few months we will start manufacturing small heat/cool and cooling only package units in Canada. The reason is the increased cost of the U.S. dollar and our market position. We intend to regain profitability and market share corresponding to

our 5-year marketing plan. Our short-term strategy had been to maintain market share at the expense of margins but not to lose money on the product groups involved. We may also make the larger, 7 1/2, 10 ton units in Canada after the redesign. This will be done to regain market share and take advantage of the reduced value of the Canadian dollar.

9. When faced with market share/margin pressures:
  - lower prices from the U.S. are not available (they buy at plant cost)
  - no special pricing in Canada (no discounts in one area offset by premium, or at least standard pricing in another area).
  - margins are left to the distributor's discretion in each area, and some differential exists
  - biggest thrust is through the buying influence, i.e. getting specified to demand a slight premium from contractors. This thrust continues regardless of Canadian dollar position
  - salesmen training - the best salesmen are well trained. They can get us an extra dollar
10. This last measure has been successful on a percentage of all jobs bid. The majority of projects are sold on one basis: price. We still have to be competitive. We are reducing price to meet competition, and are relying on our product and sales people to get us business at prices equal to or higher than the market price. Our Canadian-built products are rising in price faster than U.S.-built product. Margins are improving on those products which does help offset our problem areas.
11. We are making plans now to build these problem products in Canada.
12. Canadian-built units are better priced but often not substantially. Where they used to be about the same price, they are now about 10% lower. They can drop lower yet on large projects but we feel they are making better margins. The small heat/cool units (YAC-R) are selling at our landed cost but these manufacturers are probably not picking up much market share. Other people, including ourselves, won't allow that to happen.
13. Dollar may rise to .90-.92 by 1982. We are assuming that it won't rise further (otherwise decision to manufacture in Canada could be a poor decision). Expect the Canadian dollar to remain low for quite a few years.

14. As mentioned earlier, we are making plans to build more product in Canada. How far we go depends on:

- whether additional land and buildings are required
- if existing production lines can be used or if new lines have to be built
- what effect it might have on the U.S. plant. In some areas, we represent 15% of the U.S. plant's volume. The effects on that plant have to be analyzed before proceeding

Company 'C' (Director of Marketing)

1. We distribute all those product groupings in Canada.
2. All those groupings are made in Canada except large condensing units (SPL-C). Our volume is too low in that grouping to justify manufacture in any plant. We import our requirements from the U.S. Our Canadian volume is very low but we aren't concerned. Our other products are performing very well. We are not much more profitable now. It has been difficult to raise prices relative to exchange increase. Other manufacturers have attempted to raise market share in face of price increases due to devaluation. Consequently, devaluation and our Canadian production have now allowed dramatic increases in market share of profitability. Note that devaluation has increased component costs (compressors, heat exchangers). These costs have been recovered.
3. Most of our emphasis has been on the financial aspects, sales volume, margins, expense control. Share of market has been and is a very important consideration. We know that we can't increase our market share without a reaction, but we also won't allow our share to drop beyond a certain range.
4. Share of market is constantly monitored. As long as it doesn't fluctuate too much we are not overly concerned.
5. Margin increases would be traded off for an increasing market share. But no dramatic increases in margin rate or share of market has been experienced as a result of the Canadian dollar devaluation. Our competitors have found a means to meet our lower prices, if they are actually much lower.
6. Only U.S. equipment that is being imported is the large condensing unit (SPL-C). We aren't concerned with share of market for that product. It has always been low.
7. Some competitors make equipment in Canada and some of them recently introduced new product to Canadian plants. They haven't affected us much. Perhaps they are recovering lost margins at our price levels by manufacturing here. One effect of the Canadian dollar devaluation is that American manufacturers no longer "dump" their product in Canada. Their costs are too high.
8. We already make all the product groups in Canada but are considering making a larger range of capacities. Also, we are culling out bad sizes, those with low volume or poor margin performance. We just introduced another product this year that we are importing at a loss. We did so to gain market position (market share), build up a dealer organization to handle that product.

9. There will be no market share decline. With the exception of the one product group mentioned earlier, we have never received special consideration from our U.S. parent. They gave us special pricing to establish market share before commencing Canadian assembly. Otherwise we are on our own.

The Canadian company does give some consideration to our Western distributor. Prices are identical in the West to prices in Ontario or Quebec. But a significant freight differential exists. We "subsidize" their freight cost to ensure a good market share.

10. Our measures have been successful. We have slowly picked up market share. Our thrust has been more successful, but not dramatically, with the dollar devaluation.
11. We used, and will use, special pricing in Canada to gain and keep our market shares. They are now quite good and we will probably not attempt to gain further increases.
12. There have been some minor increases in prices for Canadian-built equipment but American-built units have not changed as quickly as they might with the U.S. exchange. A few suppliers have tried to capture market share with U.S. produced equipment in spite of the adverse exchange rate. These suppliers make it difficult to raise prices. No one seems to be getting any major market share increases, however.
13. Anticipate a .90 range but doubt that par will ever again be achieved. We will probably produce more in Canada to offset duty and exchange.
14. Long term: definitely more production in Canada. We expect the share of market/margin trade-off position to improve as U.S. manufacturers are forced to raise their prices.

Company 'D' (President)

1. Our company distributes all these product groups.
2. We manufacture the larger equipment in Canada. The higher volume, smaller equipment ranges are produced in the U.S. The increased productivity of large production lines plus some concessions enable us to remain competitive in that equipment range. Canadian-produced products are about equal in profitability. We pay more for components that we bring from the U.S. If the whole unit were brought in, it would now cost more, and we would lose margin dollars. So, Canadian production has been an advantage whereas before devaluation, it was a slight disadvantage (due to higher U.S. productivity).
3. Share of market is very important. We will emphasize it as long as total margin dollars rise (not necessarily margin percentage). Our aim is to be the largest factor in every area and in every product group. It will not be allowed to fall without a battle.
4. Share of market is monitored very closely in every product grouping where it is available. Share of market targets are a part of every distributor's objectives as well as for the whole Canadian company.
5. A share of market drop is met with a lowered price level to regain lost territory. A strong rise (in market share) can cause prices to rise slightly. The equilibrium position is when small market share increases are realized every year.
6. The U.S. made equipment (PAC-R, YAC-R, and SPL-R) has had the most serious margin pressure. The higher productivity inherent in large U.S. runs has kept the Canadian distributors in the ball game, but only through special price concessions from the U.S. manufacturer.
7. Two competitors had increased their market share at our expense. One company achieved gains in SPL-R, another in YAC-R. Both companies experienced lower costs from Canadian production. Not only share of market but margin percentage, and especially margin dollar, losses were incurred. Only contractor loyalty gave sufficient price levels to maintain a respectable S.O.M./margin performance. The strategy had been to keep competitors out of loyal accounts by meeting whatever prices were offered, at the expense of margin.

8. More product will be manufactured in Canada. A new product introduced this year was RAC equipment. This will be followed by other groupings as the need arises. In the meantime, special concessions will be pursued to offset pressures and maintain or increase market shares.
9. We've reacted by using a combination of:
  - lowered transfer prices on U.S.-built equipment (from 10% to 25% off depending on need)
  - lowered margins and increased productions from Canadian plant where market shares were too low
  - special funds for low-margin projects
  - emphasis on product differentiation: quality, reliability, consultant's specifications, contractor incentives
10. The measures have been relatively successful. It is too early to tell since some programs are recent, but early indications are that market shares will be maintained or increased.
11. These programs are of limited duration. If the dollar remains devalued, other strategies may become necessary.
12. Our experience is that Canadian-built products have not risen rapidly (near inflation rates increases) while U.S. product costs have risen at inflation rates levels plus exchange-rate changes. The selling price change is somewhere in between but nearer the cost rise in Canadian-built products. Their strategies (Canadian producers) are apparently to increase market share or to make U.S. imports unprofitable. But through special concession, neither goal will be realized. We will increase market share and maintain necessary margin levels.
13. The dollar will remain below par for some time, at least 3 or 4 years.
14. We must investigate additional Canadian production depending on setup costs, Canadian productivity, and effects on our U.S. plants.



APPENDIX B  
CANADIAN VERSUS U.S. WHOLESALE PRICE INDICES  
(AT 3 MONTH INTERVALS, 1967 - 1980)

MONTH	POINT	ISPI	PPI	R	PPI.R
JAN 67	1	98.4	100.0	1.0795	108.0
APR 67	2	88.4	99.4	1.0824	107.6
JUL 67	3	87.8	100.0	1.0778	107.8
OCT 67	4	89.6	100.3	1.0733	107.7
JAN 68	5	91.8	100.5	1.0847	109.0
APR 68	6	91.3	102.1	1.0801	110.3
JUL 68	7	91.9	102.9	1.0736	110.5
OCT 68	8	92.1	103.2	1.0727	110.7
JAN 69	9	94.0	103.8	1.0727	111.3
APR 69	10	94.8	104.5	1.0762	112.5
JUL 69	11	94.8	105.5	1.0806	114.0
OCT 69	12	94.4	106.6	1.0779	114.9
JAN 70	13	96.8	107.7	1.0728	115.5
APR 70	14	97.1	109.4	1.0728	117.4
JUL 70	15	98.4	111.6	1.0320	115.2
OCT 70	16	98.0	113.0	1.0214	115.4
JAN 71	17	98.5	113.6	1.0116	114.9
APR 71	18	99.8	114.7	1.0076	115.6
JUL 71	19	100.0	115.9	1.0211	116.3
OCT 71	20	100.7	116.3	1.0044	116.8
JAN 72	21	101.7	115.9	1.0059	116.6
APR 72	22	103.9	117.9	.9956	117.4
JUL 72	23	103.9	119.0	.9839	117.1
OCT 72	24	104.9	119.2	.9826	117.1
JAN 73	25	105.5	118.8	.9991	118.7
APR 73	26	107.9	120.5	1.0006	120.6
JUL 73	27	108.5	120.9	.9994	120.8
OCT 73	28	10.90	120.8	1.0009	120.9
JAN 74	29	113.6	122.9	.9914	121.8
APR 74	30	119.4	127.5	.9673	123.3
JUL 74	31	122.0	137.1	.9761	133.8
OCT 74	32	125.3	145.0	.9830	142.5
JAN 75	33	131.1	149.9	.9948	147.5
APR 75	34	136.0	150.2	1.0111	151.5
JUL 75	35	138.1	151.9	1.0307	154.8
OCT 75	36	140.9	155.7	1.0250	155.7
JAN 76	37	141.3	156.0	1.0064	156.7
APR 76	38	147.0	158.5	.9833	153.4
JUL 76	39	147.2	160.1	.9722	154.1
OCT 76	40	149.0	162.9	.9726	155.7
JAN 77	41	150.5	163.5	1.0109	164.7
APR 77	42	155.6	168.0	1.0511	171.9
JUL 77	43	156.9	171.3	1.0610	175.5
OCT 77	44	160.2	172.7	1.0988	184.6
JAN 78	45	162.2	174.4	1.1011	189.6
APR 78	46	168.4	176.7	1.1416	197.2
JUL 78	47	170.5	174.4	1.1245	196.1
OCT 78	48	174.0	176.7	1.1827	209.0
JAN 79	49	179.8	180.1	1.1898	214.3
APR 79	50	186.1	183.9	1.1463	210.8
JUL 79	51	188.2	186.0	1.1634	216.4
OCT 79	52	192.4	191.9	1.1753	225.5
JAN 80	53	199.4	197.3	1.1639	229.6

SOURCES: ISPI: Statistics Canada, Catalogs 62-543 and 62-011, Heating Equipment .  
PPI: Monthly Labor Review, U.S. Department of Labor, Heating Equipment  
r: Bank of Canada Review. Figures are noon averages for the month.

# BIBLIOGRAPHY

Aliber, Robert Z. The International Money Game. New York:  
Basic Books, Inc., 1973.

\_\_\_\_\_. "The Firm Under Pegged and Floating Exchange Rates."  
Scandinavian Journal of Economics 78 (1976): 309-322.

Black, Sidney W. International Money Markets and Flexible Exchange  
Rates. Princeton Studies in International Finance, No. 32.  
Princeton: Princeton University, 1964.

Cassel, Gustav. "The Present Situation of the Foreign Exchanges."  
Economic Journal 26 (March 1916): 62-65.

Dunn, Robert M., Jr. "Flexible Exchange Rates and Oligopoly Pricing:  
A Study of Canadian Markets." Journal of Political Economy 78  
(Jan/Feb 1970): 140-151.

Einzig, Paul. A Textbook on Foreign Exchange. London: MacMillan, 1970.

Fournier, H., and Wadsworth, J.E. Floating Exchange Rate - The Lessons  
of Recent Experience, Leyden, the Netherlands: A.W. Sijthoff,  
1976.

Frenkel, Jacob A. "A Monetary Approach to the Exchange Rate: Doctrinal  
Aspects and Empirical Evidence." Scandinavian Journal of  
Economics 78 (1976): 200-224.

Gaillot, Henry J. "Purchasing Power Parity as an explanation of Long-  
Term Changes in Exchange Rates." Journal of Money, Credit, and  
Banking 2 (August 1970): 348-357.

- Holmes, James M. "The Purchasing-Power Parity Theory: In Defense of Gustav Cassel as a Modern Theorist." Journal of Political Economy 75 (October 1967): 686-695.
- Kravis, Irving H., and Lipsey, Robert E. "Price Behavior in the Light of Balance of Payments Theories." Journal of International Economics 8 (1978): 193-246.
- Myhrman, Johan. "Experience of Flexible Exchange Rates in Earlier Periods: Theories, Evidence, and a New View." Scandinavian Journal of Economics 78 (1976): 169-196.
- Officer, Lawrence H. "The Purchasing Power Parity Theory of Exchange Rates: A Review Article." International Monetary Fund Staff Papers XXIII (1976): 1-60.
- \_\_\_\_\_. "Effective Exchange Rates and Price Ratios over the long Run: A Test of the Purchasing Power Parity Theory." Canadian Journal of Economics XIII, No. 2 (May 1980): 206-230.
- Richardson, J. David. "Some Empirical Evidence on Commodity Arbitrage and the Law of One Price." Journal of International Economics 9 (1978): 341-351.
- Sohmen, Egon. Flexible Exchange Rates. Chicago: University of Chicago Press, 1969.