

379
N81
NO. 6440

CORPORATE TAX RATES AND THE
PURCHASING POWER PARITY
DOCTRINE

THESIS

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

By

Billy L. Ballard, B.S.

Denton, Texas

August, 1988

Ballard, Billy L., Corporate Tax Rates and the Purchasing Power Parity Doctrine. Master of Science (Economics), August, 1988, 55 pp., 4 tables, bibliography, 29 titles.

This thesis analyzes the effect of corporate tax rates on the purchasing-power-parity (PPP) doctrine. The data used to test this hypothesis are drawn from the U. S., the U. K., the Federal Republic of Germany, Canada, and Japan.

The first chapter introduces the reader to the concepts of the PPP doctrine and states the hypothesis. Chapter 2 reviews the literature on the PPP doctrine. Chapter 3 specifies a model of the PPP doctrine including tax rates. Chapter 4 reports and interprets the findings. The study is summarized and conclusions are drawn in chapter 5.

In this study it is shown that tax rates are significant only in the case of the U. S. dollar/Canadian dollar exchange rate.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	iv
 Chapter	
1. INTRODUCTION AND PRESENTATION OF THE PROBLEM.	1
Chapter Overview	
Introduction	
Statement of the Problem	
Statement of the Importance of the Problem	
Hypotheses	
2. SURVEY OF THE LITERATURE.....	9
3. METHODOLOGY.....	27
Chapter Overview	
Data	
Absolute PPP	
Relative PPP	
Tax Rates and Exchange Rates	
Tax Rates, Relative PPP, and Expectations	
4. RESULTS AND INTERPRETATIONS.....	36
Chapter Overview	
U.S. Dollar/Japanese Yen	
U.S. Dollar/Canadian Dollar	
U.S. Dollar/German Mark	
U.S. Dollar/British Pound	
5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS....	44
Chapter Overview	
Summary	
Conclusions	
Recommendations for Further Research	
APPENDIX.....	51
BIBLIOGRAPHY.....	53

LIST OF TABLES

Table		Page
1.	U.S. DOLLAR/JAPANESE YEN EXCHANGE RATE.....	37
2.	U.S. DOLLAR/CANADIAN DOLLAR EXCHANGE RATE....	38
3.	U.S. DOLLAR/GERMAN MARK EXCHANGE RATE.....	40
4.	U.S. DOLLAR/BRITISH POUND EXCHANGE RATE.....	41

CHAPTER 1

INTRODUCTION AND PRESENTATION OF THE PROBLEM

Chapter Overview

This chapter introduces the reader to the study undertaken. The chapter includes: (1) an introduction, (2) a statement of the problem, (3) a statement of the importance of the problem, and (4) a statement of the hypotheses.

Introduction

This study involves an examination of the effect of corporate tax rates on the purchasing power parity doctrine. The purchasing power parity (PPP) doctrine is a set of tenets that explain how market exchange rates are determined, and relates these exchanges rate to the balance-of-payments (BOP). The PPP doctrine can be viewed from two different aspects. According to the "absolute" version, the actual rates of exchange tend toward the rates required to keep the (BOP) in equilibrium. These equilibrium exchange rates will be equal to purchasing-power parities calculated as a ratio of consumer goods prices for any pair of countries. Subsequently, the "relative" interpretation of the doctrine asserts that changes in the ratio of consumer goods prices, or changes in the expectations about consumer

goods prices as measured by the market interest rates, must necessarily indicate imminent adjustments in the equilibrium exchange rates. The absolute version can be thought of as providing the criterion for a condition of static equilibrium, whereas the relative version provides a dynamic rendition. Acceptance of the first implies approbation of the second; reciprocity is not, however, mandated (Balassa 1964, 584; Officer 1982, 1-7).

In essence, this theory proclaims that the exchange rate required to keep the BOP in equilibrium and the exchange rate required to insure parity in the purchasing power of any two countries currencies is one and the same. Extended to its relative interpretation, this doctrine asserts that, under a floating exchange rate regime, any change in the price level, or expectations about the price level, in one country will be manifested in the other country by a change in the exchange rate. Given a fixed exchange rate regime, a change in the price level in one country must be offset by a change in the price level of the other country. In either case, equilibrium in the BOP is maintained.

Underlying the PPP doctrine is the quantity theory of money, the idea that price levels reflect, directly and proportionately, the amount of currency in circulation. If the exchange rate is allowed to float, any increase or decrease in the amount of currency supplied to, or demanded

from, the foreign exchanges in response to price level movements, or expectations, will result in adjustment in the exchange rate. If the exchange rate is fixed, any increase in the supply of (demand for) a particular currency in the foreign exchange markets can be viewed as a manifestation of a decrease or increase in the amount of currency in circulation in that particular country. The price level will then be required to adjust, via the quantity theory of money.

The intuitively appealing logic inherent in the PPP doctrine has made it the most popular theory of exchange rate determination. This doctrine also serves as a building block in international economic and financial theory.

Statement of the Problem

Unfortunately, contemporary empirical tests do not support the validity of this doctrine. Studies done since the era of floating exchange rates began (1971) almost unanimously reject the theory as an explanation for short run movements in the exchange rate (Officer 1982). The jury is still out on the question of whether exchange rates tend toward parity in the long run, but studies that have been done do not reach this conclusion (Edison 1987). However, it seems that the exchange rate does not follow a random walk either (Isard 1987). One must suspect then that models constructed to test the theory have, up to this point, left some explanatory variables out. The purpose of this study

is to show that the rates of taxation on multinational corporations are the variables that have been left out.

Multinational corporations (MNC), in their quest to maximize after tax profits, set prices on products traded between affiliates in a manner that allows them to transfer profits to lower taxed countries. Essentially then, these MNC's create an internal price level. This internal price level is determined in response to the tax rates applied to the MNC and not by the forces of supply and demand as is the external price level. Thus, the external and internal price levels will coincide only if the tax rates in the two countries are the same.

The PPP doctrine, in its relative interpretation, proclaims that the exchange rate moves such that the price levels in two countries will be equal. But, as was just shown, there may be two distinct price levels in each country. One, the outside or external price level, determined by the interaction of supply and demand, and two, the internal price level, determined by the tax rates applied to the MNC. If the theory holds, then the exchange rate may be responding to two separate forces. On the one hand, the exchange rate is attempting to equate the external price levels. On the other hand, it is attempting to equate the internal price levels. This scenario may explain both the reason empirical evidence runs contrary to the PPP doctrine and the reason exchange rates exhibit such

volatility in movement.

Statement of the Importance
of the Problem

As was stated earlier, the concept inherent in the PPP doctrine, the idea that a set amount of currency has the exact same amount of purchasing power, via the exchange rate, regardless of the country in which it is spent, is a major building block in international economic and financial theory. Commodity and currency arbitrage virtually assure, if markets are efficient, that any one currency possesses the exact command over goods and services as any other currency. If the doctrine is not valid, then thinking in the economics profession will need to be altered to reflect this. A reformulation of virtually ever hypothesis of international trade put forward since Ricardo would be in order. However, if the hypothesis contained in this investigation holds, the validity of the PPP philosophy would not be revoked. The logic intrinsic in the PPP doctrine would be maintained and the empirical discrepancies explained as a result of the existence of two well defined price levels per country.

Over the past 50 years, discussion concerning the imminent integration of all economies into a unified international economic order has been predominant in economics and political science. However, an appealing program for accomplishing this integration has not been put

forth. If the hypothesis suggested here holds, a major step in this direction will have been established. If tax rates do indeed have a significant affect on the exchange rate, as is proposed, governments will have the ability to at least guide that exchange rate toward its desired level.

Developed nations, such as the U.S. and Japan, who regard a lower rate of exchange as favorable, could increase the tax rates applied to the MNCs, thus forcing the internal price level down, resulting in downward pressure on the exchange rate. Less-developed nations, such as Mexico and Brazil, who consider a higher exchange rate more favorable, could decrease the rates applied to the MNCs, thus causing the MNCs to increase the internal price level, thus exerting upward pressure on the exchange rate. Competition, for exchange rate position, would, conceivably, result in international cooperation on MNC taxation policies.

Hypotheses

The hypotheses to be examined in this analysis are as follows:

Hypothesis I. Changes in the ratio of the price levels and expectations about the price levels of two countries as measured by the consumer or producer price indices and interest rate differentials will not significantly affect changes in the spot exchange rate.

Hypothesis II. Changes in the ratio of tax rates applied to the MNCs between two countries will have a

significant affect on changes in the spot exchange rate.

Hypothesis III. Changes in the ratio of the price levels, expectations about the price levels, and tax rates applied to the MNCs between two countries will induce a significant amount of the systematic changes in the spot exchange rate.

CHAPTER BIBLIOGRAPHY

- Balassa, Bela. 1964. The purchasing power parity doctrine: A reappraisal. Journal of Political Economy 72 (May): 584-596.
- Edison, Hali J. 1987. Purchasing power parity in the long run: A test of the dollar/pound exchange rate (1890-1978). Journal of Money, Credit, and Banking 19 (August): 376-387.
- Isard, Peter. 1987. Lessons from empirical models of exchange rates. International Monetary Fund Staff Papers 34 (March): 1-28.
- Officer, Lawrence H. 1982. Purchasing power parity and exchange rates: Theory, evidence and relevance. Contemporary Studies in Economic and Financial Analysis, ed. Edward I. Altman and Ingo Walter, no. 35. Greenwich: JAI Press Inc.

CHAPTER 2

SURVEY OF THE LITERATURE

Though fragments of the PPP doctrine have been traced back to the Salamanca School in 16th century Spain (Officer 1982, 30), modern day formulation of the theory is typically credited to Gustav Cassell. Cassell is responsible for both the absolute and relative versions of PPP and, as will be seen later in this chapter, he is also a forerunner in conceiving the monetary approach to the balance of payments and exchange rate determination.

In 1916 Cassel writes "If we consider two countries, A and B, with independent paper currencies, the money of A can have value in B only on the ground that it represents buying power, or more generally paying power, in A" (Cassel 1916, 62). Here Cassel embodies the intuitively appealing idea that money has value only in respect to its command over goods and services into the PPP theory. Cassel goes on to establish the absolute version of PPP "the rate of exchange between the two countries will be determined by the quotient between the general levels of prices in the two countries" (Cassel 1916, 62). And, writing in a later paper, Cassel gives PPP its christening "At every moment the real parity between two countries is represented by this quotient

between the purchasing power of the money in the one country and the other. I propose to call this parity 'the purchasing power parity'" (Cassel 1918, 413).

The relative version of the PPP theory is consistently presented in Cassel's writings. One example is "The general inflation which has taken place during the war has lowered this purchasing power in all countries, though in a very different degree, and the rates of exchanges should accordingly be expected to deviate from their old parity in proportion to the inflation of each country" (Cassel 1918, 413).

It is also interesting to note that Cassel believed that any hindrances to trade, such as tariffs, quotas, etcetera, would not cause the exchange rate to deviate from this purchasing power parity as long as these hindrances were applied equally in both directions. Cassel remarks "Even restrictions of trade will not cause the rate of exchange to move from this purchasing power parity as long as they strike the trade in both directions equally" (Cassel 1918, 413). However, if the trade restrictions were not applied equally, then the exchange rate could be expected to move away from parity as measured by the internal price levels. In Cassel's words "if the trade between the two countries is hampered more severely in one direction than in the other the rate of exchange will deviate from its purchasing power parity" (Cassel 1918, 413). In this case

the country, whose imports are restricted more than its exports, would experience a surplus in its BOP as well as an appreciation of its currency (more units of a foreign currency would be required to purchase one unit of the domestic currency). Whether or not this disequilibrium would persist indefinitely or would correct itself became an argument that has yet to be decided. Cassel himself believed that equilibrium and parity would be restored via the quantity theory of money. As more currency flowed into a country the price level would be forced upward until parity was again reflected in the purchasing power thus eliminating the uneven currency flow. Equilibrium in the BOP would thus be restored (Cassel 1924, 486-496). Given this scenario, the long run effects of trade restrictions are negated by movements in the exchange rate.

John Maynard Keynes also figures prominently in the development, and the post WWII eradication, of the PPP doctrine. According to Keynes, the PPP theory, as Cassel left it, has two overriding difficulties. First is the allowance for transport costs and import and export taxes, second is how to treat goods and services that do not enter into international trade at all. As is well known, Keynes was not one for relying on the long run explanations provided by the quantity theory of money.

To Keynes, the absolute version of the PPP doctrine was of no use whatsoever in explaining the actual exchange

rate. First of all was the obvious fact that transportation costs and import and export taxes do exist so that the actual exchange rate should be expected to deviate from PPP by an amount that allowed for these. Also, the amount of this deviation at any one point in time would not be consistent with the deviation at any other point in time since these aberrations should not be expected to be static. Technological change assured that transportation costs would change; Import and export taxes are at the whim of the polity (Keynes 1923, 73-74).

Second, not all goods and services are traded internationally. Keynes thought that if only traded goods were considered, after making allowances for transport and tariff cost, the market rate of exchange would always equal that required for PPP. As Keynes saw it "Indeed, it is the whole business of the international merchant to see that this is so; for whenever the rates are temporarily out of parity he is in a position to make a profit by moving goods" (Keynes 1923, 74-75). The theory, stated in terms of only internationally traded goods, thus reduces to a tautology "and as nearly as possible jejune" (Keynes 1923, 74). This formulation was later to become known as the law of one price. In order for the theory to be expanded such that the exchange rate should equate the general price indices required, Keynes thought, a further assumption "namely, that in the long run the home prices of the goods and services

which do not enter into international trade, move in more or less the same proportions as those which do" (Keynes 1923, 75). Keynes thought this would be true only if capital and labor could move freely, on a large scale, between home and export industries without a loss of efficiency. If this were not the case or if there were changes in other economic relationships between the two countries it would not be "correct to assume that the coefficients of purchasing power parity, calculated...by means of the relative variations of index numbers of general purchasing power from their pre war levels, must ultimately approximate to the actual rates of exchange" (Keynes 1922, 76).

In his earlier writings, Keynes did however accept the relative version of the PPP doctrine and its stabilizing affects. In 1922 he writes "Purchasing power parity, thus defined, tells us an important fact about the relative changes in the purchasing power of money...but it does not necessarily settle what the equilibrium exchange rate...ought to be" (Keynes 1922, 78) In later years Keynes turned against the PPP theory in its relative interpretation as well.

Keynes' disenchantment with PPP was partly due to his growing belief that price levels did not respond, even over extended periods, to changes in the amount of currency in circulation. The Keynesian idea that V , in the "equation of exchange" ($MV=PQ$), is inherently unstable is well

documented. Mostly though, Keynes' despondence over the PPP doctrine arises from what he called a change in the terms of trade when investment is more attractive abroad. Keynes thought this increased attractiveness "depends on non-monetary factors--on physical facts and capacities, and on the elasticities of demand in each of the two countries for goods which the other can produce with physical efficiency. ... The neglect to allow for the effect of changes in the terms of trade is, perhaps, the most unsatisfactory characteristic of Prof. Cassel's Purchasing Power Parity Theory of the Foreign Exchanges. For this not only upsets the validity of his conclusions over the long period, but renders them even more deceptive over the short period, ..." (Keynes 1930, 334-336). The elasticities argument proved to be the most cataclysmic argument against the PPP doctrine.

When there is a deficit in the BOP more currency is leaving the domestic economy than is coming in. The forces of supply and demand in the foreign exchange markets ultimately cause the domestic currency to loose value. Normally, one would think that a devaluation of the domestic currency (less units of a foreign currency commands one unit of the domestic currency) would improve the BOP. The devaluation makes domestic goods cheaper and foreign goods more expensive. More of the domestically produced goods would be bought by foreigners, thus increasing the credit column in the BOP. Less foreign goods would be bought by

domestic consumers, thus decreasing the debit column in the BOP. The end result would be an improvement in the BOP. However suppose that the price elasticities of the domestic demand for foreign produced goods are below unity. Then the devaluation would increase the debit column in the BOP. And if the same is true for the foreign demand for domestically produced goods, the devaluation would decrease the credit column in the BOP. Here a devaluation would have the opposite effect as would normally be assumed. In fact a devaluation would have the opposite affect anytime the two elasticities sum to less than unity (Harberler 1944, 191). Therefore, in order for exchange rate adjustments to cause the BOP to return to equilibrium, the two elasticities must sum to more than unity. This is commonly known today as the Marshall-Lerner criterion. It is also thought that in the short run, the two elasticities may indeed sum to less than unity, however, in the longer term, as the two economies adjust, the elasticity coefficients increase and ultimately sum to greater than one (Harberler 1944, 192). This type of adjustment is manifested as a j-curve when the BOP is plotted against time. This "perverse elasticities argument", as it came to be called, meant that, in a dynamic world, if the exchange rate was allowed to float freely it would exhibit extreme volatility. And, as the price levels in different countries vary to differing degrees, movements in the exchange rate could not be expected to maintain

parity in the purchasing power of the currencies, or equilibrium in the BOP, as the relative version of the PPP theory predicts. The PPP doctrine was to lie in disrepute from the end of world war II until Leland Yeager reestablished its stabilizing effects in 1958.

Yeager laid to rest the perverse elasticities argument using two logically sound counter arguments. First Yeager points out that "Currency undervaluation lowers the general level of prices of a country's productive factors relative to foreign levels, enabling the country's businessmen to compete in world markets with an expanded variety of products. Imports, on the other hand, are restricted in variety as well as in volume" (Yeager 1958, 516-517). So, even if the demand for the currently traded goods was inelastic, the change in the relative costs of production would bring an expanded variety of goods into the international arena so as to make the overall demands elastic. Yeager also points out that consumers in both countries are subject to their respective budget constraints. According to the calculations performed by Yeager on the deviations of the actual exchange rate from its par in 35 different countries, only one was either more than double par or less than one half of par. This implies that the prices of imports would have to rise by less than 100 percent before the elasticity coefficients exceeded unity. And as Yeager put it "It seems inherently

implausible that imports (from both the home and the foreign viewpoints) would be in such extremely inelastic demand as to cause exchange-market instability and yet would bulk so large in budgets that a less-than-doubling of their prices would bring the budget restraint enough into play to render the demand elastic" (Yeager 1958, 529). Yeager goes on to point out that "In view of all these implications, even such large discrepancies as actual exchange rates of half or double the corresponding purchasing-power parities would hardly demonstrate the existence of perverse elasticities" (Yeager 1958, 529). The sheer logic inherent in Yeager's reasoning left the perverse elasticities argument defunct. However, the empirical discrepancies, made available by the new statistical material presented by Yeager, were in need of explanation. One explanation was provided by Bela Balassa. This was, however, merely an extension of Keynes' reasoning of some 42 years early.

Balassa claimed that the existence of a non-traded good, which he identified as services, caused the divergence in the actual exchange rate from its par value. "In other words, assuming that international productivity differences are greater in the production of traded goods than in the production of non-traded goods, the currency of the country with the higher productivity levels will appear to be overvalued in terms of purchasing-power parity" (Balassa 1964, 586). Balassa goes on to state that "If per capita

incomes are taken as representative of levels of productivity, the ratio of purchasing-power parity to the exchange rate will thus be an increasing function of income levels" (Balassa 1964, 586). The empirical tests conducted by Balassa do indeed show a positive correlation between the deviation of the actual exchange rate from its PPP and per capita GNP. Balassa concludes that "the reliance on general price indexes for deciding on exchange rate adjustments appears to be misplaced more useful results can be achieved if, ... more attention is paid to the behavior of sectoral indexes with appropriate disaggregation" (Balassa 1964, 595). Balassa, at once, confirms the logic that the exchange rate adjusts to equalize the prices of traded goods and disavows the idea that it adjusts to equate the general level of prices in two countries as Cassel suggested. In order for the latter to hold, the prices of non-traded goods must also be equalized. And, Balassa thought this would require "the migration of labor in response to intercountry differences in living costs" (Balassa 1964, 596). Since migration was occurring, the long run stabilizing effects of the PPP doctrine were held intact. Though Yeager's and Balassa's work did return some respectability to the PPP doctrine, it was still not without its critics.

One of the more prominent critics of the PPP doctrine was MIT's Paul Samuelson. Samuelson found difficulty with the PPP doctrine on two counts. First, he did not accept

the idea that the flow of causation ran from prices to exchange rates. In his calculations, the San Francisco dollar was overvalued relative to the Houston dollar. In the PPP equation then $R(\text{exchange rate}) > P(\text{San Francisco's price index}) / p(\text{Houston's price index})$. Samuelson reasons "instead of R's adjusting, it is the numerator of California's price index that primarily adjusts to restore the equilibrium" (Samuelson 1964, 148). Extending this argument to the international level, Samuelson promotes similar reasoning. "These days, when contemplating an apparently overvalued currency of a mixed economy, it is a pretty good bet that the electorate and government will not force upon itself a general deflation of the P numerator; less certain is the guess that the other sovereign country will manage its affairs well enough to prevent an inflation in the p denominator" (Samuelson 1964, 148). If prices changes are caused by changes in the exchange rate, then what determines the exchange rate? Samuelson's point had been made; the PPP theory did not provide the answer.

On the second count, Samuelson points out that general price indexes reflect consumer preference patterns. For instance, the consumer price index in the U.S. weights Bourbon heavily and the British cost-of-living index weights Scotch heavily. The PPP doctrine proclaims that the exchange rate will move to equate these indices. Samuelson declares "Evidently a new, and bizarre, kind of arbitrage is

tacitly envisaged: somebody demands lbs. whenever something (a market basket?) called COL can be bought more cheaply than can something called (our?) COL can be bought for \$" (Samuelson 1964, 147-148). Samuelson draws the conclusion that "...PPP is a misleadingly pretentious doctrine, promising us what is rare in economics, detailed numerical predictions" (Samuelson 1964, 152). The indictments wrought by Samuelson against the PPP doctrine were disturbing. Nonetheless, PPP withstood the attack, and, indeed, even gained popularity.

As the 60's passed so did the era of fixed exchange rates. The 70's brought floating exchange rates and an intensive interest in exchange rate determination. Throughout the 70's and early 80's, the PPP theory was the most popular subject of research in economics. With the 70's also came the end of the Keynesian Revolution and a return to the precepts of Classicism. The monetary approach to the BOP and exchange rate determination were developed during this period as a reflection of this philosophical shift.

The monetary approach views money as simply another asset. The exchange rate is the price of that asset in terms of another currency (or another asset). Thus, "the equilibrium exchange rate is attained when the existing stocks of the two moneys are willingly held" (Frenkel 1976, 201). It is supply and demand that determine equilibrium in

the money market, as in any other market, not the price levels in two countries. However, this equilibrium exchange rate will also equate the price levels in two countries since the price levels are also determined by the money supply ala the quantity theory of money. The BOP will also be in equilibrium at this exchange rate since there is no incentive for money to move (Johnson 1976, 46-63).

Ultimately, everything is determined by the monetary policies in the countries under consideration. Thus the name, the monetary approach. At its extreme, this approach suggest that any surplus or deficit in the BOP is a direct reflection of a surplus or deficit in the governments budget. To alleviate any BOP problems requires "monetary policy that is directed at preserving equilibrium in the balance of payments rather than financing budget deficits" (Mundell 1976, 87). As was stated early, Cassel was a forerunner in conceiving the monetary approach. Cassel thought that prices responded directly to changes in the money stock in accordance with the quantity theory of money (Cassel 1916, 62). Its seems clear that Cassel meant for price levels to represent a proxy for equilibrium in the money market.

Expectations also play a fundamental role in the monetary approach. As Frenkel notes "The demand for domestic and foreign moneys depends, like the demand for any other asset, on the expected rates of return" (Frenkel 1976,

204). It should therefore be expected that the expectations, concerning monetary expansions or contractions and their affect on price levels, of market participants are incorporated in the exchange rate.

Tests of the monetary approach typically involve regressing the ratio of the money supplies, income levels, and interest rates in two countries on the spot exchange rate. The demand for money is assumed to be a constant function of nominal income since only transaction demand is considered, a Classical precept. The interest rate ratio is said to show the differences in expectations between the two countries. Frenkel (1976) conducts this test on the dollar/German mark rate during the German hyperinflation of the 1920's. His findings strongly support the monetary approach. Bilson(1978) tests the English pound/German mark exchange rate over the period 1970-1977 and finds empirical support. Bilson's study finds substantial amounts of first order serial correlation, however, suggesting that some other force may be acting on the exchange rate. These two studies are, it seems, isolated incidents. Various other authors, applying the theory to a variety of countries find that it does not predict the exchange rate (Isard 1977; Kravis and Lipsey 1978; Crouhy-Veyrac and others 1982).

The problem was not that price levels do not reflect the amount of money in circulation, they do, but rather that the market rate of exchange did not equate the two price

levels. In other words, the stabilizing effects inherent in the PPP doctrine were not observed empirically during the 70's (Frenkel 1981).

Various explanations have been put forth regarding the empirical deviations. One suggestion is that markets are not competitive and thus not efficient (Crouhy-Veyrac and others 1982). Monopolist practice price discrimination, selling at different prices at home and abroad, oligopolist, in their desire to maintain price stability, absorb changing exchange rate in their profits so that prices do not move with the exchange rate. This argument may be valid for a few goods but can hardly explain large scale differences in the exchange rate from its par.

Another argument put forth suggest that product differentiation in both production and consumption may be the culprit (Isard 1977). While its true that different countries use different methods of production and have different taste, these differences should be reflected in the weighing patterns of the different cost-of-living indexes. Oddly, it is also envisioned that it is these differing weighing patterns that cause the deviations in the exchange rate from its par (Kravis and Lipsey 1978). This contention does not hold simply because different weighing patterns reflect consumer preferences and production methods.

To date, no convincing argument has been put forth that explains why the empirical evidence runs contrary to the predictions of the PPP doctrine. By 1987, virtually everyone who has been involved in testing the PPP doctrine has come to the conclusion that it does not provide reliable predictions for short run movements in the exchange rate (Isard 1987; Dornbusch 1987). It has also been proven mathematically that the PPP doctrine and the existence of different tax rates are not compatible. Thus the idea that, in the long run, the exchange will equate the price levels of two countries is also doubted (BenZion and Weinblatt 1984). Empirical tests of long run equilibrium have shown that exchange rates do not tend toward parity as well (Edison 1987). As was stated at the outset, this paper will attempt to show that different tax rates and the PPP doctrine are compatible. Different tax rates simply mean that the exchange rate is attempting to equate two different price levels.

CHAPTER BIBLIOGRAPHY

- Balassa, Bela. 1964. The purchasing power parity doctrine: A reappraisal. Journal of Political Economy 72 (May): 584-596.
- Benzion, Uri, and J. Weinblatt. 1984. Purchasing power, interest rate parities and the modified Fisher effect in presence of tax agreements. Journal of International Money and Finance 3 (April): 67-73.
- Bilson, John F.O. 1978. The monetary approach to the exchange rate: Some empirical evidence. International Monetary Fund Staff Papers 28 (March): 48-75.
- Cassel, Gustav. 1916. The present situation of the foreign exchanges. Economic Journal 26 (March): 62-65.
- _____. 1918. Abnormal deviations in international exchanges. Economic Journal 28 (December): 413-415.
- _____. 1924. The theory of social economy. New York: Harcourt, Brace, and Company.
- Crouhy-Veyrac, L., M. Crouhy, and J. Melitz. 1982. More about the law of one price. European Economic Review 18 (July): 325-344.
- Dornbusch, Rudiger. 1987. Exchange rate economics: 1986. Economic Journal 97 (March): 1-18.
- Edison, Hali J. 1987. Purchasing power parity in the long run: A test of the dollar/pound exchange rate (1890-1978). Journal of Money, Credit, and Banking 19 (August): 376-387.
- Frenkel, Jacob A. 1976. A monetary approach to the exchange rate: Doctrinal aspects and empirical evidence. Scandinavian Journal of Economics 78 (No. 2): 200-224.
- _____. 1981. The collapse of purchasing power parities during the 1970's. European Economic Review 16 (May): 145-165.
- Harberler, Gottfried. 1944. Some comments on professor Hansen's note. Review of Economics Statistics 26 (November): 191-193.
- Isard, Peter. 1977. How far can we push the 'law of one

price'?. American Economic Review 67 (December): 942-948.

_____. 1987. Lessons from empirical models of exchange rates. International Monetary Fund Staff Papers 34 (March): 1-28.

Johnson, Harry G. 1976. Towards a general theory of the balance of payments. In The monetary approach to the balance of payments, ed. Jacob A. Frenkel and Harry G. Johnson, 45-63. Buffalo: University of Toronto Press.

Keynes, John M. 1923. A tract on monetary reform. Vol. IV, The collected writings of John Maynard Keynes. London: Macmillan St. Martin's Press.

_____. 1930. A treatise on money. New York: Harcourt, Brace, and Company.

Kravis, I. B. and R. E. Lipsey. 1978. Price behavior in the light of balance of payments theories. Journal of International Economics 8 (May): 193-246.

Mundell, Robert A. 1976. Barter theory and the monetary mechanism of adjustment. In The monetary approach to the balance of payments, ed. Jacob A. Frenkel and Harry G. Johnson, 63-87. Buffalo: University of Toronto Press.

Officer, Lawrence H. 1982. Purchasing power parity and exchange rates: Theory, evidence and relevance. Contemporary Studies in Economic and Financial Analysis, ed. Edward I. Altman and Ingo Walter, no. 35. Greenwich: JAI Press Inc.

Samuelson, Paul A. 1964. Theoretical notes on trade problems. Review of Economics and Statistics 46 (May): 145-154.

Yeager, Leland B. 1958. A rehabilitation of purchasing-power parity. Journal of Political Economy 66 (December): 516-530.

CHAPTER 3

METHODOLOGY

Chapter Overview

This chapter provides an analysis of the methods that will be employed in testing the hypotheses. This chapter includes an explanation of the data, a recitation of the absolute and relative interpretations of the PPP theory including expectations, a formulation of the effects of tax rates on the exchange rate, and finally an expression of exchange rates as a function of price levels, expectations about price levels, and tax rates.

Data

The data included in this study are price levels, interest rates, corporate tax rates, and exchange rates from five different countries. The countries included are the United States, the United Kingdom, the Federal Republic of Germany, Canada, and Japan. These countries were included because statistical information is reliable and readily available, and because they represent varying distances of transportation thus, the effects of transport costs may be analyzed. The data is annual data from 1972 through 1987.

In all countries, both the consumer price index and wholesale price index are used to represent price levels. For the U.S., Canada, and the U.K. treasury bill rates are

used for interest rates. Public authority bond yields were used for interest rates in Germany and Japan. Data on treasury bill rates were not available for these countries. In all cases the exchange rate is expressed as the dollar value of one unit of foreign currency. Data for the exchange rates, consumer price indexes, wholesale price indexes, and interest rates were obtained from the International Financial Statistics International Monetary Fund (Washington D. C.). In all cases, the tax rates utilized are the maximum corporate tax rates in each country. The assumption is that MNC's are, in most if not all cases, large enough to fall into the highest tax brackets. This assumption draws on the fact that the highest brackets generally start at \$35,000. Tax data for the U.S. was taken from the Internal Revenue Code. For all other countries, tax data comes from International Tax and Business Service and from Pechman (1987). Means and standard deviations of the data are listed in the appendix.

Absolute PPP

The absolute version of the PPP doctrine states that the equilibrium exchange rate is equal to the ratio of the price indexes of the two countries. This relationship can be written as follows:

$$R = a(P / p)^{b_e u}$$

Where R represents the exchange rate(dollar value of one unit of foreign currency), P is the price level in the

U.S.(both consumer and wholesale indexes), p stands for the foreign price level(both consumer and wholesale), u is the error term, and a and b are both 1 (Frenkel 1981, 148).

Testing the absolute version requires that some time period be set as the base period in which the prevalent exchange rate is in equilibrium. Then the exchange rate can be expected to maintain equilibrium with the price level ratio, if there are no changes in any other economic variables such as transportation costs, export and import taxes, and various other international agreements. If, in the period chosen, the exchange rate is not at its equilibrium, or there are changes in any of the other variables, then the exchange rate can not be expected to gravitate toward that equilibrium (Officer 1982, 123-128). Since it seems virtually impossible to convincingly defend any time period chosen as a base, the absolute version will not be tested in this expose.

Relative PPP

The relative version of the PPP theory asserts that any change in the exchange rate will be equal to any change in the ratio of the price indexes of the two countries. This relationship can be stated as follows:

$$dR = a(dP / dp)^b e^u$$

or

$$dR = a(d(P / p))^b e^u$$

Where d represents change and the other variables are as

before. If interest rates are used as a proxy for expectations about future price levels, the relative version of the PPP theory including expectations can be written as follows:

$$dR = a(d(P / p)^{b1} * (I / i)^{b2})e^u$$

Where I represents the interest rate in the U.S. i is the foreign interest rate and the other variables are as before. Expectations are included in the relative version because they give an approximation of the purchasing power of money in the future. In most cases, the exchange rate discounts this future purchasing power. Thus movements in the exchange rate not only show present price level ratios, but also incorporate the expectations of economic agents about price level ratios in the future (Frenkel 1976, 208-209).

In the tests, a double log functional form is used for its simplicity and better fit. Therefore, the relative PPP relationship, including expectations, can be transformed to

$$[\ln(R) - \ln(\text{lag}R)] = a^* + b1[\ln(P/p) - \ln(\text{lag}P/\text{lag}p)] + b2[\ln(I/i) - \ln(\text{lag}I/\text{lag}i)] + u \dots \dots \dots (\text{equ.1})$$

Where ln is the natural logarithm, lag preceding a variable means the value of the last observation, u is the error term, a* is the intercept, and b1 and b2 are the parameters to be estimated. The pure PPP a priori expectations are that a* equals 0, b1 equals unity, b2 is the interest elasticity of money, and u is normally distributed (Officer 1982, 150). Because of differences in tax rates, the

expectation in this investigation is that b_1 will not be significantly different from zero. This expectation reflects hypothesis I in chapter 1.

Testing the relative version has problems as well. Any change in any of the other economic variables -- transportation costs, import and export taxes, international trade agreements -- will, no doubt, cause aberrations in movements in the exchange from its equilibrating trend. Hopefully, by taking the natural logarithms, these aberrations will be minimized. The results of tests of the relative version are reported in chapter 4.

Tax Rates and Exchange Rates

It is proposed in this paper that the rates of taxation applied to MNCs will cause movements in the internal price levels, and thus, changes in the exchange rate. This relationship can be expressed in the following equation:

$$dR = a(dT / dt)^{b_e} e^u$$

Where T is the maximum tax rate applied to corporations in the U.S. and t is the maximum in the foreign country. The other variables are as before. It should be understood that T and t are being used as a proxy for the internal price levels. Thus, this relationship is the same as the relative version of PPP presented earlier only a different price level is used. It is expected that increases (decreases) in T will induce decreases (increases) in the internal price level that prevails in the U.S., since MNCs will attempt to

transfer profits out of the U.S. via the prices of internally traded goods. The same logic holds for t and the internal price level in the foreign country. However, if the internal price level in the U.S. does decrease it will cause the exchange rate, from the U.S. perspective, to depreciate (i.e. the fraction $R(=\$/fc)$ (fc =one unit of foreign currency) will increase). This phenomenon requires some explanation.

It seems mathematically correct to infer that, in the equation $R=T/t$, if T/t is a proxy for the ratio of internal price levels (IP/ip), and if t , and thus ip , is held constant, decreases in IP will induce decreases in R . However, the assertion put forth here is that the price elasticities in the internal markets are perfectly inelastic. In other words, the quantities demanded for goods in the internal markets are not a function of price. They are rather, determined by executive orders. Therefore, when the internal prices in the U.S. are lowered, in response to tax increases, the same amount of goods will be demanded in the internal markets. The sole reason for manipulating internal prices in response to changes in tax rates is to transfer profits, not affect quantities demanded. The decreased demand for dollars in the foreign exchanges required to pay for the same amount of goods then causes the price of the dollar to decrease in terms of other

currencies (the dollar depreciates). Thus, increases in T result in decreases in IP but, increases in R.

In order to test this hypothesis, a double log functional form will be employed. The resulting, transformed equation is as follows:

$$[\ln(R) - \ln(\text{lag}R)] = a^* + b[(\ln(T/t) - (\ln(\text{lag}T/\text{lag}t))] + u \dots \dots \dots (\text{equ. 2})$$

The symbols are the same as before. The a priori expectation is that b will be positive and different from zero because of the impact of external price level ratio changes. If we could efficiently measure the internal price levels (IP and ip) and used them rather than T and t, b would be expected to be negative. However gathering the information on internal price levels is beyond the scope of this investigation. Hypothesis II, in chapter 1, is the basis for the expectation using T and t. The results of testing this equation are reported in chapter 4.

Tax Rates, Relative PPP and Expectations

The final objective of this chapter is to formulate an expression of exchange rate movements as a function of changes in tax rate, price level ratios and expectations about price level ratios. This can be done by combining the relationships developed in the two previous sections. The resulting equation is presented below.

$$dR = a((d(P/p))^{b1} * (d(I/i))^{b2} * (d(T/t))^{b3})e^u$$

And transforming this relationship to a double log

functional form for testing gives:

$$\begin{aligned} [\ln(R) - \ln(\text{lag}R)] = & a^* + b_1[\ln(P/p) - (\ln(\text{lag}P/\text{lag}p))] \\ & + b_2[\ln(I/i) - \ln(\text{lag}I/\text{lag}i)] + b_3[(\ln(T/t) - \\ & (\ln(\text{lag}T/\text{lag}t))] + u \dots\dots\dots(\text{equ. 3a}) \end{aligned}$$

The a priori expectations are that a^* will equal 0, b_1 and b_3 will be statistically different from zero, b_2 is the interest elasticity of money, and u will be normally distributed. Hypothesis III, in chapter 1, is the subject of this examination. Results of testing this equation are presented in chapter 4.

CHAPTER BIBLIOGRAPHY

- Frenkel, Jacob A. 1976. A monetary approach to the exchange rate: Doctrinal aspects and empirical evidence. Scandinavian Journal of Economics 78 (No.2): 200-224.
- Frenkel, Jacob A. 1981. The collapse of purchasing power parities during the 1970's. European Economic Review 16 (May): 145-165.
- Internal Revenue Code. St. Paul, Minnesota: West Publishing Company.
- International Financial Statistics. International Monetary Fund. (Washington D. C.).
- International Tax and Business Service. 1982. New York: Deloitte Haskins and Sells.
- Officer, Lawrence H. 1982. Purchasing power parity and exchange rates: Theory, evidence and relevance. Contemporary Studies in Economic and Financial Analysis, ed. Edward I. Altman and Ingo Walter, no. 35. Greenwich: JAI Press Inc.
- Pechman, Joseph A. ed. 1987. Comparative tax systems: Europe, Canada, and Japan. Arlington, Virginia: Tax Analysts.

CHAPTER 4

RESULTS AND INTERPRETATIONS

Chapter Overview

This chapter reports the results of the tests of the equations formulated in chapter 3. Interpretations of these results are also incorporated. The chapter includes analyses of the tests on (1) the U.S. dollar/Japanese yen exchange rate, (2) the U.S. dollar/Canadian dollar exchange rate, (3) the U.S. dollar/German mark exchange rate, and (4) the U.S. dollar/British pound exchange rate.

U.S. Dollar/Japanese Yen

Table 1 shows the outcome of equations 1, 2, and 3a when applied to the U.S. and Japanese data. Equation 3b is equation 3a with the inclusion of the variables time and time squared. Time and time squared were included as a proxy for the growth in international trade since 1972.

Equation 1 represents the test of hypothesis I in chapter 1. As can be seen in Table 1, hypothesis I cannot be rejected. Neither the coefficient estimates of the price level index or of expectations are significant at the 10% level. Also the adjusted R^2 is not in the expected range of .9 or greater. Thus, movements in the exchange are not consistent with movements in the price level and

expectations about the price level. Equation 2 is the test of hypothesis II in chapter 1. Hypothesis II is rejected. The coefficient estimate of tax ratio changes is not significant at the 10% level and the adjusted R^2 is not in the expected range. Equation 3a represents the test of Hypothesis III in chapter 1. Hypothesis III is also rejected. None of the coefficient estimates are significant

TABLE 1
U.S. DOLLAR/JAPANESE YEN EXCHANGE RATE

Independent variables	equ.1	equ.2	equ.3	equ.3a
Intercept.....	0.018 (0.481)	0.045 (1.182)	0.025 (0.622)	0.247 (2.389)
PPI differentials.....	1.017 (1.689)		1.059 (1.700)	1.455 (2.546) *
Int. rate diff.....	0.205 (1.596)		0.210 (1.584)	0.214 (2.036) *
Tax rate diff.....		-0.383 (-0.326)	0.586 (0.617)	1.605 (1.739)
Time.....				-0.077 (-2.880) *
Time squared.....				0.005 (3.236) *
Adj. R^2.....	.434	.009	.455	.766

Note: Estimates of the Yule-Walker equation were used to correct for autocorrelation see (Gallant and Goebel 1976).

^at-ratios are in parenthesis.

^b* denotes significance at the .10 level.

at the 10% level. It seems that in the U.S.-Japan case, tax rate ratios do not significantly affect movements in the exchange rate. When time and time squared are added all of the coefficient estimates are significant except tax rate ratios, and the adjusted R^2 increases.

U. S. Dollar/Canadian Dollar

Table 2 contains the results of testing equations 1, 2,

TABLE 2

U. S. DOLLAR/CANADIAN DOLLAR EXCHANGE RATE

Independent variables	equ.1	equ.2	equ.3a	equ.3b
Intercept.....	-0.005 (-0.439)	-0.021 (-2.150)	-0.012 (-1.279)	-0.003 (-0.094)
PPI differentials....	1.190 (2.030)*		1.024 (2.208)*	1.129 (1.474)
Int. rate diff.....	0.079 (-1.457)		-0.113 (-2.541)*	-0.105 (-2.007)*
Tax rate diff.....		-0.439 (-1.866)*	-0.507 (-2.541)*	-0.399 (-1.309)
Time.....				-0.003 (-0.352)
Time squared.....				0.000 (0.494)
Adj. R^2.....	.338	.225	.609	.628

Note: Estimates of the Yule-Walker equation were used to correct for autocorrelation see (Gallant and Goebel 1976).

^at-ratios are in parenthesis.

^b* denotes significance at the .10 level.

and 3a using data from the U.S. and Canada. Equations 3b includes equation 3a, time, and time squared.

As before, equation 1 is a test of hypothesis I. In the U.S.-Canada case, hypothesis I cannot be rejected. The adjusted R^2 is not in the acceptable range and only the PPI correlation estimate is significant. Equation 2 is the test of hypothesis II. It seems that in this case hypothesis 2 cannot be rejected either. Although the adjusted R^2 is not acceptable, it wasn't expected to be. Hypothesis II doesn't suggest that the exchange rate may be predicted by observing tax rate ratios, but rather that tax rate ratios are a significant factor in determining exchange rate movements. And, indeed, the coefficient estimate of tax rate ratios is significant at the 10% level. However, the coefficient estimate is negative as opposed to the expected positive. The implication here is that the international trade multiplier must be fairly large (Harberler 1944, 192). Hypothesis III must, however be rejected. Even though all of the independent variables are significant at the .10 level, the adjusted R^2 of .609 is not in the acceptable range.

U.S. Dollar/German Mark

The results of testing equations 1, 2 and 3a on data from the U.S. and Germany are reported in Table 3. As in the two prior cases, equation 3b is equation 3a including time and time squared.

Hypothesis I, as tested by equation 1, cannot be rejected in this case. The coefficient estimates of the price level and expectations are both insignificant, and the adjusted R^2 is not acceptable. Hypothesis II must be rejected in this case. Tax rate ratios apparently have no significant affect on movements in the exchange rate between

TABLE 3

U. S. DOLLAR/GERMAN MARK EXCHANGE RATE

Independent variables	equ.1	equ.2	equ.3a	equ.3b
Intercept.....	0.039 (0.696)	0.033 (0.766)	0.006 (0.144)	1.222 (1.216)
PPI differentials.....	0.016 (0.096)		-0.049 (-0.326)	0.913 (0.980)
Int. rate diff.....	0.225 (1.012)		0.244 (1.068)	0.070 (0.228)
Tax rate diff.....		-0.742 (-0.763)	-1.244 (-1.130)	0.785 (0.509)
Time.....				-0.214 (-1.413)
Time squared.....				0.009 (1.663)
R^2.....	.087	.046	.205	.488

Note: Estimates of the Yule-Walker equation were used to correct for autocorrelation see (Gallant and Goebel 1976).

^at-ratios are in parenthesis.

the dollar and the German mark. Hypothesis III is rejected as well. The adjusted R^2 of .205 is not acceptable and none of the coefficient estimates are significant. Even when time and time squared are added the model performs little better than a random walk model. It seems that price levels, expectations, and tax rates are of little significance in this case.

U.S. Dollar/British Pound

TABLE 4

U. S. DOLLAR/BRITISH POUND EXCHANGE RATE

Independent variables	equ.1	equ.2	equ.3a	equ.3b
Intercept.....	-0.003 (-0.064)	-0.018 (-0.367)	-0.003 (-0.058)	0.030 (0.168)
PPI differentials.....	0.483 (0.720)		0.495 (0.667)	0.433 (0.538)
Int. rate diff.....	0.012 (0.099)		0.012 (0.098)	0.025 (0.181)
Tax rate diff.....		-0.081 (-0.167)	0.022 (0.039)	0.015 (0.025)
Time.....				-0.022 (-0.467)
Time squared.....				0.002 (0.625)
Adj. R^2.....	.049	.002	.050	.145

Note: Estimates of the Yule-Walker equation were used to correct for autocorrelation see (Gallant and Goebel 1976).

^at-ratios are in parenthesis.

The results of equations 1, 2, 3a, and 3b on the data from the U.S. and the U.K. are reported in Table 4.

Hypothesis I cannot be rejected in this case. It seems that price levels and expectations do not significantly predict movements in the dollar/pound exchange rate. Neither of the coefficient estimates are significant at the 10% level nor is the adjusted R^2 acceptable. Hypothesis II must be rejected however. The tax rate ratio coefficient estimate is not significant at the .10 level. Hypothesis III must also be rejected. None of the coefficient estimates in equation 3a are significant at the .10 level and the R^2 is also not acceptable. When time and time squared are added no appreciable gain is noticed.

CHAPTER BIBLIOGRAPHY

Gallant, A. R. and J. J. Goebel. 1976. Nonlinear regression with autoregressive errors. Journal of the American Statistical Association 71 (December): 961-967.

Harberler, Gottfried. 1944. Some comments on professor Hansen's note. Review of Economics Statistics 26 (November): 191-193.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter Overview

This chapter provides (1) a summary of the research, (2) some broad conclusions that may be drawn, and (3) some recommendations for further research.

Summary

The primary focus of this study has been to develop a theory that shows that the tax rates applied to MNCs could have a significant affect on exchange rates; thus, deviations of exchange rates from their purchasing power parities could be explained by this affect. Chapter 1 introduced the reader to the concepts of purchasing power parity and stated the hypotheses to be tested. Hypothesis I asserts that changes in price level ratios and expectations do not significantly determine changes in exchange rates. Hypothesis II proclaims that the ratio of tax rates applied to MNCs between two countries have a significant affect on exchange rates. Hypothesis III suggests that price level ratios, expectations, and tax rate ratios determine a significant amount of the movements in exchange rates. Chapter 2 reviewed the literature on purchasing power parity. Chapter 3 recited the method for testing purchasing

power parity and developed a method for including tax rates in the test. In chapter 4 the results from the test on the data from the U.S., the U.K., Canada, Germany, and Japan were used to provide empirical evidence.

Hypothesis I, it was found, could not be rejected in all cases. This confirmed the findings of other recent studies (Isard 1987, 6). It seems that exchange rates do not respond to movements in price level ratios and expectations about price level ratios. Hypothesis II was rejected in all cases except the U.S.-Canada instance. Tax rates are, according to this study, a significant factor in determining the U.S. dollar/Canadian dollar exchange rate. Hypothesis III was rejected in all cases. While tax rate ratios were a significant factor in determining the U.S. dollar/Canadian dollar exchange rate, the exchange rate was not significantly predicted in any of the situations in this study. However, in the U.S.-Japan example, the variables do predict over 75% of the movements in the exchange rate. Transportation costs and Central Bank intervention in the foreign exchange markets can, to some extent, explain the remainder. The models failure in the U.S.-U.K. and U.S.-Germany instances can, to some degree, be explained by the workings of the European Economic Community as will be seen later. The models weakness in predicting movements in the U.S. dollar/Canadian dollar exchange rate implies that either some force, other than those elucidated in this

study, are acting on the exchange rate, or that the exchange rate varies randomly outside of the pressures presented here.

Time and time squared were added as, more or less, ad hoc operators for the growth in international trade. It is conceivable that as international trade grows, as more participants become active in the foreign exchange markets, the exchange rate would become more volatile. Even though these factors were significant in only the U.S.-Japan case, their addition did increase the adjusted R^2 in all cases.

Conclusions

The finding that tax rate ratios have a significant influence on movements in the U.S. dollar/Canadian dollar exchange rate leads to the conclusion that when two economies are integrated to a large degree, and transportation costs are at a minimum tax rates may be used to guide the exchange rate to a desired level. In situations where transportation costs are relatively large, as in the U.S.-Japan case, tax rates, it must be concluded, are not an effective policy tool.

An implicit assumption underlying this investigation is that the exchange rate be allowed to freely float and international trade agreements be kept at relative minimum. This assumption is observed, to a fair degree, in the U.S.-Canada and U.S.-Japan relations. However, it is not observed in the other two examples. The European Monetary

Agreement of 1979 was designed to keep the currencies of the countries in the European Economic Community (EEC) pegged at $\pm 2.5\%$ of a previously established par (Dennis 1985). Thus, the assumption of a free float is violated in the U.S.-U.K. and U.S.-Germany instances. Also, the EEC trade pact, while it allows relatively free trade among its members, presents substantial trade barriers to outside countries (El-Agraa 1985). Therefore, the tendency of price levels to gravitate towards their par is not allowed. This may explain the reasons for the models failure when applied to these countries. At any rate, it must be concluded from this study that tax rates do not represent a viable policy tool when trade pacts and exchange rate management are involved.

In the one case where tax rate ratios were significant (U.S.-Canada) the coefficient estimate was found to be negative as opposed to positive as was expected. As was stated earlier, this implies that the international trade multiplier is fairly large. This means that when the exchange rate is under pressure from the internal markets to go down and does start down, pressures in the external markets, resulting from the now more favorable exchange rate, are stronger and pull the exchange rate up. The conclusions that must be drawn from this is that international trade in the external markets is substantially more frequent than is trade among subsidiaries of MNCs. This phenomenon should disappear as time passes.

Recommendations for Further Research

Several avenues of study may be pursued to enhance the theory introduced in this thesis. One is formulate a better proxy for the internal price levels. In this study, the ratio of maximum corporate tax rates was used to represent a one to one proxy for internal price level ratios. This one to one proxy may not be appropriate when international tax agreements are present or when tax reductions are used to lure MNCs into a country. A second avenue of pursuit might be to examine the extent to which MNCs utilize transfer pricing as a method of maximizing after tax profits. Any deviation from all out maximization would also upset this one to one proxy. Since in reality trade agreements do exist and countries are competing for MNC investment, using tax rates as a proxy for internal price levels present and extreme caveat.

All of the data in this study are from developed countries. This is due to the reliability of data generally associated with developed countries. Another avenue of further research would be to test the theory on data from less developed countries (LDCs). It is generally thought that MNC trade is more abundant between LDCs and developed countries because of the wage differentials. MNCs can take advantage of the technology of the developed world and the relatively low wage rates of the LDCs. The sign of the tax rate coefficient, in this case, would be expected to be

positive opposed to the negative sign found in this study. Special caution should be used in specifying the operators used to represent the internal price levels if such research is conducted. With the more lenient tax enforcement usually associated with a LDC government, tax rates probably would lead to erroneous results.

As international trade increases, and MNCs further dominate this arena, tax rates will undoubtedly play a larger role in determining the flow of goods and payments between countries. As this is written, research on comparative tax systems is becoming an increasingly attractive area of study in economics (Pechman 1987, 1).

CHAPTER BIBLIOGRAPHY

- Dennis, G. E. J. 1985. The European monetary system. In The economics of the European community, ed. Ali M. El-Agraa, 314-330. New York: Phillip Allan/St.Martin's Press.
- El-Agraa, Ali M. 1985. External trade relations. In The economics of the European community, ed. Ali M. El-Agraa, 372-387. New York: Phillip Allan/St. Martin's Press.
- Isard, Peter. 1987. Lessons from empirical models of exchange rates. International Monetary Fund Staff Papers 34 (March): 1-28.
- Pechman, Joseph A. ed. 1987. Comparative tax systems: Europe, Canada, and Japan. Arlington, Virginia: Tax Analysts.

APPENDIX

VARIABLE	MEAN	STD. DEVIATION
U.S. dollar/Canadian dollar	.875	.106
U.S. dollar/Japanese yen	.004	.001
U.S. dollar/German mark	.431	.077
U.S. dollar/British pound	1.907	.393
Canada		
CPI	100.173	36.337
PPI	92.164	32.299
Int. rate	9.492	3.361
Tax rate	46.578	1.257
Japan		
CPI	91.552	22.598
PPI	85.231	16.376
Int. rate	7.368	1.499
Tax rate	42.244	0.482
Germany		
CPI	98.420	18.461
PPI	97.673	18.815
Int. rate	7.829	1.489
Tax rate	56.000	0.000
U.K.		
CPI	92.669	41.834
PPI	92.617	40.643
Int. rate	10.400	2.288
Tax rate	48.828	5.927
U.S.		
CPI	94.738	30.688
PPI	88.395	25.690
Int. rate	7.887	2.728
Tax rate	46.500	2.000

BIBLIOGRAPHY

- Balassa, Bela. 1964. The purchasing power parity doctrine: A reappraisal. Journal of Political Economy 72 (May): 584-596.
- Benzion, Uri and J. Weinblatt. 1984. Purchasing power, interest rate parities and the modified Fisher effect in presence of tax agreements. Journal of International Money and Finance 3 (April): 67-73.
- Bilson, John F.O. 1978. The monetary approach to the exchange rate: Some empirical evidence. International Monetary Fund Staff Papers 25 (March): 48-75.
- Cassel, Gustav. 1916. The present situation of the foreign exchanges. Economic Journal 26 (March): 62-65.
- _____. 1918. Abnormal deviations in international exchanges. Economic Journal 28 (December): 413-415.
- _____. 1924. The theory of social economy. New York: Harcourt, Brace, and Company.
- Crouhy-Veyrac, L., M. Crouhy, and J. Melitz. 1982. More about the law of one price. European Economic Review 18 (July): 325-344.
- Dennis, G. E. J. 1985. The European monetary system. In The economics of the European community, ed. Ali M. El-Agraa, 314-330. New York: Phillip Allan/St. Martin's Press.
- Dornbusch, Rudiger. 1987. Exchange rate economics: 1986. Economic Journal 97 (March): 1-18.
- El-Agraa Ali M. 1985. External trade relations. In The economics of the European community, ed. Ali M. El-Agraa, 372-387. New York: Phillip Allan/St. Martin's Press.
- Edison, Hali J. 1987. Purchasing power parity in the long run: A test of the dollar/pound exchange rate (1890-1978). Journal of Money, Credit, and Banking 19 (August): 376-387.
- Frenkel, Jacob A. 1976. A monetary approach to the exchange rate: Doctrinal aspects and empirical evidence. Scandinavian Journal of Economics 78 (No. 2): 200-224.

- _____. 1981. The collapse of purchasing power parities during the 1970's. European Economic Review 16 (May): 145-165.
- Gallant, A. R. and J. J. Goebel. 1976. Nonlinear regression with autoregressive errors. Journal of the American Statistical Association 71 (December): 961-967
- Harberler, Gottfried. 1944. Some comments on professor Hansen's note. Review of Economics Statistics 26 (November): 191-193.
- Internal Revenue Code. St. Paul, Minnesota: West Publishing Company.
- International Financial Statistics. International Monetary Fund. (Washington, D. C.).
- International Tax and Business Service. 1982. New York: Deloitte Haskins and Sells.
- Isard, Peter. 1977. How far can we push the 'law of one price'?. American Economic Review 67 (December): 942-948.
- _____. 1987. Lessons from empirical models of exchange rates. International Monetary Fund Staff Papers 34 (March): 1-28.
- Johnson, Harry G. 1976. Towards a general theory of the balance of payments. In The monetary approach to the balance of payments, ed. Jacob A. Frenkel and Harry G. Johnson, 45-63. Buffalo: University of Toronto Press.
- Keynes, John M. 1923. A tract on monetary reform. Vol. IV The collected writings of John Maynard Keynes. London: Macmillan St. Martin's Press.
- _____. 1930. A treatise on money. New York: Harcourt, Brace, and Company.
- Kravis, I. B. and R. E. Lipsey. 1978. Price behavior in the light of balance of payments theories. Journal of International Economics 8 (May): 193-246.
- Mundell, Robert A. 1976. Barter theory and the monetary mechanism of adjustment. In The monetary approach to the balance of payments, ed. Jacob A. Frenkel and Harry G. Johnson, 63-87. Buffalo: University of Toronto Press.

- Officer, Lawrence H. 1982. Purchasing power parity and exchange rates: Theory, evidence and relevance. Contemporary Studies in Economic and Financial Analysis, ed. Edward I. Altman and Ingo Walter, no. 35. Greenwich: JAI Press Inc.
- Pechman, Joseph A. ed. 1987. Comparative tax systems: Europe, Canada, and Japan. Arlington, Virginia: Tax Analysts.
- Samuelson, Paul A. 1964. Theoretical notes on trade problems. Review of Economics and Statistics 46 (May): 145-154.
- Yeager, Leland B. 1958. A rehabilitation of purchasing-power parity. Journal of Political Economy 66 (December): 516-530.