# THE PURCHASING POWER PARITY THEORY

AND THE DEVELOPING COUNTRIES .

A Dissertation

Presented to

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In Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

By

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#### Thesis Abstract

In this work, the Purchasing Power Parity (PPP) theory is empirically tested for a twenty year period for 12 developing countries following different exchange rate arrangements in relation to their two most important trading partners by using different models and methods of estimation. The theory tends to hold for a majority of the countries contrary to what is commonly believed regarding developing countries. It also works better for those countries having more flexible exchange rates than those following rather fixed exchange rate systems. This finding has important implications regarding the design of domestic macroeconomic policies in developing countries.

When the unofficial exchange rate is used for the PPP estimation, the theory holds for those countries following fixed exchange rate systems too. This result can be utilized to evaluate the exchange rate policy of less developed countries.

The evidence on the factors commonly believed to be responsible for PPP not to hold like structural change, real shocks, trade impediments, productivity bias, low substitutability between home and foreign goods, price discrimination, transport cost, differences in weights, changes in relative prices, capital movements, etc. is not conclusive but they tend to be relevant.

The support for the PPP relation when unofficial exchange rates are used for those countries in the fixed exchange rate arrangements suggests that other factors help to sustain a certain official exchange rate when deviating from the PPP rate. We empirically found those factors to be, as expected, the current account balance, capital account balance, foreign exchange reserves and changes in reserves.

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Chapter I

#### Introduction

In this dissertation, I have attempted to test the Purchasing Power Parity theory empirically for 12 developing countries in relation to their two main trading partners. Though there have been many studies on PPP relating to developed countries, there have been only a few attempts to look at the issue from the developing country perspective. This theory has been a subject of great intellectual debate on both theoretical and empirical grounds earlier this century and also in the seventies with the introduction of the floating exchange rate system. Accordingly, it has been interpreted differently by different some writers interpreted it as the law of one price, some writers: interpreted it as a theory of exchange rate determination, and others used it as a tool in their discussion of balance of payments. From the empirical viewpoint, some authors found it particularly operational during fixed exchange rate periods while others found evidence that it works better in a flexible exchange rate regime. From these studies, they attempted to draw policy conclusions regarding exchange rate management and the issue of the design of domestic macroeconomic policies.

The PPP theory can be expressed either in an absolute version or in a relative version. Both have been empirically tested mostly for developed countries. Many factors like structural change, real shocks, trade impediments, productivity difference among countries, low substitutability between home and foreign goods, changes in terms of trade, price discrimination, transport cost, differences in weights in the price index, changes in relative prices, capital movements, etc. are commonly held responsible for PPP not to hold. These factors are also most prevalent in the developing countries and as such it could be thought that PPP may not hold for the developing countries at all. Various studies undertaken by the World Bank and the International Monetary Fund on the exchange rate problems of developing countries manifestly overlooked this particular question as to whether PPP should hold for developing countries.

Before the discontinuation of the Bretton Woods arrangements, most of the developing countries used to peg their currency to an intervention currency. But after its discontinuation and the consequent wide fluctuations in the value of the intervention currencies like U.S.\$, U.K.f and French franc, developing countries have been facing a tough decision: to peg to some currency or to keep their currency floating. Accordingly, we observe different types of exchange rate arrangements followed by developing countries. In addition, the developing countries are following different types of internal economic and trade policies, are in different stages of economic development, and are undergoing different degrees of changes in the structure of their economy.

In view of these facts, it would be interesting to look at the issue of the PPP theory in the context of the developing countries.

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We have chosen 12 countries representing various geographic regions of the world following different types of exchange rate arrangements and experiencing different rates of economic growth. They also represent various types of trade and economic arrangements. Of these 12 countries, Turkey, Greece, Malaysia and Yugoslavia have adopted a fairly flexible exchange rate policy while Venezuela, Taiwan, Egypt and Burma followed an essentially fixed exchange rate policy. In the middle group, Colombia, Korea, Indonesia and India followed controlled and moderately flexible exchange rate from time to time to certain indicators.<sup>1</sup>

We have estimated different models of PPP by using various methods of estimation for a period of 20 years from 1964 to 1983. Our estimates show that the PPP theory tends to hold for a majority of the countries considered. It works better for those countries with flexible exchange rates than for those with rather fixed exchange rates. The results, though not conclusive, vary from country to country depending on their characteristics like level and rate of economic growth, degree of openness, structure of their economy measured by relative share of agriculture and industry in their GNP, inflow of foreign capital, structure and policy towards international trade, level of financial and monetary development.

The fact that PPP holds for those countries following flexible exchange rate seems to suggest that prices and exchange rates cannot

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be segregated from each other in the developing countries also and as such exchange rate policy and price policy can be coordinated for a better management of their economies. If the exchange rate deviates very much from the PPP rate for a substantial period of time in a country following a fixed exchange rate system, the government, by taking appropriate steps, may bring it back in line with the PPP rate and thus can prevent any misallocation of foreign exchange arising from over or under valuation of its currency. Also, in case of severe pressure on domestic prices due to some exogenous disturbance, the government, by allowing the exchange rate to float freely can neutralize some of the price pressure and can maintain desired price stability. Thus, the developing countries, with a fairly advanced industrial sector and capital markets, may solve some of the external adjustment problem by following a floating rate without interfering very much with their domestic objective.

Besides calculating the PPP relation by using official exchange rate, we have also estimated the relation using unofficial (black market) exchange rates and find that the theory also holds for those countries following a fixed exchange rate system. This result can be utilized to evaluate the exchange rate policy of less developed countries. This also suggests that other factors help to sustain a fixed exchange rate like current account balance, capital account balance, foreign exchange reserves and changes in reserves. Empirically these variables were quite significant.

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The thesis is developed in four main chapters. After this introductory chapter, we present a detailed literature review in chapter 2 which has four main sections. In section I, a review of the PPP theory has been made along with the criticism against the concept from the historical perspective. In section II, the concept has been reviewed from four different perspectives as can be found in various recent works. In section III, we examine the relevance of those perspectives from the context of the developing countries. In section IV, we have critically reviewed various recent works on the PPP theory. We develop our model and present our estimates in chapter 3. which has also five sections. In Section I, we discuss the exchange rate arrangements of our sample countries. In Section II, we develop our models and discuss the main hypotheses to be tested. In Section III, we talk about the various estimation techniques. Section IV contains the empirical estimates of our main models and an economic analysis of the main findings. In section V, we report some extensions of the basic model. Finally, in chapter 4, we present a brief summary of our findings along with some concluding remarks about the policy implication of our work.

#### Footnotes

1. It is very difficult to classify their exchange rate regime according to a normal way of classification due to diverse practices prevalent among different countries. Most of our classification is based on the information found in IMF report on Exchange Rate Arrangements and mostly refer to the exchange rate policy followed after 1972. A brief discussion of the exchange rate arrangements is given in appendix III. Chapter II

#### Literature Review

Section I: Historical Origin

Although there has been some controversy regarding the origin of the PPP concept, it is generally believed that Gustav Cassel (1918), a Swedish economist, gave the theory its name and put it in its modern form. But in a rudimentary form, the PPP doctrine can be traced to the 16th century Spanish writers and to the 18th century British bullionist writers like Thornton, Wheatley, Ricardo and Blake, who tried to explain the fall in the external value of the floating paper pound following Britain's suspension of gold convertibility in 1797. They were instrumental in developing and integrating this theory in to a framework which is now popularly known as the monetary approach to exchange rates. A summary of their contribution can be found in Humphrey and Keheler [1982]. Also Officer [1976] and Katseli [1979] contain nice surveys of the purchasing power parity literature.

The hypothesis of the PPP theory can be expressed by the equation  $P = eP^*$  which means that domestic price (P) is equal to the foreign price (P<sup>\*</sup>) times the exchange rate (e). In other words, the equilibrium exchange rate is equal to the ratio of domestic to foreign price levels. This is referred as the absolute version of PPP and implies that since currencies of different countries are valued

according to what they buy, the exchange rate between them must be equal to the internal relative purchasing power indicated by the general price level.

The relative version of the doctrine states that changes in the equilibrium exchange rate will equal changes in the ratio of general price levels. This can be expressed as  $\Delta e = \Delta P - \Delta P^*$ . Expressed in the absolute or the relative forms, the PPP doctrine is believed by some not to be a very useful hypothesis but it shows an equilibrium relationship. There is also controversy regarding PPP as to whether it is a theory of exchange rate determination. There are several important propositions that can be identified from the writings of its originators which are quite prevalent in the modern day as can be seen from different interpretations of the concept.

The first proposition refers to the internal equalization of price levels expressed in common currency if exchange rates are allowed to float freely. If prices in one country vary from another country, people will try to buy from a cheaper source, raise the demand for that currency and increase the value of that currency accordingly and the opposite effect will occur with respect to the other country's currency forcing the exchange rate to its PPP equilibrium. This is known as the "law of one price" in modern terminology and as such PPP is regarded as the arbitrage condition in the absence of transport cost.

Another proposition which follows from the first is that the purchasing power of money should also be equal across countries. This should hold because the value of money is the inverse of price level. If the purchasing power differs, people will demand more of the currency with the higher purchasing power and less of the currency with the lower purchasing power. So equilibrium will be ensured with a different exchange rate which will be the PPP rate.

The third proposition refers to the stability of the PPP equilibrium. If actual exchange rate deviates from the PPP equilibrium due to disturbances like real shocks, speculative activities, capital flows etc., it can not stay away from PPP rate for long and a self correcting mechanism will ensure PPP equilibrium.

Another implication of the writings of those authors is the neutrality of the exchange rate: it affects only relative prices in both countries without affecting real variables like production, exports, imports, or the terms of trade. The real exchange rate will be equal to one if PPP holds. This neutrality postulate resembles the neutrality of money in the quantity theory framework and, as such, is an extension of the quantity theory of money to an open economy under floating exchange rates.

The other implication of the PPP doctrine is the assertion that the money supply affects the price level which would affect the exchange rate. Thus it is commonly believed that price ratios cause exchange rates. This is the modern day tenet of the monetary approach to exchange rate determination which implies that equilibrium exchange rate is determined by the relative national money stocks. [Mussa 1976]

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Gustav Cassel had the single most important contribution in the development of the PPP theory. He had put it in its modern versions and distinguished its absolute and relative forms. To quote from his writing:

> The rate of exchange between two countries is primarily determined by the quotient between the internal purchasing power against goods of the money of each country ... I propose to call this parity 'the purchasing power parity.' As long as anything like free movement of merchandise and a somewhat comprehensive trade between the two countries takes place, the actual rate of exchange cannot deviate very much from this purchasing power parity. Even restrictions of trade will not cause the rate of exchange to move from this parity rate as long as they strike the trade in both directions equally. [Economic Journal, Dec. 1918, pp. 413]

He also distinguished the relative version of PPP by saying "the old rate multiplied by the quotient of the degree of inflation in both countries." [Money & Foreign Exchange after 1914, pp. 140]

The equalization of the value of money and the neutrality of nominal exchange rate can also be traced from Cassel's writings. In reference to the former, he said, "A certain representative quantity of commodities must cost the same in both countries if the exchange rate stands at its equilibrium". Ibid. Regarding the neutrality proposition, he said:

> The PPP represents an indifferent equilibrium of the exchanges in the sense that it does not affect international trade either way. - Ibid.

Any changes in PPP exchange will, therefore, leave the real exchange rate (which is defined as inflation-adjusted exchange rate  $\frac{eP^*}{P}$ ) undisturbed and have no effect on real exports and imports. The implication of this in terms of policy analysis is that a country cannot increase its competitiveness in foreign markets by simply deflating its price level which would be matched by an equal decrease in the equilibrium exchange rates.

Cassel also strongly believed in price level-exchange rate causality. According to him, the causality runs from the money supply to the price level and then to the exchange rate. To quote from his writing:

> Thus the rate of exchange between two countries will be determined by the quotient between the general levels of prices in the two countries. [E.J. March 1916, p. 62]

This assertion of causality by Cassel has a very important policy implication for imported inflation. If the exchange rate is kept floating, no inflation can be imported from outside. To quote from his writing:

A rise in prices in a foreign country can never cause a rise in prices at home. - Ibid.

This is due to the reasoning that if the prices of a country's

goods are quoted very high, there would be a corresponding drop in its equilibrium exchange rate and a drop in imports. The opposite chain of events would occur if prices were quoted very low. Even if a country has to import from a foreign country at a higher price it may not have any immediate effect on domestic inflation if the domestic money stock and spending remain fixed.

Cassel, however, recognized some limitations of his analysis and showed why there could be temporary deviations of the actual exchange rate from its PPP level and how self-correcting forces may be inopera-He mentioned: 1) asymmetric trade restrictions applied on tive. imports and exports, 2) different adjustment speeds of the exchange rate and the price levels to future anticipations, 3) speculative activity on currency, 4) government intervention and forced sales of currency at low rates, 5) changes in relative prices due to differential sectoral growth in the economy 6) capital movement and random real disturbance in the balance of payment of a country and 7) failure prices of exports to move in proportion to domestic general prices caused by domestic money growth. In the absence of any such factors, even if there is a deviation, the trade flows will be directed in a way to counteract the deviation and correct for it.

Besides the recognized limitations of the PPP doctrine by Cassel, several critics like Taussig [1941] Haberler [1936], Keynes [1923], Pigou [1922], Viner [1937], Metzler [1947], Samuelson [1964], Balassa [1964], Yeagar [1958] have discussed the shortcomings of the doctrine.

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The early critics of the doctrine like Taussig, Haberler, Keynes, Pigou, Viner, Metzler and Samuelson contended that it ignored other important factors like the terms of trade, tariffs, the transportation cost of trade, and the price structure in both trading countries which may affect the exchange rate besides domestic prices and may generate a disparity between the equilibrium exchange rate and the PPP rate. These critics generally discussed the PPP doctrine from the context of trade theory and the equilibrium of trade balance. To elaborate their point, it can be said that the price of foreign exchange is determined by the demand and supply of foreign exchange which would be affected by changes in trade or capital flows without necessarily affecting the domestic price level. Another point about these trade theorists is that they emphasized the real exchange rate and its determinants.

Other lines of attack on PPP centered around the choice of price index to calculate PPP. Some writers [Balassa] suggested the usage of traded goods prices in PPP calculation, others [Keynes, Samuelson] favored a general price index. Balassa suggested that the inclusion of non-traded goods and services in price indices will produce systematic differences between the ratio of price index numbers of two countries. He also pointed out that non-traded goods prices like services would vary according to different levels of productivity among different countries and their inclusion in the price index would, therefore, strongly bias PPP estimates [Balassa 64]. Keynes in his Tract of Money [1923] maintained that consideration of only traded

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goods would reduce PPP calculation to a mere truism. Samuelson [64] maintained that differences in the weights used in calculating the price index in different countries will also distort the PPP calculation and point out that transport cost, and structural changes in an economy may drive exchange rate away from PPP.

Officer[1976] tried to counter Balassa's productivity bias hypothesis by saying that prices of the same non-traded goods may differ among countries due to differences in quality and, as such, if price differences account for quality differences, there may not be any bias in the PPP calculation if appropriate steps are taken.

The most debated issues like transport cost, tariffs, capital movement, differences in weights, productivity bias, traded vs. nontraded goods etc. make the absolute version of PPP doctrine somewhat However, they are also applicable to the relative version of weak. the PPP model also. Any asymmetric changes in those variables among different countries over time may cause deviation in the relative PPP. Thus any changes in the structure of the economy, international capital flows, trade restrictions, tariffs, transport costs, etc. which might involve a differential shift in the internal price ratio between countries would be quite unfavorable to the PPP. In addition to these, the relative version of the PPP has another limitation in regard to the choice of the base year which is used as the basis of comparison. The base year should be chosen as the year when exchange rate corresponds to equilibrium rate. The debate about using a

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general index or only an index of traded goods prices in fact leads us to a present day controversy regarding PPP as both a spatial arbitrage hypothesis and an asset market hypothesis which we shall discuss later.

Another line of attack on PPP centers around the causality issue. There has been claim that the causation runs from the exchange rate to the price level contrary to the claim of Cassel. His claim on causality is true so long as the price level is determined by the money supply with a constant velocity and real income. This is the core of the modern monetarist view [Bilson 1978, Frenkel 1976]. On the other hand, there have been strong arguments in favor of the idea that exchange rates cause the price level to change. Studies asserting causation from exchange rate changes to price levels and wages changes different countries are numerous [Einzig 1935, Keynes in 1923 Goldstein 1974, Balassa 1964, Frenkel 1978, Connolly and Taylor 1976, 1979]. Yeager [1976] supports the idea of causation running from the price level to the exchange rate in a floating exchange rate regime, According to Yeager, many goods may have sticky prices; and in a fixed exchange rate world, the story may be different [1976, p.226]. Keynes pointed out that this line of causation as asserted in the PPP theory may be true in case of monetary disturbances alone. The causality issue will be discussed later in the empirical section.

From this historical perspective, we see that there were both supporters and opponents of Cassel's views, and the applicability of

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the theory was not completely denied. Haberler [1961] sums up the position on the PPP in saying that: 1) under normal circumstance, the PPP theory holds in an approximate fashion; 2) when general price movements dominate changes in relative prices, the relative PPP is a useful concept and 3) when trade relations have been interrupted due to war, barter trade or inter-governmental trade, the PPP can provide an indication of the equilibrium exchange rate that would prevail when normal trade relations resume.

#### Section II: Various Perspectives

From the above survey of the PPP literature in its historical context, it is clear that the PPP theory has been looked at from various perspectives: 1) the PPP as a spatial arbitrage relationship, 2) the PPP as a theory of foreign exchange, 3) the PPP as a tool in a monetary approach to balance of payments (MABP) and 4) the PPP as a reduced form relationship or an asset market relationship. In this section, I shall review the contribution of modern writers on the PPP based on the above classifications and examine the relevance of this discussion in relation to developing countries.

#### 1) The PPP as a Spatial Arbitrage Relationship:

The PPP Theory in its absolute version says that the domestic price of an item should be equal to the foreign price converted at the

If the equality does not hold, commodity arbitrage exchange rate. will take place and bring them to equality in the absence of trade impediments and price discrimination. This view of the PPP is popularly known as the "law of one price." Given perfect knowledge about prices in different countries, free trade and assuming no transport cost, the PPP theory reduces to a tautology and the use of identical traded goods prices for calculating the PPP relationship would imply that it cannot deviate from the equilibrium exchange rate. Some studies which use the notion of arbitrage relationship are Balassa [1964], Samuelson [1964], Isard [1974], 1977, 1978], Lee [1976], Magee [1979], McClosky and Zecher [1981] and Morande [1985]. Kravis and Lipsey, in their several studies on international price comparison, also used this arbitrage interpretation. Empirical findings of these studies will be critically discussed in the next section. Dornbus ch and Krugman [1976] also applied the arbitrage notion in the PPP calcu-The most important points of debate in this interpretation of lation. the PPP as already mentioned in the last section concern: their assumption of intergrated world commodity markets, no transport cost, perfect knowledge, free trade, constant terms of trade, no price discrimination, equal productivity levels for all countries, no change in relative price and structure of production, and perfect substitution between home and foreign goods.

2) The PPP as a Theory of Exchange Rate:

The PPP Theory has been interpreted as a theory of exchange rate determination. As quoted from Cassel in Katseli [79]

The purchasing power parities represent the true equilibrium of the exchanges and it is of great practical value to know those parities. It is in fact to them we have to refer when we wish to get an idea of the real value of currencies whose exchanges are subject to arbitrary and sometimes wild fluctuations.

Cassel, in his earlier writings, mentioned the PPP as the theoretical exchange rate.

Genberg [1978] discusses the implication of the PPP for the transmission of inflation in a domestic country. He asserts that, under fixed exchange rates, inflation rates must be equal in different Purvis [1979] also maintains that domestic prices must countries. follow foreign prices under fixed exchange rates, and hence, that flexible exchange rates are a necessary precondition for the prevention of imported inflation. Extending this idea further it can be implied that under flexible exchange rates this reasoning would assert that the domestic price level is determined by domestic factors like excess demand, expectations, and the internal policies of the government while the exchange rate will be determined by the PPP relation-Under the same reasoning some authors (Frenkel [1978], ship. Kalamotousakis [1978], Yeager [1976])tried to argue about the causal relationship between exchange rate and prices and vice versa. This causality issue will be discussed in the next section in the review of empirical work on PPP theory. In addition, there are various studies on the determination of exchange rate besides the PPP doctrine. The exchange rate overshooting models like Dornbusch [1976], Kouri [1976], Helpman and Razin [1982] and Papell [1984] try to show how exchange rate can deviate from its PPP level in the short run under different assumptions about asset and commodity markets and expectations structure.

#### 3) PPP as a Tool in a MABP

As pointed out earlier, the PPP doctrine can be interpreted as an extension of the quantity theory of money to an open economy and the exchange rate is the relative price of two monies. In this interpretation, the exchange rate is determined by the demand and supply of national money stocks and, as such, the PPP is used as a tool in the monetary approach to balance of payments discussion. [Frenkel 1976, Mussa 1976, Dornbusch 1976, Mundel 1963, Johnson 1977, Aghevli and Khan 1977]. The implication of the PPP theory in the monetary model is that for a small country, the price level is determined by its fixed exchange rate and if exchange rate is flexible, the domestic price level determined by the domestic money supply will in turn determine the exchange rate [Krueger 1983, p.64]. In a monetary model, the determination of exchange rate is explained as follows: assuming a stable money demand function and given some equilibrium money stock, if there is a change in any variable in the money demand

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function which raising money demand and if the government follows a system of fixed exchange rate, it will have to buy foreign exchange to prevent its currency from appreciating. Under a flexible exchange rate system in the above situation, the exchange rate will adjust. Under a regime of controlled floating, the government must decide the extent to which this pressure will be relieved by changing exchange rate or by changing foreign exchange reserves. [Mussa 1976]

This framework of analysis of the PPP, thus, emphasizes monetary disturbances, the quantity of money and a reliance onbuying and selling foreign exchange to stabilize the domestic currency [Katseli 1979].

In the context of monetary analysis, Whitman [1975] tries to use the PPP in a global framework. As distinguished from a MABP, she calls it "global monetarism" and holds the view that the world economy is one integrated market, where world prices and exchange rate determine the domestic price level. She also refers to the PPP as a short run and long run phenomena which we shall highlight next.

### 4) PPP as a Reduced Form Relation:

The various interpretations of the PPP examined thus far and the causality discussion shed light on a variety of aspects of the controversy about the PPP. The fundamental question remains as to whether the PPP is an equilibrium relation or a causal relation, and if so, what are the factors that might cause any change in the exchange rate. Different writers have tried to analyze this question and their analysis have emphasized the role of foreign exchange and money as assets; this interpretation is also called "the Asset Market View of PPP."<sup>2</sup> In the process, they also differentiated between the short-run and the long-run view of the PPP.

Frenkel [1976] points out that "since in general both prices and exchange rates are endogenous variables that are determined simultaneously, discussions of the link between them provide little insights into the analysis of the determinants of the exchange rate." Most of the recent literature on the determination of exchange rate views the exchange rate as being determined in the asset market along with interest rates. This view was expounded in the writings of Branson [1976], Kouri [1976], [1975], Dornbusch and Isard [1978]. Expectations about future exchange rate developments, speculative activity in foreign exchange, stocks of money, real capital, bonds, government policy towards tax structure, budget deficit, balance of payments position, and interest rates may also have significant influence on exchange rate.

So a proper test of the PPP, according to this view, would be to examine these factors and their influence on the exchange rate. Dornbusch [1976] assumes that asset market adjusts faster than the goods market and shows how the exchange rate may overshoot the PPP rate in the short-run under rational expectations. Genberg [1978] asserts that the long run equilibrium real exchange rate might deviate from PPP if the balance of payments is quickly affected by monetary

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policy measures and price level influences have longer lags. Various writers explain the widespread fluctuation of exchange rate in the 70's after the discontinuation of the Bretton Woods system by the asset market view.<sup>3</sup> As pointed out by Artus [1978], "the long run equilibrium value of the exchange rate is, of course, a function not of the current PPP value of the currency, but of its prospective values. Asset market theory focuses on the equilibrating role of exchange rate in balancing the foreign demand for domestically issued financial assets and the domestic demand for foreign financial assets."

So in order to determine the actual movement of the exchange rate and to see whether it conforms to the PPP, we need to express the exchange rate as a function of all the exogenous factors and be able to ascertain the causes of exchange rate movement. This attempt is made in asset market models.

After this brief sketch of various interpretations of PPP that are found in the literature we shall try to see their relevance for the developing countries in the next section.

# Section III: Relevance of the PPP Interpretations for Developing Countries

The discussion of the PPP in the context of developing countries is very limited in the literature. Although there have been studies by the World Bank and the  $IMF^4$  on the exchange rate problem of developing countries, there has not been much said as to whether the PPP holds for developing countries or it is only to be considered in the context of developed countries. The issue needs special attention because the problem is quite different for the developing countries and foreign exchange (sometimes called hard currency) is a very delicate issue in view of various restrictions and rules in handling it. Each country has its own methods in dealing with foreign currency. It is most often handled by the Central Banks even though commercial banks can work as authorized agents in dealing in foreign currency. Many developing countries do not allow free convertibility of foreign currency in view of their shortage. In some countries, it is quoted in their stock exchange. In view of severe imperfections in the way foreign exchange is transacted, there are very active black markets in some developing countries, [Blejer 1978] and there is a high premium on the unofficial rates.

Under the Bretton Woods arrangement, most developing countries pegged their currency to an intervention currency. But after 1973 the wide fluctuation in the value of the intervention currencies like U.S.\$ and U.K.f, the developing countries have been facing a tough decision: to keep their currency floating or to peg it to some currency. There are four exchange rate arrangements evident: 1) independently floating, 2) controlled floating, 3) pegged to a foreign currency and 4) pegging to a basket of currencies like SDR or other currencies according to their choice.

Besides exchange rate arrangements, different countries are following different types of internal economic and trade policies. They are in different stages of development and undergoing different degrees of changes in the structure of their economy. The pattern of exports and imports are changing rapidly and in different directions as can be seen from the tables on exports, imports and the share of agriculture and industry of their GDP provided in the appendix. Most of these countries are viewed as small open economies having no significant influence on world prices.

In view of these facts, it would be interesting to look at the issue of the PPP theory in the context of the developing countries. So we shall first examine the relevance of the various interpretations of the PPP in this section and explore the relevance of the estimating models in the next section.

#### i) Relevance of PPP as a Spatial Arbitrage Theory

As discussed before, the PPP from this interpretation shows an equilibrium relation and in the absence of trade impediments and transport cost, the prices of traded goods of identical nature must be equal in countries converted to the same currency. Developing countries mainly export primary products and import industrial goods. However, this pattern is quickly changing and is very different for different countries. In the absence of any distortion in trade and barring transport cost, there is no reason to contradict the PPP idea in principle and that arbitrage would take place in the presence of differences in the prices of same goods.

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The assumptions behind the arbitrage hypothesis are quite strong and most are inapplicable for developing countries. Different countries follow different tariff and custom rules which distort free trade prices. Price discrimination, followed directly or indirectly to promote their political interest, may result in price differences. There is also the possibility that a country, as a matter of policy, maintains a lower price (exchange rate converted) than competitors to promote exports. Some countries follow multiple exchange rate practices for exports and imports. The productivity bias, structural change, differences in weighting system, internal distribution cost difference and the control and rationing of items are quite relevant for these countries. The constancy of terms of trade and substitutability assumptions are also quite inappropriate for developing countries.

These issues will make the applicability of the arbitrage interpretation of the PPP less attractive to the developing countries and application of the PPP in the developing countries needs to be carefully interpreted.

## ii) PPP as a Theory of Exchange Rate Determination

This interpretation of PPP may be important for developing countries. As mentioned earlier, most developing countries control their foreign exchange and official rates are quite different from the equilibrium (PPP) rate or what will actually prevail in the market. As can be seen later from the deviation of official rate from unofficial rate, there is considerable distortion in the prevailing exchange rate. So the PPP can be a guide for exchange rate management and can show the extent of imperfection or distortion in official rate from free or equilibrium rate.

Similarly, the transmission of inflation under fixed or flexible exchange rate will be quite relevant for developing countries. These countries experienced various rates of inflation during the 60's and 70's. Their inflation problems may vary depending upon their exchange rate arrangements. The question of whether inflation was caused by domestic factors or it was imported from abroad could be analyzed in the context of this interpretation of the PPP. Balassa [1980] and Bautista [1980] discussed this issue after the oil shock of 70's for some developing countries.

# iii) The PPP as a Tool of the MABP

There are some quite interesting studies about the MABP for developing countries [Khan 1977, Fry 1976, Bhatia 1981]. These studies tend to support the idea that the monetary approach to balance of payments applies very much to the developing countries. Domestic prices are influenced heavily by domestic money creation due to budget deficits in view of the rising government expenditure. The exchange rate changes or also have an effect on domestic prices and wages [Connolly and Taylor 1979, Goldestein 1974, Robinson and others 1979]. However, this issue needs special attention in view of the prevalence of real factors like crop failure, natural calamity, excess demand, inflow of foreign capital and aid in the developing countries.

Studies on money demand in developing countries show quite interesting results [Khan 1977, Fry 1976]. Money is regarded as a very important asset in the absence of other assets like bonds and stocks. So money demand and money supply may play important role in influencing exchange rate. [McKinnon 1973]

# iv) The PPP as in Asset Market Hypothesis

Even though the exchange rate depends on various factors mentioned before, their relevance for developing countries are terribly limited. The scope of the foreign exchange market in developing countries varies widely and the extent of trade in foreign exchange is scanty. So the asset market interpretation which assumes a free market for foreign exchange and a well-developed forward market in foreign exchange is not equally relevant for all developing countries. For those countries having a well developed exchange market, this may still be relevant. All these above points suggest that the PPP results should be carefully interpreted in the context of the developing countries and a researcher should be aware of these limitations.

We shall now review the empirical studies on the PPP doctrine in the next section.

Section IV: Review of Recent Empirical Studies

The empirical works on the PPP are numerous and were undertaken for different purposes. Some of these studies concentrated on individual comparison of commodity prices [Isard 1974, Kraris and Lipsey 1971, 1977 and 1978]. Others compared general price level movements and exchange rates. Also the PPP theory was tested as a theory of exchange rate to examine whether pegged or floating rate represented a disequilibrium. We shall concentrate our review on the recent studies along with a reference to those specially for the developing countries.

Balassa [1964] studied the absolute version of the PPP from the commodity arbitrage view point and made both individual price comparison and comparison of general price level and exchange rates. He compared the exchange rate converted prices of different services in several industrialized countries and compared their national income at the PPP exchange rates and actual exchange rates. He pointed out that: a) in the absence of trade restriction, the prices of traded goods should be equal with allowance for transport cost, b) intercountry wage differences correspond to productivity difference which is strongly correlated with per capita incomes, and c) since services enter the calculation of the PPP but do not affect exchange rates, the PPP between the currencies of any two countries expressed in terms of the currency of the country with higher productivity levels, will be lower than the equilibrium rate of exchange.

Kravis and Lipsey in their several studies [1971, 1977, 1978] on traded goods showed unfavorable results on the PPP. There is a large deviation from the law of one price due to price discrimination and trade restriction. They also mention about problems in finding out criterion of similar price movement. The difficulty of the PPP lies in practical issues in calculating the PPP rates and not pitfalls in the basic PPP doctrine. Isard [1974] also showed significant variability in prices. In his later study [1977], he showed significant uniformity of prices of industrial exports.

The problem with these studies is that they concentrate too much on the disaggregated level. It is really hard to classify all commodities according to uniform categories produced in different countries.

Gailliot [1970] did a comparative study of the PPP for seven industrial countries for two fixed exchange period 1900-1904 and 1963-67. He used the wholesale price index and calculated the ratio of the PPP exchange rate to the actual exchange rate and they were very close to one.

His results tend to support the view that the PPP holds during fixed exchange rate period and among industrial countries without experiencing much structural change and trade impediments. However, when he considered other periods experiencing trade restriction, his results did not support the PPP. This has important ramification for developing countries where trade restrictions are widely prevalent.

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Several studies were undertaken after the discontinuation of Bretton Woods. These studies emphasized one or more interpretation of the PPP doctrine mentioned before. Studies by Genberg [1978], Frenkel [1978], Dornbusch and Krugman [1976] and Krugman [1978] attempt to estimate the PPP relations and test their validity for different developed countries for the PPP as a theory of the exchange rate and try to find out the implications for transmission of inflation under fixed and flexible exchange rates. The basic model used in Genberg study was log  $\rho_t = \alpha_0 + \alpha_1 \log \rho f + u$  in absolute form and  $\Delta \log \rho_i = \beta_0 + \beta_1 \Delta \log \rho f + \gamma_i$  in the relative form. Since the exchange rate was fixed, he found the relation between domestic and foreign consumer prices for 10 industrial countries from 1955 to 1970. His results supported the PPP theory.

His study is particularly suitable for developed countries. However, if we use his model for developing countries and use the consumer price index like his study for our analysis, we may run into some problem. Weights may be different in different developing countries' price indices.

Frenkel [1978] discusses some doctrinal issues regarding PPP and then estimates PPP relationship in the short-run and in the long run besides doing a causality study. He calculates two models:

 $\ln S_t = a + b \ln P - b^* \ln P_t^*$ 

and

$$\Delta \ln S_t = b \Delta \ln P_t - b^* \Delta \ln P_t^*.$$

He makes several tests whether  $b = b^*$  or  $b = b^* = 1$ . He considers the relationship between U.S.\$, U.K.£ and French Franc taking monthly observations from 1921-1925 and considers three price indices. He ran a Granger causality test to see whether prices cause exchange rate or vice versa and found that exchange rates cause prices and not vice versa. Frenkel's PPP tests are like those suggested by Bilson [1978].

Since Frenkel first ran the causality tests to see the direction of causality, he could use simple estimating methods in calculation the PPP relation (he used ARI method). Without really knowing the direction of causality if we apply simple estimation method like OLS or AR method, we shall encounter the problem of simultaneity bias since both exchange rate and prices are endogenous and cannot be taken as independent of the error of term.

Krugman [1978] tried to estimate the PPP from a reduced form model taken from 3 structural equations. He maintained that a simple PPP test may reject the hypotheses due to simultaneity and if we correct for it, the results may support the PPP. He tested the PPP for 6 industrial countries like U.S.A., U.K., Germany, France, Italy and Switzerland using an instrumental variable technique corrected for serial correlation. He used data from 1920-1925 and again from 1973-1976. He used wholesale price index and his results were more favorable to the PPP. Krugman's method of estimation is an improvement on others for his recognition of the problem of simultaneity. He uses a time trend as an instrument which is assumed to be uncorrelated with the error term. Other suitable instruments could also be tried. It is really hard to get instrument to use as proxy which are uncorrelated with the error term.

Frenkel [1981] again calculated PPP for U.S.A., U.K., Germany and France using an instrumental variable technique. He compared estimates for 1921-23 and those for 1973-1979. He concluded that the PPP worked better during the 20's but not in 70's and also the PPP worked better among European countries than between U.S.A. and European countries. The difference in results were attributed to real shocks in the 70's like oil shocks, food shortages, changes in commercial policies etc. He also estimated the extent of changes in relative prices and showed its importance for his results. He used both consumer price and wholesale price indices.

In his insightful discussion of the results he pointed out the important issues like real shocks and relative price change for the PPP not to work. He also tried to avoid the simultaneity problem. However, he did not consider any lagged relation.

In our analysis, we choose to use a model similiar to his along with the consideration of a lagged relation. The PPP model may be found inoperable in developing countries due to real shocks and structural changes. Another study incorporating arbitrage hypothesis with the PPP as an exchange rate hypothesis was done by McClosky and Zecher [1981]. They ran several tests of the PPP. Their first assertion was that in the absence of equality, arbitrage will develop and prices will be brought to equalities. They tested a model like

$$\begin{bmatrix} \overline{C}hanges & in U.S. & trade \\ balance & with U.K. \end{bmatrix} = a - b [\Delta(P_{US} - eP_{UK})]$$

Using this model they ran an alternative test of the PPP. Thus if there is a rise in the deviation from the PPP expressed as a rise in the difference between the U.S. price index and the U.K. price index in U.S.\$, it should cause a fall in the trade balance. Their criticism of the conventional tests of the PPP centered on statistical grounds like the closeness of fit and standard error of the estimate. They speak eloquently about the success of the PPP.

Their model also faces the conventional problems of the PPP calculation like the arbitrage assumption in traded goods and the use of price index which gives rise to the problem from the weighting differences. There are some PPP estimates in the context of monetary approach [Frenkel 1976, Bilson 1978, Dornbusch 1980].

Frenkel estimated the PPP during German hyperinflation incorporating the quantity theory of money. He estimated an equation like  $\log S = a + b \log P + u$ . He considers monthly data from 1921-1923 for Germany and assumes foreign price (P\*) as fixed. The elasticity of the exchange rate with respect to the various price indices are very close to unity. He asserted that a wholesale price index works better in the PPP calculation.

This model is a very special one in the sense that it was applied to German hyperinflation case and assumed foreign price constant and used ordinary least square technique for estimation.

Dornbusch estimated a PPP model like  $e = m-m^* + h(i-i^*) + k(y-y^*)$ where e is log of exchange rate; m represents log of nominal money; i nominal interest rate; y real income; h and k are are elasticities. He estimated the equation for most of the industrial countries and his results were not favorable to the PPP.

The main defect of this model in the context of our research is the assumption that h and k are same for both types of countries. In addition, there exists a multicollinearity problem between the right hand variables.

Bilson estimated almost similar type of model and his results were not supportive of the PPP. There were some indirect test of the PPP in terms of the variability of real exchange rate [Thygesen 1978, Vaubel 1978]. If exchange rate changes conform to inflation differentials and the real exchange rate stays fairly constant, then we can assert that the PPP holds.

These tests also suffer from the same problem mentioned above since they use the same technique and data.

Shapiro [1983] examines the theoretical and empirical content of the PPP in efficient markets and analyses the sources of deviation from the strictest version of the PPP focusing on the role played by uncertainty, relative price changes, inappropriate price data, transport cost and government intervention. He also examines the question of whether agents can exploit the information about deviation from PPP for profit motive and that agents cannot.

Since his study assumes existence of developed capital and foreign exchange market, it mainly refers to developed countries.

Some of the studies on the PPP and developing countries are Amacher and Hodgson [1974], Dervis and Robinson [1978], Morande [1985]. They typically mention the problems that may hinder the PPP to work for developing countries.

The Amacher and Hodgson [1973] study is based on arbitrage model estimated on price indices for Yugoslavia with Germany and Italy taken as foreign trading partners. Their results tend to support the PPP for Yugoslavia.

Morande [1985, forthcoming] develops a micro model with retail and wholesale prices and shows the deviation from law of one price for Chile during 1975-1982 mainly on account of domestic distribution cost.

Dervis and Robinson [1978] calculates an equilibrium exchange rate for Turkey under a multisector growth model (CGE) and found out that differential inflation is important but it is not the sole determinant in changing equilibrium exchange rate. Changes in worker's remittances and changes in investment rate were very important in changing the equilibrium exchange rate. So one would thus assume that PPP may not work for developing countries undergoing structural changes and facing both real and monetary disturbances. With this state of current information on PPP, I shall now move on to estimate PPP empirically for developing countries in Chapter 3.

#### Footnotes

- 1. When the PPP holds, the real exchange rate turns out to be I. The PPP is P = eP\*. Real Exchange Rate:  $\frac{eP^*}{P}$ . Substitute for P as  $eP^*$  RER becomes  $\frac{eP^*}{eP^*} = 1$ .
- Another variant of the Asset Market View is the Efficient Market Hypothesis. Shapiro [1983] discusses the PPP in this context.
- 3. Cassel recognized the influence of expected change in inflation on exchange rate as argued in Frenkel [1976]: "A continued inflation will naturally be discounted to a certain degree in the present rates of exchange."
- 4. Various studies by Black [1976, 1977], Khan [1974, 1977], Crockett and Nsouli [1977], Fry [1976, 1976], Balassa [1980], Bautista [1980], Branson and Katseli [1981] deal with exchange rate arrangements and finding out formulae whether to peg to a particular currency or basket of currencies.

Chapter III

### Empirical Estimates of PPP

Section 1: Introduction

In this chapter the PPP estimates of 12 developing countries will be provided. As mentioned in Chapter I, these countries can be classified under three exchange rate regimes:

- Turkey, Greece, Malaysia and Yugoslavia having more flexible exchange rate,
- Venezuela, Egypt, Burma and Taiwan having less flexible or pegged exchange rate, and
- 3) Colombia, Korea, Indonesia and India having controlled floating exchange rate system and will be in the middle category.

The extent of flexibility of exchange rate is based on the classification done in the IMF Report on Exchange Rate Arrangements and by looking into actual variation of official exchange rate as reported in International Financial Statistics. We have calculated average rate of appreciation or depreciation of their currency during the period under study: 1964-1983. These countries changed their exchange rates at different times switching from pegged to unpegged and from fixed to flexible rates. Some of them followed formulae floating while others followed composite pegging or pegging to a basket of currencies or SDR. Accordingly. the latter group experienced a different amount of fluctuation in the rate of exchange. The tables following empirical estimates will contain information on average rate of exchange rate movement.

After the assignment of different countries to various exchange rate regimes, we shall briefly discuss the model and hypotheses that we shall be testing in section 2. In section 3, we shall briefly discuss the estimation technique used for the study and in section 4 we shall report the estimates of our model and discuss the economic interpretation of our results.

#### Section 2: Model and Hypotheses

Our goal in this thesis is the empirical estimation of the PPP relation for 12 developing countries following different exchange rate arrangements. As shown in the literature review, several studies have been undertaken for different countries and the conclusions are mixed. We shall use the existing PPP models already tested for developed countries with some modifications in cases. We shall consider their two main trading partners as the foreign countries and will see whether PPP relation holds.

As discussed in the review, various authors tried to estimate the basic PPP relation  $P = eP^*$  in an econometric relation like

$$\log e = a + \log P - \log P^{*} + u$$

or

$$\log e = a + b(\log P - \log P^*) + u'$$

or they tried to put it in the form of a price equation with the price ratios in left hand side. The hypothesis tested was whether P and  $P^*$  have same elasticities; this would imply that the value of b should not be significantly different from 1 at some significance level. This is the absolute version of PPP.

The relative version of the PPP model is expressed as  $\Delta \ln e = \alpha + \beta(\Delta \ln P - \Delta \ln P^*) + v$  and researchers hypothesized whether  $\beta$  was close to 1 for PPP to hold.

Based on those models we have rephrased our estimated equations as under: 1) ls = c + 110 + u in absolute form and 2) DLS = c + DDLO+ v in the relative form, where ls is the log of the exchange rate of domestic currency per unit of foreign currency, c is a constant, 110 is the log of the ratio of domestic to foreign price, DLS is the difference of exchange rate from one year to the last year and DDLO is the difference of price ratios, u and v are error terms. For PPP to hold the coefficients of 110 and DDLO should not be different from one. In order to see whether there is any lag in PPP to hold we have also estimated a lagged model like

3) 1s = c + 110 + 110(-1) + u

and would hypothesize that the sum of coefficients of 110 and 110(-1) should add up to 1.

Besides estimating these exchange rate equations, we also estimated a slightly different model by putting prices in the lefthand side in the form of price equations.

Regarding the phase of the study and data used, we chose 1964-1983 for the reason of availability of a complete series of data of all the countries. During the 60's there was widespread capital control and other development efforts by these countries in attempt to achieve rapid economic growth and most countries pegged their currencies to an intervention currency. But things changed after 1972 with the breaking up of Bretton Woods system. The world experienced two major oil shocks during the 70's. There has been rapid inflow of foreign capital both private and public to the developing countries. Workers remittances increased for some countries. Exchange rate management became a serious issue for developing countries in the face of floating exchange rate of the dominant industrialized countries with There were other currency developments like the whom they trade. emergence of Eurocurrency market, European Monetary Union and other regional currency unions like Asian Clearing Union etc. Under these arrangements some countries receive special trade and tariff advantages over others.

We used <u>annual</u> data mostly from the IMF and the World Bank sources. For the exchange rate, in addition to using the official

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exchange rate published by IMF, we have done a separate set of estimates using unofficial (black market) exchange rate published in World Currency Review (formerly Pick's Currency Year Book). The estimates are interesting and are reported in table VI. The use of unofficial exchange rates along with official ones would be a significant contribution of our study since it will help in explaining the distortion in official rates due to government control and what rate will prevail in the absence of it. This is specially important for the developing countries where government controls exchange rate by different ways. For price level, wholesale price index is used.

In the next section we shall discuss our estimation technique.

#### Section 3: Estimation Technique

In estimating the PPP relationships we have used three procedures: the ordinary least square (OLS), the autoregressive model (ARI) and the Instrumental Variable technique (IV). The OLS estimates are provided in appendix I. As can be seen from the low Durbin-Watson statistics, our estimates are plagued with autocorrelation problems. Even though the OLS estimates are unbiased, they are not efficient and sampling variances are biased downwards and, as such,  $R^2$  and t statistics tend to be exaggerated.

We used the autoregressive model to get around the autocorrelation problem and the simple autoregressive structure was assumed (ARI), (found in TSP routine) and used the maximum likelihood method of estimation. The other methods of solving ARI models are a) Cochrane-Orcutt, b) Durbin, c) Hildreth-Lieu and d) Prais-Winston. For a large sample of 20 or more, Maddala<sup>1</sup> [1977] suggests using ML procedure for best results. As can be seen from our estimates mentioned in tables I-III in the next section, we have got rid of the problems of autocorrelation and D.W. statistics improve significantly.

Even if we have taken care of the autocorrelation problem, another important issue (mentioned earlier in review) is the problem of simultaneity. In a PPP relation, it is hypothesized that the exchange rate is caused by the domestic and foreign price ratio, and as such, the exchange rate is regressed on the price ratio. However, both the exchange rate and the price level are endogenous variables and are not independent of the error term. As shown in Frenkel [1978] exchange rate may cause prices but not vice versa. So in our model of the PPP, both variables may affect each other raising the simultaneity bias and use of simple estimation technique mentioned above will give biased estimates. So we have also used the instrumental variable<sup>2</sup> method for estimation which corrects for autocorrelation by using time, time squared, lagged values of the dependent and the independent variables as instruments. The estimates are provided in Table V.

Since it has been argued that both the exchange rate and prices are endogenous variables, we have run a separate set of regressions to test the PPP theory by regressing price ratio on exchange rates in the form of "price equations." Estimates are provided in Table IX.

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In case of the countries following fixed exchange rate for which the PPP does not hold, we have estimated alternative models with foreign exchange reserves, changes of reserves, current account balance and capital account balance. Some of these variables turn out to be significant in explaining the PPP relation. The results are given in Table IV and are discussed in the next section.

In view of the changing exchange rate policy after 1972 of most of our sample countries, we have done a separate set of estimates by using dummy variable technique too. The estimates are provided in appendix II.

### Section 4: Empirical Estimates

In this section we shall report the estimates followed by an economic interpretation of them. The main estimates are provided in Tables I through III. For convenience of examination of the results, the estimates of all flexible exchange rate countries are reported in Table I. Table II gives estimates for less flexible exchange rate countries while Table III gives those of moderately flexible controlled floating countries. The U.S.A., Germany and Japan are considered as foreign trading partners and, for the reason of parsimony, only the estimates for the two most important partners are reported. When the U.S. price level is considered as foreign price, then domestic currency per unit of U.S.\$ is considered as exchange rate (1s) and similarly when German price level is considered as foreign price, then domestic currency per unit of Deutsche mark is considered as exchange rate (1SG) and same for Japan (1SJ). Other notations in the tables are straightforward (S.E. stands for standard error of regression,  $R^2$  coefficient of determination, D.W. Durbin-Watson statistics and  $\rho$  refers to the final value of rho). Standard error of coefficients are mentioned in parentheses under each coefficient. Star represents that the estimate is not significantly different from one at 5% level.

a) The PPP Estimates for Countries With Flexible Exchange Rates:

In this sub-section, we shall present the empirical estimates followed by an economic analysis of the results for the first group of countries.

i) Table I contains a summary of the estimates of the PPP models for Turkey, Greece, Malaysia and Yugoslavia. The PPP holds for Turkey and U.S.A. both in absolute and in relative forms without any lag. The coefficients of both the price ratio and the changes in the price ratio are not significantly different from one. The constant term in the relative version is not significantly different from 0.

When Germany is considered as the foreign trading partner, PPP holds in absolute version with a one year lag and the sum of the coefficient of 110 and 110(-1) is not significantly different from unity. The relative version of the model also holds. The  $R^2$ 's are

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quite high in all the equations of absolute version and D.W. statistics indicate an absence of any autocorrelation. In the relative version estimate  $R^2$ 's are somewhat low but still explain more than 50% variation of the exchange rate and D.W. statistics show an absence of serial correlation.

For Greece, the PPP holds for absolute and relative models in relation to the U.S.A. The coefficient of 110 is 1.04 and that of DDLO is .73 and both are significantly different from 1. The  $R^2$  in the former model is quite high (.94) and the D.W. statistics indicate the absence of serial correlation. When Japan is taken as the other important trading partner, PPP holds in the lagged model of the absolute version as well as in the relative version. The former model explains more than 98% of the variation in exchange rate and the D.W. statistic is 1.91 while the latter model explains more than 65% of the variation and the D.W. statistic is 2.3. The relatively lower  $R^2$  of the relative version is possibly due to the differencing of the variables. Our results are very much in conformity with those results that Frenkel [1978, 1981] derived for some developed countries mentioned in the literature review.

Estimates of the PPP relationship between Malaysia and the U.S.A. and Japan, its trading partners, are also favorable to this doctrine both in absolute and in relative forms. The  $R^2$  is quite high in the absolute version and the D.W. statistic indicates the absence of autocorrelation. Similar results are found in relation to Japan as can be seen from Table I.

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### Table I

	Trading	Varia	bles	Price Ratio	Price Ratio	Difference				
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLG	S.E.	R <sup>2</sup>	D.W.	ρ
Turkev	U.S.A.	LS	2.3	1.11*	-	-	.15	.92	1.63	•59
		LS	2.33	.58	.60	-	.15	.95	1.74	.47
		DLS	.002	-	-	1.16* (.26)	.17	•54	1.99	.001
	Germany	LSG	1.12	1.10	} -	-	•13	.98	1.67	.37
		LSG	1.13	.83 (.25)	.30* (.27)	-	•13	.98	1.74	.35
		DLS	.03 (.05)	-	-	.93* (.21)	.15	.53	1.98	03
Greece	U.S.A.	LS	3.3	1.04*	-	-	•08	.94	1.47	.58
		LS	3.3	•60 (•35)	.60	-	•07	.96	1.32	.66
		DLS	.02 (.02)	_	-	.73* (.26)	•08	.32	1.27	-
	Japan	LSJ	-2.5 (.02)	1.19 (.04)	-	-	.07	.98	1.99	.08
		LSJ	-2.5 (.02)	1.19 (.34)	(.40)	-	•07	.98	1.91	08
		DLS	.009 (.02)	-	(.19)	1.07*	•08	.65	2.3	4

Malaysia	U.S.A.	LS	1.05	.86*	-	-	.04	.91	1.52	.5
	1	те	1.05	1 00	- 124	1				1
		1 13	( 07)	( 22)	13-	-	.04	1.91	1.55	1.49
		DIC	(.02)	(.32)	(.32)		1			i
		015	.003	-	-	.60*	•05	.16	1.90	.08
			(.01)	1		(.30)	1			]
	Japan	LSJ	-4.7	.67*	-	-	-08	.97	2.4	.75
			(.06)	(.34)		ľ	1	1		• • • •
	1	LSJ	-4.7	.69	76	-	.07	.97	2 02	56
			(.04)	(.34)	(.35)	{			2.02	
	Į	DLS	.01	-	-	.71*	.07	.27	2.04	- 42
	i		(.04)	1		(.36)		1	1.04	
Yugoslavia	U.S.A.	LS	2.6	1.3*	-	-	.14	.77	1.67	.83
	1		(.17)	(.15)		(		1	1	1
		LS	2.5	1.95	83*	- 1	.14	.99	1.87	.11
			(.11)	(.43)	(.45)			1		1
		DLS	08	- 1	-	1.67*	.13	.74	2.01	3
			(.04)	1		(.36)		1		
	Germany	LSG	1.4	1.11*	-	-	.12	.96	1.74	.32
	-		(.05)	(.06)			1		1	
	[	LSG	1.26	2.14	-1.08*	-		90	1 97	
			(.04)	(.32)	(.34)		1		1.01	
		DLS	04	-	-	1.39*	.14	.47	1.89	- 3
			(.05)	1		(.34)			1.07	
							1			
			•	•		•	,	•		

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Estimates of the coefficients are also favorable to the PPP for Yugoslavia in relation to its trading partners, the U.S.A. and Germany. The coefficient of the price ratio is 1.3 and the coefficient of the differences in price ratio is 1.67 and neither are significantly different from 1 when the U.S.A. is considered as the partner. When Germany is considered as the trading partner, the estimates of 110 is 1.11 and that of DDLO is 1.39 and these are not significantly different from 1. The  $R^2$ 's in all equations are quite good and the D.W.'s indicate an absence of the serial correlation problem. The lagged model for both trading partners also supports the PPP relationship.

### ii) Economic Analysis of the Results:

We shall now try to discuss some of these results from the context of <u>a priori</u> theory and highlight some economic evidence in those countries that may lend support to them.

The implication of having flexible exchange rate for a country is that their inflation rates can diverge from the world rate while domestic prices vary according to domestic factors like the money supply, government expenditure and excess demand [Johnson 1977, Purvis 1979]. A country that is more open to the foreign world and has a liberal trade policy may have more of an opportunity for arbitrage. Also a country that has a strong financial sector which increase capital mobility will be more favorable to the PPP. The Purchasing Power Parity works better in the absence of severe capital controls and sterilization efforts by the government and also in the absence of structural change in the economy [Samuelson 1964]. In case of a floating exchange rate system, the exchange rate change constantly helps the adjustment of the balance of payment and as such, direct intervention by government in reserve management is less necessary. The PPP can work better between countries in the absence of any of the following effects: large productivity difference among them [Balassa 1964], changes in terms of trade, changes in relative prices, real shocks and price discrimination. Higher substitutability between home and foreign goods and uniformity in weights on different items while calculating the price index may be favorable to the PPP to hold between countries.

Some of the information mentioned above is not readily available for developing countries and as such we shall use some statistics as a proxy for them. We shall use growth in per capita income as a proxy for productivity difference, the deviation of official exchange rate is used as a proxy for capital control, changes in reserves is used as a proxy for sterilization efforts by the government, the ratio of  $M_2$ to GDP is used to look for financial development and the ratio of total trade to GDP is used as a measure of openness of a country. To identify structural change in an economy, we shall consider the share of agriculture and industry in the GDP. To notice any change in relative prices, we shall use the difference in inflation rates calculated from CPI and WPI. This procedure was used in Frenkel [1981] too. Table I:A below shows some of the statistics mentioned above. Other relevant information is presented in the Appendix.

If we illustrate Table I:A and compare them with other two groups of countries discussed later, we can see some interesting facts. As suggested by theory inflation rates diverge between domestic and foreign countries in this group. The rate of inflation during 1964 to 1983 in the U.S.A., Germany and Japan were 6.5%, 4% and 5% respecttively and GDP growth rate per capita during the same period were 2.3%, 3.3%, and 6.3% respectively. Inflation rates were quite high in all countries except Malaysia. Their domestic rates of growth of the money supply were also high. These countries, however, experienced similar rates of growth in the GDP per capita in relation to the developed trading partners. Except for Turkey, the other three countries had fairly high ratios of  $M_2$  to the GDP. Since they had a fairly flexible exchange rate system, the rate of change of the unofficial exchange rate was very much similar to that in the official exchange rate implying that there was not relatively much activity on the black market of foreign exchange. Also there was not a significant premium on the unofficial rate as compared to the official rate (mentioned in Appendix VI). The percentage change in reserves was also not very high, reflecting relatively less frequent sterilization attempts by the government. There have been considerable changes in the share of agriculture and industry in GDP between 1960 and 1981 signifying that these countries experienced structural changes in their economy.

# Table I:A

	Average	Growth in per	Average of Ratio	Average Rate of	Average Rat	e of Change	Average	Average Change in	Shaı Agricu	ce of Iture	Share Indus	e of strv
	Growth	capita	of Import	Inflation	of Excha	ange Rate:	of Ratio	Total	in (	DP	in C	GDP
	of money	GDP	+ Export	%	Official	Unofficial	of M <sub>2</sub> to	Reserves	1960	1981	1960	1981
<u>Country</u>	%	%	to GDP	(70 base)	%	%	GDP	%	%	%	%	%
l. Turkey	33.3	4.0	.20	24.4	19	17	.3	19	41	23	21	32
2. Greece	16.5	5.4	•38	12.1	6.3	6.3	.57	8	23	17	26	31
3. Malaysia	12.6	4.3	•95	4.5	-1.4	-1.5	.41	12	37	23	18	36
4. Yugoslavia	22.0	5.0	•45	20.1	16	14	.67	16	24	12	45	45
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[Data refer to the period from 1964-1983. Averages refer to geometric mean.]

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Inflation rates measured by the WPI were higher in Greece and Malaysia and lower in Turkey and Yugoslavia [mentioned in Appendix VIII] reflecting changes in relative prices. The rate of growth of industry was faster than that of agriculture over the period and also the share of agriculture in trade declined and that of industry grew for all these countries. It can be suggested, then, that the dominance of industry might lead to production of more traded goods which may have favorable impact on the workability of the PPP. The rate of growth of international trade was very remarkable and surpassed their GDP growth rate due mainly to the changing emphasis of the government [Chenery and Keesing 1981]. Growth of total trade were 20% in Greece, 36% in Turkey, 13% in Malaysia and 28% in Yugoslavia between 1964-1983. Both Turkey and Greece are members of the EEC and the OECD which helps them to maintain close ties with the economies of the developed countries.

b) The PPP Estimates for Countries With Fixed Exchange Rates:

We shall now present the PPP estimates for those countries having fixed exchange rate policy followed by a discussion of the estimates in this subsection.

i) Table II provides a summary of the PPP estimates for Venezuela, Egypt, Burma and Taiwan. As can be seen from the table, the PPP estimates for Venezuela in relation to the U.S.A. are not supportive of the theory both in absolute and in relative forms. However, the estimates are favorable to the PPP when Japan is considered as the other trading partner. This is a surprising result which will be discussed below. The PPP equation for Venezuela in relation to U.S.A. has a low D.W. statistic even though we have used the ARI model suggesting that ARI is not the proper specification.

The estimates for Egypt with U.S.A. are not supportive of the PPP theory in both absolute and relative forms. The coefficients of 110 and DDL0 are significantly less than zero. The lagged model also does not work. When Japan is considered as the trading partner, the absolute version does not give favorable result but the relative version supports the PPP theory and the coefficient of DDL0 is not significantly different from one. In all the equations D.W. statistics show an absence of any serial correlation and the  $R^2$ 's are high in most cases.

The PPP estimates for Burma and U.S.A. are not favorable in all the models. It is favorable only for Japan in the absolute version, but the relative version and lagged model are not. The  $R^2$ 's are relatively low indicating lower explanatory power of the equations. The D.W. statistics for all the equations are good and indicate the absence of any serial correlation problem.

The estimates for Taiwan in relation to U.S.A. as the foreign country gives a wrong sign and are significantly different from one. The coefficient of 110 is -.05 and DDL0 is -.11. However, when Japan is considered as the trading partner, the estimates improve significantly and the absolute version supports PPP but not the relative ver-

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### Table II

	Tradias	Varia	bles	Price	Price Ratio	Difference			1	
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	ρ
Venezuela	U.S.A.	LS	1.47	.05	] -	-	.007	.99	.89	.96
		Te	(.02)	(.04)	006		008	00	07	96
		63	(.02)	(.04)	(.04)		•000	• 3 7	.07	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
		DLS	.002	-	-	.04	.006	.10	1.64	.43
			(.002)			(.03)				
	Japan	LSJ	-4.3	.71*	-	-	.08	.96	1.78	.77
			(.08)	(.20)						
		LSJ	4.27	.83	26	-	•08	.96	1.69	.78
		סזמ		(.29)	(.34)	68*	09	20	1 96	0.5
		040	(.02)			(.32)	•••	•20		.05
Egypt	U.S.A.	LS	89	.09	-	-	.02	.85	2.00	.91
			(.04)	(.09)	{					1
		LS	89	.09	.04	) - (	.25	•86	2.03	.90
			(.04)	(.11)	(.13)		~~		0.05	
		DLS	.008	-	-	.18	•02	.23	2.05	26
			(.004)			(.08)				
	Japan	LSJ	-6.5	.55	-	-	.08	.98	1.71	.78
			(.07)	(.20)				[		
		LSJ	-6.6	.75	.42	-	•08	.98	1.37	.8
			(.08)	(.25)	(.30)	504	~~			
		DLS	.002	-	-	.59 <del>*</del> (.26)	.09	.23	1.9	.008
					ł	1		l	1	1

	1	1	1	1	1	1	1	1	4	1
Burma	U.S.A.	LS	1.75	.43 (.22)	-	-	.08	.56	1.78	.94
		LS	1.78	.61	35	-	.08	.61	1.56	.94
		DLS	.03 (.02)	-	-	.43 (.19)	.08	.23	2.03	.08
	Japan	LSJ	-4.03	.77* (.35)	-	-	.13	.86	2.04	.93
		LSJ	-4.0	.86 (.41)	20 (.42)	-	.13	.84	1.88	.93
		DLS	.04 (.02)	-	-	.54 (.28)	.12	.18	2.1	27
Taiwan	U.S.A.	LS	3.6	05 (.05)	-	-	.01	.99	2.1	.9
		LS	3.6	07 (.06)	.02 (.06)	-	.01	.99	2.16	.89
		DLS	003 (.002)		-	11 (.04)	.01	.25	2.03	34
	Japan	LSJ	-2.1	.96*	-	-	.09	.85	1.89	.91
		LSJ	-2.07	1.11	31* (.45)	·-	.09	.86	1.9	.71
		DLS	.01 (.02)	-	-	.49 (.48)	.09	•06	2.02	14

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sion. The  $R^2$ 's in absolute version were quite high and the D.W. statistics suggest that there is no autocorrelation problem.

So except a few cases, the estimates are not favorable to the PPP theory for these countries. We shall analyze the economic rationale for these results next.

#### ii) Economic Analysis of the Estimates:

Table IIA summarizes some important economic indicators for the countries having fixed exchange rate system which may be helpful in explaining the PPP estimates mentioned previously. Even though inflation rates of these countries were not exactly the same as their trading partners, they were less than those of most of the first group of countries. These countries followed diverse practices in their economy. So we shall discuss them separately.

Taiwan followed a rapid industrialization program by promoting manufacturing exports. The money supply grew at an annual rate of 22% and inflation rose by about 7%. It experienced a fairly high per capita GDP growth rate of 6.6% annually. The Taiwanese economy underwent a huge structural change as can be seen from the relative share of agricultural and industry in its GDP. The reserve fluctuation was about 30%, which is very high as compared with other countries. Taiwan had a very open economy and a relatively developed capital market. The average growth of trade and the growth of the industry sector were 15% each during the period of study. The premium on the

# Table II:A

# Period: (1964-1983)

		Growth	Average	Average				Average	Shar	e of	Share	e of
	Average	in per	of Ratio	Rate of	Average Rat	e of Change	Average	Change in	Agrícu	lture	Indus	stry
	Growth	capita	of Import	Inflation	of Excha	inge Rate:	of Ratio	Total	in C	SDP	in (	GDP
	of money	GDP	+ Export	%	Official	Unofficial	of M <sub>2</sub> to	Reserves	1960	1981	1960	1981
Country	%	%	to GDP	(70 base)	%	%	GDP	%	%	%	%	%
l. Taiwan	22.0	6.6	.69	5.7	29	41	.60	30	28	10	29	48
2. Egypt	15.3	3.5	.44	8.0	56	1.77	.49	26	30	21	24	38
3. Burma	8.9	1.4	.15	6.1	2.9	4.3	•26	10	33	47	12	13
4. Venezuela	15.7	2.4	.53	7.5	24	5.3	.28	16	6	6	22	45

unofficial exchange rate was 4% on the average. In order to expedite export growth, Taiwan provided a lot of incentives to exporters in the form of subsidies. These factors may explain why PPP may not hold for Taiwan. PPP holds in relation to Japan which may be due to geographic nearness, lower transportation cost, severe competition between them in marketing their products, and similar growth rates of per capita GDP and export. Consequently, it is difficult to tell which factors are more important in explaining PPP relationship.

Egypt and Venezuela had similar rates of average money growth over the period and about same rate of inflation. Per capita growth of the GDP was low for both countries. The ratio of  $M_{2}$  to the GDP was higher in Egypt as compared to Venezuela. The ratio of trade to the GDP was higher in both countries. This is due mainly to the rise in the price of oil. Both countries were heavily dependent on the production of primary items and did not change their industrialization strategy for quite a long time. They have been emerging from primary exports since late sixties [Chenery and Keesing 1981]. There have been considerable capital controls prevailing in those countries as can be seen from the greater changes of the unofficial exchange rate as compared to those changes in official rates and a high premium on the unofficial rate of exchange. These countries also experienced huge inflows of foreign capital and export earnings from the rise in oil price and workers remittances. Internal rationing and subsidies on food items were very significant in Egypt. These factors may explain why the PPP will not work between them in relation to the developed countries. The PPP works between Venezuela and Japan whereas it does not hold in relation to U.S.A. This may be due to the import of diversified consumer items from Japan in to Venezuela having significant influence on domestic price level.

Burma is mainly an agricultural country with lower per capita income and productivity growth. The foreign trade to the GDP ratio is only .15 and financial sector is also not very organized as can be seen from the lower  $M_0/GDP$  ratio. Industry sector contributes only 13% of the GDP and this share has not changed from the 1960 level. The share of agriculture increased from 33% in 1960 to 47% in 1981. Share of agriculture in total export fell from 95% in 1961 to 86% in Total growth of trade was also low as compared to other 1981. countries (10%). Since a large part of agricultural produce is used for self-consumption, they are mainly non-traded in relation to manufactured goods. In addition, the average change of the unofficial exchange rate was higher than that of official rate and the premium on the black market rate was almost 200% on the average indicating severe capital control. These factors may explain why the PPP may not work for Burma.

c) The PPP Estimates for Countries With Controlled or Moderately Flexible Exchange Rates

i) In this section we shall discuss the performance of the PPP relationship for the moderately flexible exchange countries like

Colombia, Korea, Indonesia and India. The estimates are summarized in Table III. These countries followed different types of exchange rate arrangement during the period under study such as pegging to some country for some period following an occasional change of par values based on some indicators and adopted some sort of managed floating for some period. As a group therefore, they lie in between two groups discussed before and the performance of the PPP relationship also seems to closely follow the flexible exchange rate countries due to one common factor among all these countries, their attempt to revise exchange rates whenever actual exchange rate deviated from the PPP equilibrium rate, thus, necessitating interventions by the government. Since they followed controlled floating, possibly they could manipulate the exchange rate more often as needed by the state of the economy.

The estimate of the PPP relationship between Colombia and U.S.A. shows the coefficient of 110 is .91 which is not significantly different from 1, the  $R^2$  is .87 and the D.W. statistic is 2.3. The lagged model and the relative version do not, however, perform well. When compared with West Germany as the trading partner, the coefficient of 110 is .95 and is not significantly different from 1. The lagged model also gives significant coefficient. However, the  $R^2$  is relatively low.

The PPP estimates for Korea in relation to U.S.A. show that 110 is .88 and DDLO is .82; both are not significantly different from 1. Similarly, the estimates with Japan as the foreign country are also favorable to PPP with a good  $R^2$  and a better D.W. statistics showing an absence of serious autocorrelation problem.

The coefficient estimates for Indonesia when U.S.A. is considered as the foreign country are .95 for 110 and 1.07 for DDLO; both are not significantly different from 1. The  $R^2$ 's are more than .90 and D.W. statistics indicate absence of autocorrelation. Similar estimates are found when Japan is considered as the foreign country. Explanatory power of the equations are quite high also and there is not a problem of serial correlation.

Finally, the coefficient estimates of 110 is 1.52 and DDLO is .95 for India taking U.S.A. as the foreign country. However, the  $R^2$  of the equations are somewhat low and the explanatory power of the equations are lower. The D.W. statistics indicate the absence of serial correlation. When Japan is taken as the foreign country, the absolute version of the PPP doesn't work but the relative model does and the coefficient of DDLO is 1.02. The D.W. statistic is also good.

The estimates for these countries are not quite uniform as we might expect due possibly to large scale government intervention some of which were helpful in correcting the market exchange rate towards the equilibrium or the PPP rate and others of which noted the market exchange rate away from the PPP rate because of changes in peoples' speculative behavior which will be explained in the next subsection.

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Table I	I	I
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		Varia	ibles	Price	Price Ratio	Difference				
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	ρ
Korea	U.S.A.	LS	5.79 (.04)	•88*	-	-	.05	.98	1.34	.69
		LS	5.8 (.02)	.80 (.19)	.09 (.18)	-	.05	.98	1.47	.67
		DLS	.008 .02	-	-	.82* (.21)	.05	.49	1.94	.13
	Japan	LSJ	.007 (.04)	1.07* (.06)	-	-	.09	.94	1.98	.31
		LSJ	02 (.05)	1.09 (.31)	01 (.31)	-	.10	.94	1.99	.3
		DLS	.03 (.03)	-	-	•68* (•32)	.11	.22	2.15	43
Colombia	U.S.A	LS	2.8 (.06)	.91* (.06)	-	-	.09	.87	2.3	.56
		LS	2.9 (.04)	•27 (•27)	.61	-	.04	.97	1.23	•7
		DLS	.06 (.03)	-	-	.45 (.24)	•08	09	•61	75
	Germany	LSG	1.5 (.15)	•95* (•10)	-	-	.11	.33	2.3	.83
		LSG	1.67 (.13)	•67 (•39)	.21*	-	•08	.64	1.43	•87
		DLS	.12 (.05)	-	-	.11 (.37)	•09	11	1.32	23
		DLS	.12 (.05)	-	-	.11 (.37)	.09	11	1.32	

			.02			(.21)		1	1	
	Japan	LSJ	.007	1.07*	-	-	.09	.94	1.98	.31
		LSJ	02	1.09	01	-	.10	.94	1.99	.3
		DLS	(.05) .03 (.03)	-	(.31)	•68* (•32)	.11	.22	2.15	43
Colombia	U.S.A	LS	2.8	.91 <b>*</b>	-	-	.09	.87	2.3	.56
		LS	2.9	•27 (•27)	.61 (.28)	-	.04	.97	1.23	.7
		DLS	.06 (.03)	-	-	.45 (.24)	.08	09	•61	7
	Germany	LSG	1.5	•95*	-	-	.11	.33	2.3	.83
		LSG	1.67	•67 (-39)	.21*	-	•08	.64	1.43	.87
		DLS	.12 (.05)	-	-	•11 (•37)	.09	11	1.32	23
Indones i a	Π.S.A.	LS	5.7	95*	_		,		1	1.
Indones i a	U.S.A.	LS	5.7	.95*	_	_	1.1	.98	1.89	1
Indones 1a	U.S.A.	LS LS	5.7 (.06) 5.6	•95* (•04) 1•64	43	-	.3	•98 •91	1.89	1
Indones 1a	U.S.A.	LS LS DLS	5.7 (.06) 5.6 (.09) 02	.95* (.04) 1.64 (.13) -	- 43 (.10) -	- - 1.07*	.3 .18 .34	•98 •91 •91	1.89 1.72 1.54	1 .5 7
Indones 1a	U.S.A.	LS LS DLS LSJ	5.7 (.06) 5.6 (.09) 02 (.05)	.95* (.04) 1.64 (.13) -	- 43 (.10) -	- - 1.07* (.08)	•3 •18 •34	.98 .91 .91	1.89 1.72 1.54	1 .5 7
Indones 1a	U.S.A. Japan	LS LS LSJ LSJ	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64	- 43 (.10) - -	- - 1.07* (.08) - -	.3 .18 .34 .27	.98 .91 .91 .99	1.89 1.72 1.54 1.82	1 .5 7
Indones 1a	U.S.A. Japan	LS LS DLS LSJ LSJ DLS	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14)	- 43 (.10) - - 41 (.10) -	- - (.07* (.08) - - 1.06*	.3 .18 .34 .27 .18 .35	.98 .91 .91 .99 .98 .90	1.89 1.72 1.54 1.82 1.82 1.55	1. .50 70 30 .31
Indones 1a	U.S.A. Japan	LS LS DLS LSJ LSJ DLS	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01 (.05) 2.04	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14) -	- 43 (.10) - - 41 (.10) -	- - (.08) - - 1.06* (.09)	.3 .18 .34 .27 .18 .35	.98 .91 .91 .99 .98 .90	1.89 1.72 1.54 1.82 1.82 1.55	1 .50 70 31 .31 70
Indones ia India	U.S.A. Japan U.S.A	LS LS DLS LSJ LSJ DLS LS	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01 (.05) 2.04 (.04) 2.04	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14) - 1.52* (.34) 0.3	43 (.10) - 41 (.10) -	- - (.08) - - 1.06* (.09) -	.3 .18 .34 .27 .18 .35 .10	.98 .91 .91 .99 .98 .90 .22	1.89 1.72 1.54 1.82 1.82 1.55 1.95	1 .5 7 3 .3 7 ( .4
Indones i a India	U.S.A. Japan U.S.A	LS LS DLS LSJ DLS LS LS LS	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01 (.05) 2.04 (.04) 2.06 (.04) 2.06	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14) - 1.52* (.34) .93 (.6)	- 43 (.10) - - 41 (.10) - - .64* (.53)	- - 1.07* (.08) - - 1.06* (.09) - -	.3 .18 .34 .27 .18 .35 .10 .10	.98 .91 .91 .99 .98 .90 .22 .35	1.89 1.72 1.54 1.82 1.82 1.55 1.95 1.96	1. .50 70 33 .3 70 .40 4.
Indones ia India	U.S.A. Japan U.S.A	LS LS DLS LSJ DLS LS LS LS DLS	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01 (.05) 2.04 (.04) 2.06 (.04) 2.06 (.04) .02 (.02)	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14) - 1.52* (.34) .93 (.66) -	- 43 (.10) - - 41 (.10) - - .64* (.53) -	- - 1.07* (.08) - - 1.06* (.09) - - .95* (.41)	.3 .18 .34 .27 .18 .35 .10 .10 .10	.98 .91 .91 .99 .98 .90 .22 .35 .24	1.89 1.72 1.54 1.82 1.82 1.55 1.95 1.96 2.1	1. .50 70 30 .33 70 .44 40
Indones ia India	U.S.A. Japan U.S.A Japan	LS LS DLS LSJ DLS LS LS DLS LSJ	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01 (.05) 2.04 (.04) 2.06 (.04) 2.06 (.02) -3.7 (.06)	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14) - 1.52* (.34) .93 (.6) - -	43 (.10) - 41 (.10) - .64* (.53) -	- - (.08) - - 1.06* (.09) - - .95* (.41) -	.3 .18 .34 .27 .18 .35 .10 .10 .10 .10 .12	.98 .91 .91 .99 .98 .90 .22 .35 .24 .94	1.89 1.72 1.54 1.82 1.82 1.55 1.95 1.96 2.1 2.1	1. .50 70 .33 70 .41 43 30
Indones ia India	U.S.A. Japan U.S.A Japan	LS LS DLS LSJ DLS LS LS LSJ LSJ	5.7 (.06) 5.6 (.09) 02 (.05) .41 (.04) 13 (.06) 01 (.05) 2.04 (.04) 2.06 (.04) 2.06 (.04) .02 (.02) -3.7 (.06) -3.7 (.007)	.95* (.04) 1.64 (.13) - 1.00* (.02) 1.64 (.14) - 1.52* (.34) .93 (.6) - 1.79 (.28) 1.32 (.64)		- - 1.07* (.08) - - 1.06* (.09) - - .95* (.41) - -	.3 .18 .34 .27 .18 .35 .10 .10 .10 .10 .12 .12	.98 .91 .91 .99 .98 .90 .22 .35 .24 .94 .95	1.89 1.72 1.54 1.82 1.82 1.95 1.95 1.96 2.1 2.1 1.92	1: .50 70 .31 70 .42 43 36 .56

ii) Economic Analysis of the Estimates:

Table IIIA summarizes some important economic information which may be helpful in explaining the performance of PPP relationship for Colombia, Korea, Indonesia and India.

Colombia has a relatively freely floating exchange rate when compared to the other 3 countries in this group and its rate fluctuated on the average of 12.6%. It experienced an annual rate of 22% monetary growth and rate of inflation was 19% annually. The average ratio of trade to GDP was .3. Annual growth rate in the GDP per capita was 3% which parallels the U.S.A. and Germany, its trading partners. The average changes in reserves was 20% and was very substantial as compared to other countries. The share of industry grew substantially in Colombia's GDP and the annual rate of growth of industry was 7%. There was not significant variation of the official exchange rate from the unofficial rate indicating the absence of any substantial capital controls. Colombia followed an export based industrialization technique after an initial period of import-substitution and its exchange rate system along with export subsidies helped its exports grow at an annual rate of 5%. There was also an increase in the foreign capital inflow into the economy.

Korea is another fast growing country following a rapid industrialization and export promotion growth policy. The annual average rate of growth was 7% and the industrial sector grew at a rate of 17%, as compared to 3% in the agriculture sector. The share of agriculture in the GDP fell but that of industry more than doubled in two decades.

# Table III:A

## Period: (1964-1983)

	Average Growth	Growth in per capita	Average of Ratio of Import	Average Rate of Inflation	Average Rate of Change of Exchange Rate:		Average of Ratio	Average Change in Total	Share of Agriculture in GDP		Share of Industry in GDP	
Country	of money	GDP %	+ Export to GDP	% (70 base)	Official %	Unofficial %	of M <sub>2</sub> to GDP	Reserves %	1960 %	1981	1960 %	1981 %
l. Colombia	22.8	3.2	.28	19.1	12.6	12	•20	20	34	16	26	37
2. Korea	30.0	6.9	.54	13.3	6.2	5.2	.30	16	40	17	19	39
3. Indonesia	33.0	4.1	.38	27	17	18	.14	31	54	24	14	42
4. India	11.3	1.4	.12	8.4	4.1	2.3	.32	16	50	37	20	26

The money supply grew at 30% annually and inflation was about 13%. Korea followed an "inflation-induced capital formation" technique to achieve a faster rate of growth. Korea has an open and relatively monetized economy and a developed capital market. Inflow of foreign capital was quite substantial: \$3,982 million in 1982 as compared with \$441 million in 1970. Changes in the official and the unofficial exchange rate were very similar and deviations of the official exchange rate from the unofficial rate were not very substantial. This indicates that Korea had capital controls occasionally. It also relied on foreign borrowing for financing their development. These indicators along with the liberal exchange rate policy may explain why the PPP relation held for Korea.

Indonesia experienced a high rate of annual money supply growth (33%) and a high rate of inflation (27%) during the period. The average annual per capita growth rate was 4%, and the trade to GDP ratio in the 60's was low. However, Indonesia did gain substantial reserves in the 70's due to oil price increase. Its ratio of total trade to GDP on the average was .38 during the period under study. The country doesn't have a very developed financial market and ratio of M<sub>2</sub> to GDP is only .14 indicating a large portion of non-monetized section in the economy. Capital controls were also prevalent as indicated by the differences in changes in the official exchange rate and the unofficial exchange rate from the official rate. Indonesia also

experienced structural changes in its economy. The share of agriculture in GDP fell from 54% in 1961 to 24% in 1981 and the share of industry tripled from 14% in 1961 to 42% in 1981. So as rapid industrialization (8%) and the earning of huge oil revenues as a member of the OPEC caused a comfortable foreign exchange reserves position for Indonesia, the average reserve changes (\$210 million) was not as great as in a fixed exchange rate country like Taiwan. International trade (exports and imports) grew at a rate of 6% annually.

Finally, India experienced a monetary growth rate of 11% and an inflation rate of 8%. Overall growth of per capita GDP was 1.4%. By other countries standards, India's ratio of total trade to the GDP was only .12 during this period and their financial market was not as developed as other countries. There is a large non-traded sector. The share of agriculture of the GDP is still larger than the industry even though there has been significant growth in industry (5% annually). Growth of international trade was 2.5% annually. India followed an inward-looking import-substitution policy of industrialization in the sixties pronounced by huge capital control indicated by large premiums on unofficial exchange rate. Due to India's inwardlooking policy, its GDP growth rate was one of the lowest [Balassa 1980]. India having a vast internal market did not push itself much in the international market in the sixties when other countries did. It reversed its import-substitution policy in the 70's and is gra-
dually emerging as an exporter of both primary and manufacturing goods [Chenery and Keesing 1981]. India experienced large gains in inflow of foreign exchange from workers remittances which somewhat eased its reserve position. The average change in reserves was only 16% annually. So factors both favorable and unfavorable to the PPP existed in India.

From the above discussion, it can be concluded that there is no general concensus about the factors that affect the PPP. Since these countries differ from one another in their economic characteristics, it is really hard to tell which factor was favorable to the workability of PPP and which was not. The evidence is inconclusive and therefore, it can be argued that the factors traditionally believed to be important in explaining the PPP theory may be relevant but our analysis shows that they are not conclusive. In order to get some more insights, we shall extend our basic model by considering some other variables and other methods of estimation in the next section and will see whether our findings in this section change very much or not.

# Section 5: Extensions of the Basic Model

This section is divided into six subsections and we shall examine a few extensions of our basic model by considering some other variables that may affect the PPP relation and by adopting other estimation methods. i) Estimates With Foreign Exchange Reserves et. al.:

The purchasing power parity, from the asset market view, can be influenced by factors such as expectations about future exchange rate developments, speculative activity in foreign exchange market, the stock of money, the budget deficit and the balance of payments position of a country [Katseli 1979, Shapiro 1983]. Consequently in addition to considering the price ratio for the PPP estimation, we have added some of these variables for those countries for which our basic model did not give favorable results like Venezuela, Burma, Egypt and Taiwan and the estimates are discussed in this subsection. The additional variables considered are 1) the Current Account Balance (CAB), 2) the Capital Account Balance (DCAB), 3) the Foreign Exchange Reserves (RES), and 4) the Changes in Reserves (CHR). We examine whether these variables have a coefficient significantly different from 0. A balance of payments surplus resulting in the accumulation of reserves generally will cause a currency to appreciate. So we shall hypothesize that the coefficients of those variables mentioned above should be negative and significantly different from 0.3 We have not considered any proxy variable for exchange rate speculation and expectations in view of the fact that in the less developed countries there is no significant activity in future's market for foreign exchange. The estimates are summarized in Table IV.

The PPP estimates for Taiwan in relation to the U.S.A., indicates that the coefficients of capital account balance and foreign exchange reserves have the expected sign and they are significantly different from 0. The explanatory power of the equations are very high and the variables explain 99% of the total variation in the exchange rate. The D.W. statistics are around 2 and indicate the absence of a serial correlation problem. These variables are not however, significant in the PPP estimates for Taiwan in relation to Japan. [It may be recalled that the estimates were favorable to PPP between Taiwan and Japan in our basic model.]

The PPP equations between Egypt and U.S.A. show that the coefficients of the reserves and the changes in capital account balance have the expected sign and they are significant. The explanatory power of the equations are quite high and the D.W. statistics indicate the absence of a serial correlation problem. The reserve variable is also significant in the PPP relationship between Egypt and Japan. This finding supports the fact that Egypt has been receiving a massive inflow of foreign exchange from workers remittances and foreign aid during the period of study, e.g. Egypt received \$302 million as foreign capital in 1970 which rose to \$2702 million in 1982 and workers remittances rose form \$29 million in 1970 to \$2074 million in 1982.

In the PPP estimates for Burma in relation to the U.S.A. both current account balance and changes in reserves variables have expected sign and are significantly different from 0. The explanatory power of the equations is good and the D.W. statistics show the absence of a autocorrelation problem. When Japan is considered as the foreign trading partner, the current account balance variable is still significant. If we compare these estimates with Table II above, we can see that the inclusion of current account balance in the PPP equation improves the explanatory power of the equations implying that these factors are quite important in the exchange rate determination.

The foreign exchange reserve variable turns out to be significantly different from 0 in the PPP equations for Venezuela and U.S.A. and Japan. The explanatory power of both the equations are more than 95% and the D.W. statistics indicate that there is not a serial correlation problem.

All these estimates suggest that besides the price ratio, the foreign exchange reserves, current account balance, capital account balance and changes in reserves affect the exchange rate. Our results are parallel to those of Artus[1978] and Dervis and Robinson [1978]. Another implication of this result is that when a country keeps its exchange rate fixed for a long time, there have to be some other factors that it should rely on to support their fixed exchange rate. We empirically found them to be those mentioned above.

#### ii) Estimates by Using Instrumental Variable Technique:

The estimates of the PPP relationship so far were done by using the autoregressive method. As suggested in Frenkel [1978, 1981] and in Krugman [1978], the PPP theory involves a relationship between

Country	Dependent Variable	Trading Partner	Constant	110	CAB	DCAB	RES	CHR	S.E.	R <sup>2</sup>	D.W.	ρ
Taiwan	LS	U.S.A.	3.7	14	02*	-	-	-	.01	.99	2.02	.8
			(.02) 3.7	(.08) 07	(.01)	-	02*	-	.01	.99	2.05	.7
			(.03) 3.6	(.07)	-	-	(.01)	.12 -06	.01	.99	2.1	.8
			(.02) 3.6 (.02)	(.07) 07 (.07)	-	.13 - 06	-	(.24 -05)	.01	.99	2.11	•8
	LSJ	Japan	-2.1	.98	001	-	-	-	<b>,</b> 10	.87	1.76	.6
			(.08)	(.45) .86	(.001)	-	.03	-	.11	.86	1.75	.56
			(.41) -2.1	(.64)	-	-	(.06)	12 -04	•11	.86	1.69	.5
			(.07) -2.1 (.07)	(.5) 1.26 (.49)	-	.13 -04 (.24 -04)	-	(.24 -04) -	<b>.</b> 11	.86	1.69	.5
Egypt	LS	U.S.A.	64	.14	-	-	05*	-	.02	.96	1.72	.53
			89	.12	6 -05	-	-	-	.02	.84	2.02	.93
			(.01) 89 (.04)	(.08) .12 (.09)	-	(.1 -04)	-	2 -04 (2 -04)	.02	.86	1.98	.9
	LSJ	Japan	-7.1	.33	-	-	<b>−.</b> 09*	-	.08	.98	1.72	.46
			(.16) -6.5	(.17) .52	.4 -04	-	(.03)	-	.08	.98	1.44	.8
			(.09) -6.6	(.21) .54	(.3 -03) -	.37 -04	-	-	•08	.98	1.55	.83
			(.10) -6.6 (.08)	(.52) .56 (.21)	-	(.40 -04)	-	.12 -03 (.9 -04)	•08	.98	1.54	.78
	.a			1	I	1		1				
Burma	LS	U.S.A.	(.28)	.41 (.21)	- 1 -02*		(04)	-	-08	.29	1.85	.94
			(.05)	(.19)	(.18 -03)			_	-08	.00	1.72	.25
			(.24) 1.76 (.21)	(.23) .34 (.20)	=	(.2 -03)	-	71 -03* (.3 -03)	.08	.64	1.78	.95
	LSJ	Japan	-3.8	.72	-	-	04	-	.13	.86	2.03	.93
			-4.3	(.37) 1.16 (.35)	9 -03*	-	-	-	.14	.92	1.92	.61
			-3.9	.73	-	.14 -03	-	-	.13	.85	1.92	.9
			-4.0 (31)	•64 (•36)	-	-	-	6 -03 (.5 -03)	.13	.86	1.86	.94
Venezuela	LS	U.S.A.	1.5	.05 (.04)	11 -06 (5 -06)	-	-	-	.01	.99	.91	.95
			1.6 (.09)	.02 (.02)	-	-	02* (001)	-	.01	.99	1.85	.14
			1.5	•05 (•04)	-	2 -06	-	-	.01	.99	.88	.95
			1.5 (.02)	.05 (.04)	-	-	] -	.23 -07 (.11 -05)	•008	.99	•86	.95
	LSJ	Japan	-4.3	.71 (.24)	44 -05 (.6 -05)	-	-	-	•08	.96	1.77	.77
			-4.8	•54 (•26)	-	(.08 -05)	07*	-	•08	.95	1.75	•41
			-4.3 (.09)	•66 (•25)	-	-	-	20 -04 (.13 -04)	•08	.96	1.54	.81

# (\* Significantly different from 0.)

Table IV

exchange rates and prices neither of which can be regarded as exogenous. So Frenkel [1978] establishes a chain of causality first, and then regresses price ratio on exchange rate since it was argued that prices do not "cause" exchange rates in Granger sense, but exchange rates "cause" prices. Krugman [1978] maintains that a simple test of the PPP without taking care of the problem of simultaneity may lead to the rejection of the PPP where it can be valid. So Krugman suggested the use of instrumental variable technique for estimating the PPP relationship to avoid the simultaneity problem.

In this subsection, therefore, we shall report the PPP estimates by using instrumental variable (IV) technique. If the estimates do not change very much from our previous method we can conclude that our estimates did not have a serious simultaneity bias. The IV method we have used are corrected for serial correlation with time, time squared, lagged value of exchange rate and lagged price ratio as instruments. The estimates are presented in Table V.<sup>4</sup>

If we compare table V with tables I-III, we can see that the estimates do not change much for most of the countries. As before, the estimates are favorable to the PPP for Turkey, Greece, Malaysia and Yugoslavia. The PPP estimate for Malaysia in relation to Japan is not favorable to the PPP now in this method of estimation. For those countries following fixed exchange rate policy like Venezuela, Egypt, Burma and Taiwan, the estimates are not quite favorable to the PPP as before. There was no significant difference in the estimates. As before, the PPP theory holds for Venezuela, Burma and Taiwan in

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#### Table V: Instrumental Variables Estimates

	<b>m</b>	Varia	ables	Price	Price Ratio	Difference				
Country	Partner	Dependent	Constant	110	1agged	Ratio DDL0	S.E.	R <sup>2</sup>	D.W.	ρ
Turkey	U.S.A.	LS	2.3	1.14*	-	-	.16	-	1.64	.5
	Ì		2.4	30	1.58	-	•18	-	1.85	.19
		DLS	05 (.09)	-	-	1.44* (.35)	.18	-	2.0	.01
	Germany	LS	1.09 (.06)	1.11 (.04)	-	-	.13	-	1.67	.37
	ľ		1.15 (.07)	.69 (.35)	.46* (.38)	-	.13	-	1.76	.34
		DLS	.01 (.07)	-	-	1.08* (.35)	•16	-	2.0	04
Greece	U.S.A.	LS	3.3 (.06)	1.10* (.12)	-	-	•08	-	1.57	.59
			3.3 (.07)	.74 (.27)	.46* (.31)	-	•08	-	1.34	.66
		DLS	02 (.03)	-	-	1.48* (.42)	•11	-	2.06	10
	Japan	LS	-2.5 (.02)	1.19 (.04)	-	-	.07	-	1.95	•08
			-2.5 (.02)	2.39 (.41)	-1.44*	-	.07	-	2.09	4
		DLS	.01 (.02)	-		1.07* (.21)	•08	-	2.3	4
	l	l			1	1	. :		l	ł

Malaysia	U.S.A.	LS DLS	1.06 (.02) 1.07 (.02) .01 (.02)	.92* (.13) 1.23 (.47) -	- 33* (.44) -	- - .91* (.03)	.04 .05 .05	- - -	1.53 1.57 1.9	.49 .44 .07
	Japan		-4.7 (.04)	57 (.59)	-	-	•09	-	1.89	.38
			-4.7	•28 (•6)	63	-	•08	-	1.93	.48
		DLS	.01 (.02)	-	-	25 (.7)	.09	-	2.1	3
Yugos lavia	U.S.A.	LS	2.5 (.25)	1.36* (.20)	-	-	.14	-	1.92	.8
			2.4	1.31	18* (.54)	-	.14	-	1.99	•8
		DLS	08 (.04)	-	-	1.9 (.31)	.13	-	1.75	3
	Germany	LSG	1.4 (.05)	1.12* (.06)	-	-	.12	-	1.66	.32
			1.3	2.46	-1.41*	· <b>-</b>	.10	-	1.99	8
		DLS	.04 (.04)	-	-	1.54* (.30)	.15	-	2.03	08

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# Table V continued

	Tradiog	Varia	ables	Price Ratio	Price Ratio	Difference				
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	ρ
Taiwan	U.S.A.	LS	3.7	002	-	-	•01	- 1	1.84	.89
	Į		(.02)	(.09)	0.2		01	_	1	0.0
			3.0	02	.02	-	•01	. –	1.71	.00
		DIS	002	(.00)	(.00)	.05	.01	-	1.95	.06
			(.003)			(.09)			1	
	1	1	(1005)			((0))			ł	1
	Japan	LSJ	-2.1	1.64*	- 1	-	.10	-	1.69	.55
		}	(.06)	(.44)	4	[			(	(
			-2.1	2.41	92	-	.12	-	1.88	.36
			(.05)	(.66)	(.66)	1				1
		DLS	.001	-	-	1.48	.11	-	2.0	05
			(.03)			(1.51)			1	
Favot	ILS.A.	LS	- 91	.13	_	_	.02	_	2.08	
56,95	U.U.A.		(.06)	(.13)			•••=			
		1	9	.04	.09	-	.03	-	2.06	.88
	1		(.04)	(.15)	(.15)			(		1
	1	DLS	01	-	-	.15	.02	-	2.06	23
	1		(.01)		1	(.11)			[	[
		1								
	Japan	LSJ	-6.6	.37	-		.09	-	1.89	.78
	1		(.08)	(.27)						
			-0.5	.52	27	-	•09	-	1.63	.8
	1	DIG	(.09)	(.32)	(.35)		12		1 2 06	1 10
			.03	-	-	23	•12	-	2.00	19
	1.	1	(.03)			(++5)			1	

Venezuela	U.S.A.	LS	1.45	.03	-	-	.01	-	.84	.95
			1.47	.03	.01	-	.01	-	.86	.95
		DLS	(.03) 003	(.07)	(.05)	.05	.01	-	1.68	.41
			(.02)			(.05)				Í
	Japan	LSJ	-4.3	.60* (.29)	-	-	.13	-	1.89	.78
			-4.3	.83 (.30)	26 (.34)	-	.09	-	1.69	.78
		DLS	.03 (.03)	-	-	15 (.54)	.11	-	2.08	25
Burma	U.S.A.	LS	1.8	.62 (.73)	-	-	.09	-	1.63	.9
			1.89	.67 (.40)	37 (.30)	-	•08	-	1.66	.95
		DLS	.03 (02)	-	-	12 (.49)	.10	-	1.11	.68
	Japan	LSJ	-4.5	3.14*	-	-	.24	-	1.11	.68
			(.29) -3.98 (.34)	1.11	<b>32</b>	-	.14	-	1.85	.92
		DLS	.05	-	-	.29 (.47)	.12	-	2.1	3
		1	1						1	1

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# Table V continued

	   Tending	Varia	bles	Price	Price Ratio	Difference	1		1	
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	ρ
Korea	U.S.A.	LS	5.78	.91*	-	-	.05	-	1.38	.69
			(.05) 5.78 (.05)	.88 (.21)	.04* (.20)	-	.05	-	1.42	.69
		DLS	.03 (.03)	-	-	.53 (.45)	.06	-	1.89	.002
	Japan	LSJ	03 (.04)	1.10* (.07)	-	-	.10	-	1.98	.30
	ĺ		02 (.05)	1.09 (.31)	01* (.31)	-	.10	-	1.99	.30
		DLS	13 (.15)	-	-	2.69 (1.74)	.19	-	1.98	01
Colombia	U.S.A.	LS	2.8	.85 (.03)	-	-	•05	-	1.62	.57
			2.9 (.07)	•78 (•40)	.06 (.42)	-	.05	-	1.57	.76
			01 (.06)	-	-	.99* (.46)	•06	-	1.75	-
	Germany	LSG	1.68 (.14)	.85* (.09)	-	-	•08	-	1.5	.8
			1.56 (.18)	•82 (•55)	.09* (.54)	-	.07	-	1.4	.9
		DLS	•06 (•08)	- (.57)	-	.43	•07	-	1.7	-
		1	l		1	1		1		

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Indones ia	U.S.A.	LS	5.7	1.04*	-	-	.27	-	1.79	.32
			5.7	1.20	23*	-	.15	] -	1.51	.55
			(.13)	(.41)	(.21)		1	1	[	
		DLS	03	-	-	1.27*	.26	<b>.9</b> 0	1.45	-
			(.07)			(.13)		i		
	Japan	LSJ	.02	1.06*	-	- 1	.25	_	1.75	.07
			(.06)	(.05)		(		í		
	1		08	1.49	35*	- 1	.17	-	1.82	.29
			(.11)	(.31)	(.18)	[	1	[		
		DLS	03	-	-	1.26*	.28	.89	1.64	-
			(.08)			(.14)			]	
India	U.S.A.	LS	2.05	1.77*	-	-	.11	-	1.99	.41
			(.04)	(.62)				l		
			2.2	32	.25	-	.06	-	1.62	.9
			(.12)	(.59)	(.38)	[	ſ	[		
		DLS	.01	-	-	1.41*	•11	] -	1.38	.46
			(.02)			(.56)		]		
	Japan	LSI	-3.7	1.77*	_	_	-12	-	2.1	.6
	- oupun	2	(.08)	(.42)		1	1	{		
	1		-2.8	.30	16	) –	.10	-	1.95	.98
			(.81)	(.87)	(.65)	(	1		[ · · · ·	
	[	DLS	.03	-	-	1.11	.13	.12	2.05	-
		]	(.05)			(1.4)				
	1	1	ļ.			1	l			

relation to Japan but not in relation to the U.S.A. Similarly, the estimates are favorable to the PPP for countries like Korea, Colombia, Indonesia and India. This similarity of the estimates arrived at by both methods seems to suggest that in most cases we did not have a severe simultaneity problem.

# iii) The PPP Estimates by Using Unofficial Exchange Rate:

As indicated before, in most of the developing countries, there were significant capital controls and the official exchange rate was distorted due to the government exchange rate policy. Most developing countries do not allow free convertibility of their domestic currency with foreign currency due to severe shortage of foreign exchange. Many countries artificially over valued their currency to promote an import-substitution industrialization strategy whereby the domestic importers could import industrial raw materials and spares from foreign countries at a cheaper rate [Balassa 1980]. These imperfections lead to the emergence of active black market in foreign exchange in most of the developing countries. Appendix V shows the percentage premium of the unofficial exchange rate over official exchange rate.

In order to consider the nature of imperfection in the official foreign exchange rate, we have estimated the PPP relationship by using the unofficial exchange rates and the results will be examined in this section. The estimates are provided in Table VI. Along with estimating the original model with the unofficial exchange rate, we have

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also estimated another model by extending the absolute version of the PPP equation to add a term like the premium of the unofficial rate over the official rate. So we estimated a model like

$$1s = a + 11\Theta + PRM + u$$

where

# $PRM = \frac{Unofficial Exchange Rate - Official Rate}{Official Rate}$

Other notations are same as before. This extension of our model will account for some kind of currency substitution effect. So besides price ratio, the demand for foreign exchange over domestic currency will have strong effect on the exchange rate and we shall hypothesize that the coefficient of the PRM variable will be positive and will examine whether it is significantly different from 0. The estimates are discussed briefly in the next subsection.

The use of the unofficial exchange rate for the PPP estimation will have important policy implication for developing countries in helping to find out the extent of "disequilibrium" in the sense of deviation of the actual exchange rate from the underlying PPP rate. Blejer[1978] addresses the issue of exchange control and the black market in foreign exchange for some developing countries including Colombia over the period of 1953-1973 and shows that in the face of exchange control, black market exchange rates are affected by excess money supply and other factors like the premium over the official rate. The estimates of the PPP relation by using unofficial exchange rate reported in Table VI, are interesting due to the fact that they are now favorable to the PPP for most of the fixed exchange rate countries as well as with the other two groups of countries.

The PPP relationship works between Turkey and the U.S.A. and Germany. It also works between Greece and the U.S.A. and Japan for both absolute and relative models. Similar estimates are found for Malaysia and Yugoslavia in relation to their trading partners.

The results are supportive of the PPP for controlled floating exchange rate countries like Korea, Colombia, Indonesia and India. The results vary somewhat from country to country due possibly to differences in the extent of black market activity.

When we examine the PPP estimates for fixed exchange rate countries, we see that the PPP now works for most of them. The estimates are favorable to the PPP for Venezuela in relation to both the U.S.A. and Japan. The explanatory power of the equations are also quite high and the D.W. statistics are quite good.

The estimates for Egypt in relation to both the U.S.A. and Japan are favorable to the PPP in both absolute and relative versions. Explanatory power of the equations are high as shown by the high  $R^2$ 's and the D.W. statistics show the absence of autocorrelation.

The estimates support the PPP theory between Burma and the U.S.A. and Japan in the lagged model. Similarly, for Taiwan, the estimates now give a right sign when the U.S.A. is considered as the trading partner and when Japan is considered as the trading partner, the estimates are favorable to the PPP theory.

These results tend to suggest that the market determined exchange rate closely approximate the PPP rate. Once the PPP rate is known, it can be used to find out the extent of distortion in the official exchange rate and a readjustment can be attempted by the government.

# iv) Estimates of the PPP Model with a Premium on the Unofficial Exchange:

The premium on the unofficial exchange rate over the official rate varied from country to country depending on the degree of overvaluation of their currency. As indicated before, most of the developing countries, following fixed exchange rate policy, kept their official exchange rate away from the "free market" rate by fostering an import substitution development policy. Also due to government control on foreign exchange, black markets developed in most of those countries. In this section we shall discuss the PPP estimates with an additional variable capturing the premium of the unofficial over the official exchange rate and would see whether the coefficient of that variable is significantly greater than 0 implying that the exchange rate movement was positively influenced by it.

The estimates are presented in Table VII. The U.S.A. is considered as the foreign country and accordingly domestic currency per U.S.\$ is considered as the exchange rate. The variable PRM stands for the premium. As can be seen from the table, the coefficient of PRM

#### Table VI: The PPP Estimates Using Unofficial Exchange Rate

. .

:		Varia	bles	Price	Price Ratio	Difference	1			
<b>.</b> .	Trading			Ratio	lagged	in Price		_2		
Country	Partner	Dependent	Constant		110(-1)	Ratio DDLO	S.E.	K	D.W.	ρ
Turkey	U.S.A.	LS	2.6	1.04*	-	-	.09	•91	1.09	.89
			2.5	.75	.37* (.17)	-	•08	.95	.98	.88
		DLS	.07 (.09)	-	-	.50 (.12)	.06	.46	1.23	.89
	Germanv	LSG	1.3	1.03*	-	-	.07	.98	1.7	.63
			1.3 (.02)	.95 (.12)	•11* (•13)	-	.06	.99	1.64	.45
		DLS	.002 (.03)	-	- '	•99* (•11)	•07	.82	1.8	.10
Greece	U.S.A.	LS	3.3 (.06)	1.05*	-	-	.07	.96	1.46	.68
			3.3 (.06)	.67 (.18)	.55 (.21)	-	•06	.97	1.07	.76
		DLS	.02 (.02)	-	-	.85* (.22)	.07	•46	1.31	-
	Japan	LSJ	-2.5 (.03)	1.2	-	-	•06	.98	2.1	•2
			-2.5 (.03)	1.27 (.23)	08* (.28)	-	.06	.98	2.12	•5
		DLS	.01 (.01)	-	-	1.1* (.14)	•06	.79	2.1	46
					1	l i	l		I	ļ

	1	1	1		1	1	1	1	ı	1
Malaysia	U.S.A.	LS	1.07	.85*	-	-	.03	.95	1.33	.65
	J		(.02)	(.11)		1				
		1	1.06	.84	•03*	-	.03	.95	1.31	.66
	1	]	(.01)	(.34)	(.23)		1	1		
		DLS	01	-	-	.50	.03	.22	1.64	.35
	1		(.01)			(.23)	1	[	{	1
	Japan	LSJ	-4.7	.70*	-	-	.06	.98	1 01	84
		1	(.08)	(.28)		1			1 1 1 2 1	
			-4.7	.69	•05*	-	.06	.98	1.87	.85
	1		(.08)	(.03)	(.31)	1				
		DLS	.01	] -	] -	.74*	.06	.30	2.02	06
			(.01)			(.27)				[
Yugos lavi a	U.S.A.	LS	2.7	1.22*	_	-	-09	.83	1.09	.94
			(.22)	(.12)		(			1.07	
			2.6	1.5	32*	- 1	.09	.88	1.56	.9
			(.18)	(.3)	(.31)		1			
		DLS	07	] -	- '	1.64	.08	.81	1.8	02
			(.03)			(.19)	[	1		[
	Germany	LSG	1.5	1.06*	-	-	.09	-88	1.1	.77
			(.08)	(.07)						1
			1.3	2.24	-1.26*	-	.07	.99	1.9	04
			(.03)	(.22)	(.24)		(	[		
		DLS	03	-	-	1.31*	•08	.57	1.8	.27
			(.05)			(.29)				
Ĩ	I I		1	l '		l	1	1		
					•					

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#### Table VI continued

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		Varia	ables	Price	Price Ratio	Difference				
Country	Bartoar	Dopondont	Constant	Katio	Lagged	In Price	c c	<b>"</b> 2	nu	
Country	rattiet	Dependent	COILS CAILE		110(-1)	Kalio DEG	3.6.	<u> </u>		<u> </u>
Venezuela	U.S.A.	LS	1.5	1.72*	-	-	.17	.50	1.53	2
			(.04)	(.46)		1				
			1.5	1.03	.95*	- 1	.18	.57	1.57	28
	]		(.04)	(.91)	(1.19)			1		[
		DLS	.02	-	-	1.88	.22	.14	1.24	2
			(.04)			(1.11)				
	Ianan	ISI	-43	1 72*	{ _	_	2	80	1 45	1 32
	Japan	100	(.07)	(.36)	_	-	•2	.00	1.45	
			-4.3	1.42	.55*	-	.21	.80	1.46	.33
			(.08)	(.76)	(.93)					
		DLS	.03		- 1	1.19	.23	.13	1.41	37
		1	(.04)			(.75)		1		1
				1 00+	1		~			
Egypt	U.S.A.	LS	13	1.28*	- 1	-	•06	.81	1.89	.08
			- 13	1 32	- 03	_	04	92	1 97	04
			(.02)	(.25)	(.31)	-	.00	.02	1.0/	.04
		DLS	.01	-	-	.77*	-07	.29	1.96	03
			(.02)			(.30)			1	
		į								
	Japan	lsj	-5.9	•92*	-	-	.07	.98	2.1	.8
	1		(.08)	(.18)		]				[
			-5.9	•76	.32*	-	.07	.98	1.87	.84
			(.08)	(.2)	(.24)					1
		DLS	.02	-	- (	.72*	•07	.49	2.27	25
			(.01)		1	(.18)			ł	1
	1	I I	I 1			1		I	i	1

Burma	U.S.A	LS	3.1	.16	-	-	.17	.56	1.73	.87
		4	3.0	77	1.53#	-	31	20	1 45	-
			6.11)	(.82)	(.83)			•20	1.43	
		DLS	.04	-	-	.18	.17	.01	1.9	.04
		220	(.04)			(.44)				.04
	Japan	LSJ	-2.6	.63	-	-	.22	.59	1.65	.89
		]	(.37)	(.59)		ļ	(		(	
		ŧ.	-2.7	.46	•68*		.22	.66	1.9	.85
		1	(.3)	(.68)	(.7)		(	1	[	
		DLS	.06	-	-	.34	.21	.02	1.95	•08
		ļ	(.05)			(.6)		]		
Taiwan	U.S.A.	LS	3.7	.01	-	-	.04	.98	1.45	.78
		ļ	(.03)	(.18)						
			3.7	09	.39	] -	.03	.99	1.85	.72
			(.03)	(.18)	(.17)					
		DLS	004	-	-	.04	•04	.003	1.63	-
			(.009)			(.18)				
	Japan	LSJ	-2.1	.73*	-	-	.08	.87	1.83	.82
		]	(09)	(.36)						
			-2.1	.87	.42*	-	.08	.89	1.48	•7
			(.07)	(.37)	(.38)					
		DLS	•02	-	-	.39	•08	.05	2.02	•04
			(.02)			(.39)				
			1 1							

•

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# Table VI continued

		Varia	bles	Price	Price Ratio	Difference				
Country	Partner	Dependent	Constant	110	110(~1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	D
								<u>_</u>		
Korea	U.S.A.	LS	5.9	•78*	] -	-	.09	.96	1.67	.48
			(.05)	(.09)						
			5.9	.57	.23	-	.10	.95	1.76	.39
		DI DI G	(.05)	(.38)	(.37)	50		0.0		14
	I	DLS	(03)	-	-	(39)	•11	•00	1.7	10
	ł		(.03)			(•39)				
	Japan	LS	.07	1.00*	-	-	.12	.85	1.75	.48
	1.	1	(.06)	(.09)		i i		ĺ	ĺ	
	1		.08	.67	.35*	-	.13	.85	1.85	.49
	1	ļ	(.07)	(.35)	(.35)			ļ	1	
•	1	DLS	.05	-	] -	.34	.13	.03	1.96	16
		1	(.04)			(.40)				
Colombia	ILS.A.	LS	2.9	-78	-	_	.11	.90	1.74	.31
OOIOEDIG			(.04)	(.05)	{		•••			
	Í	1	3.0	(.39)	.38	_	.06	.95	1.22	.61
			(.05)	(.39)	(.41)			[		(
		DLS	.25	-	] –	85	•11	.20	1.85	.63
	}		(.09)			(.64)				
	Germany	192	17	90*	1 _	_	12	90	1.99	5
	Germany	2.50	(.06)	(.06)	_	_	•14		1,	
		1	1.8	.68	.16	-	.08	.92	1.49	.63
			(.07)	(.43)	(.45)			1	1	1
		DLS	.15	-	-	13	.12	.01	1.53	.02
			(.07)			(.5)			1	ſ

Indones ia	U.S.A.	LS	5.9	.86	-	-	.19	.80	1.74	·•64
			5.8	1.08	27	-	.12	.85	1.37	.69
		DLS	01 (.05)	(.08)	(.07)	.93* (.08)	.21	.88	.168	.01
	Japan	lsj	.16 (.06)	.86 (.03)	-	-	.18	.98	1.7	.35
			.10 (.07)	1.07 (.09)	22 (.07)	-	.13	.97	1.42	.53
		DLS	003 (.06)	-	-	.93* (.08)	.21	.88	1.71	01
India	U.S.A.	LS	2.3 (.05)	.50 (.35)	-	-	.10	.73	1.37	.53
			2.3	•31 (•58)	31 (.52)	-	.10	.73	1.5	•2
		DLS	03 (.03)	-	-	23 (.53)	.11	.02	1.7	.28
	Japan	lsj	-3.5 (.03)	1.34* (.18)	-	-	.09	.94	1.63	.38
			-3.5	1.18	.09* (.51)	-	.09	.94	1.65	-4
		DLS	.03 (.03)	-	-	.46 (.5)	.10	.05	1.97	.001

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has a wrong sign for countries like Venezuela, Egypt and Burma. The coefficient of PRM for Taiwan has correct sign. However, none of the estimates are significant.

The black market in foreign exchange was not very strong for Venezuela and Taiwan throughout the entire period equally. For Egypt and Burma, the black market premium was very high. The reason for the insignificant estimate and wrong sign of the estimates may be due to the fact that these countries kept their exchange rates either fixed or changed it only a few times (e.g. over the entire period Taiwan and Egypt changed their exchange rate only once). So this specification of our model may not be quite accurate. However, the explanatory power of the equations as shown by the R<sup>2</sup>'s are quite high and the D.W. statistics show absence of any serial correlation except for Venezuela.

As can also be seen from the table that the inflation variable (INF) was not significant. Most of these fixed exchange rate countries experienced relatively lower inflation rate over the period of study. In order to see the affect of inflation on the exchange rate, we estimated the PPP relation for some high inflation countries in the next section.

# v) The PPP Relation with Inflation Rates:

In this section, we have estimated the PPP relation for four high inflation countries like Turkey, Yugoslavia, Colombia and Indonesia by considering the inflation rate along with price ratio and would see

# Table VII

# The PPP Estimates with Premium on the Unofficial Exchange Rate

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	Trading		ļ					1	
Country	Partner	Constant	110	PRM	INF	S.E.	R <sup>2</sup>	D.W.	ρ
l. Venezuela	U.S.A.	1.5 (.02) 1.5 (.02)	.05 (.04) .05 (.04)	002 (.004) -	- 02 (.03)	.01 .01	.99 .99	•91 •97	•96 •95
2. Egypt	U.S.A.	89 (.07) 88 (.04)	.10 (.12) .14 (.10)	001 (.04) -	- 13 (.10)	•02 •02	•86 •88	1.99 2.2	•91 •89
3. Burma	U.S.A.	1.8 (.23) 1.7 (.20)	•42 (•22) •49 (•24)	01 (.03) -	- 15 (.25)	•08 •08	•56 •57	1.81 1.77	•94 •94
4. Taiwan	U.S.A.	3.6 (.21) 3.6 (.02)	06 (.05) 03 (.07)	.07 (.08) -	- 02 (.03)	.01 .01	.99 .99	2.2	•91 •91

Fixed Exchange Rate Low Inflation Countries. (ARI Method) - (1964-1983) whether the coefficient of INF is positive and significantly different from zero. High inflation rate causes a currency to depreciate by creating a balance of payments deficit.

The estimates are provided in Table VIII enclosed. Here also we only considered the U.S.A. as the foreign country. As can be seen from the estimates, the coefficient of INF has a wrong sign for Turkey and Colombia. But for Yugoslavia and Indonesia, the coefficients are significant. For Yugoslavia, the coefficient of INF is .98,  $R^2$  is .86 and the D.W. statistic shows an absence of serial correlation. For Indonesia, the coefficient is .08 and also is significantly different from 0,  $R^2$  is .90 and the D.W. statistic is 1.59.

From the above it can be seen that, the evidence of exchange rate movement based on the inflation rate is not uniform in the case of the high inflation countries considered in our simple.

#### vi) The PPP Estimates by Regressing Price Ratio on Exchange Rate:

In this sub-section we shall test an alternative model of the PPP by regressing price ratio on exchange rate. As mentioned in subsection ii before, both price and exchange rate are endogenous. Also Frenkel [1978] argued that exchange rates cause prices in Granger sense, so a proper test of the PPP would be to regress the price ratio on the exchange rate, rather than the exchange rate on the price ratio and to see whether the coefficient of the exchange rate variable put in the righthand side of the equation is significantly different from one.

# Table VIII

Country	Trading	Constant	110	PRM	TNF	S.E.	R <sup>2</sup>	DeWe	0
1. Turkey	U.S.A.	2.5 (.16) 2.3 (.07)	1.05 (.08) 1.18 (.06)	8 (.14) -	- 45 (.17)	•09 •14	.92 .96	1.04	•89 •38
2. Yugoslavia	U.S.A.								
		2.4 (.18)	1.17 (.15)	-	•98* (•47)	.13	•86	1.97	•80
3. Colombia	U.S.A.	2.8 (.09)	.94 (.08)	•22 (•46)	-	•09	•85	2.4	•61
		2.9 (.05)	.87 (.04)	-	42 (.16)	•04	•97	1.38	•73
4. Indonesia	U.S.A.	5.8 (.11)	•90 (•04)	26 (.02)	-	•14	•96	1.23	•72
		5.7 (.11)	1.17 (.05)	-	•08* (•02)	•18	•90	1.59	•63
	ł		1	1	ł	Į.	1	l	l

# The PPP Estimates with Inflation Rate

High Inflation Countries (1964-1983) (ARI Method) •

The estimates are summarized in Table IX and a brief discussion of the results will be made here. The absolute version of the PPP theory holds between Turkey and Germany with a one-year lag. Same results are derived for Greece in relation to Japan and Yugoslavia in relation to Germany too. The estimate for Malaysia and the U.S.A. also is favorable to the PPP. All the estimates are not, however, equally robust in terms of the explanatory power and D.W. statistics.

The PPP relation holds for Korea in relation to both of its trading partners: the U.S.A. and Japan. Same result is found for Indonesia also. The estimate for Colombia in relation to the U.S.A. is favorable to the PPP in the lagged model and the estimate in relation to Germany is favorable to the PPP without any lag. The estimates for India in relation to its both partners are not supportive of the PPP theory.

For the countries following fixed exchange rate system, the PPP estimation under this specification does not give favorable result. As can be seen from the table, none of the estimates in any form lend support to the PPP theory. This is basically what we found in the original specification.

The estimates under this specification are not very good for most of the countries. Their  $R^2$ 's and D.W. statistics are not as good as those in our original specification. So, even though they support our main findings, we can not use these estimates as a very strong evidence of our findings.<sup>5</sup> This seems to suggest that the original specification of the PPP equation works better for our sample countries.

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# Table IX

# Using Official Exchange Rates Estimates of Price Equations

		Varia	bles	<u> </u>	Exchange	Change in				
<b>a</b> .	Trading		•	Exchange	Rate	Exchange		_2		
Country	Partner	Dependent	Constant	Kate	lagged	Rate DLS	5.2.	ĸ	D.W.	ρ
Turkey	U.S.A.	LLO	-1.5	.73	-		.13	.76	1.78	.86
,	1		(.31)	(.08)	İ	i			í	ĺ
		1	-1.7	.57	.22		.12	.82	1.33	.8
		i i	(.3)	(.13)	(.14)	1		İ	Í	Í
		DDLO	.08	-	-	.46	.11	.53	1.57	-
			(.003)			(.11)		ĺ	j	
	Germany	ΠA	- 97	89	_		11	08	1 66	37
	Germany		(.07)	(.03)			• • • •		1.00	•
		1	98	.78	.12*		.13	.98	1.07	-
			(.06)	(.16)	(.18)		•••			
	i i	DDLG	.08	-	-	.47	.12	.55	1.62	- 1
	1		(.04)	ſ		(.11)				ĺ
	1								1	[
Greece	U.S.A.	LLO	-2.3	.73	-	]	.07	.70	1.87	.77
	1		(.38)	(.10)				1		[
			-2.7	.35	•48	ļ	•07	.68	1.67	.6
			(.52)	(.27)	(.35)	l			Į	
		DDLO	.03	] -	-	.43	.06	.32	2.2	-
			(.02)			(.45)				
	Japan	LLO	2.05	.82	_		.06	.98	1.99	.10
		1 1	(.06)	(.03)	1	{			ſ	1
	1	1	2.24	.45	.45*		.04	.99	1.23	-
	1		(.06)	(.09)	(.11)					
	1	DDLG	.03	· -	-	.43	.06	.46	1.91	-
	1	ļ	(.02)			(.11)		[	[	

.

Malaysia	U.S.A.	LLƏ DDLƏ	-1.04 (.17) 97 (.13) 01 (.01)	.98* (.08) .46 (.16) -	- .43* (.16) -	•28 (•15)	.05 .03 .03	•88 •70 •17	.89 1.5 1.45	- .64 -
	Japan	LL <del>O</del> DDL <del>O</del>	1.3 (.6) .71 (.24) 004 (.01)	.28 61 (.10) -	- (.13) .46 (.10) -	•30 (•12)	•05 •03 •05	.20 .69 .25	1.59 1.15 1.79	.82 .66 -
Yugos laví a	U.S.A.	LLO DDLO	78 (.8) -1.6 (.31) .07 (.02)	•57 (•10) •29 (•07) -	- .39 (.08) -	•36 (•06)	•09 •05 •06	- .76 .65	2.15 1.43 2.2	•99 •97 -
	Germany	LLO DDLO	-1.23 (.09) -1.2 (.04) .09 (.02)	.88 (.04) .35 (.09) -	- (.11) -	•30 (•07)	.11 .07 .06	- .99 .48	1.67 1.13 1.51	.33 - -

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#### Table IX continued

	1	Varia	bles		Exchange	Change in				
	Trading	!		Exchange	Rate	Exchange		2		
Country	Partner	Dependent	Constant	Rate	lagged	Rate DLS	S.E.	R	D.W.	ρ
			2.05	1.45			04	0.2	1 1 76	0.2
venezuela	U.S.A.	569	-2.05	1.45	-	1	•04	.03	1.30	.95
			(1.98)	(1,34)	50		~		1	
	ļ		1.98	1.48	07	1	•04	.04	1.3	.93
			(2.3)	(1./9)	(1./9)			1	1	{
	ļ	DDLO	.02	-	-	2.6	.04	1.18	1 1.09	-
			(.01)			(1.35)				
	Japan		1.78	.38	-		.06	.18	.98	.93
			(.63)	(.15)		[			1	1
	Í	i I	52	~.56	.71		.05	.49	.56	.95
			(.75)	(.16)	(.16)	(				
		DDLO	.02	-	-	.31	.04	.22	1.15	-
			(.01)			(-14)				
			(,						· ·	
Egypt	U.S.A.	LLO	.51	.57	-		.06	.04	1.17	.9
-67 -			(.52)	(.57)	ĺ					
		1	.98	.59	.49		.06	.09	1.11	.92
			(.71)	(.58)	(.58)	(				
	1	DDLO	.02	-	-	.92	.06	.14	1.43	-
			(.01)		l	(.56)		<b></b> .	1	1
	1	1 1	(101)			(150)				[
	Japan	LLO	3.16	.47	-		.07	.20	.74	.92
			(1.21)	(.18)	[			1	1	
	1		.24	62	.61		.08	.27	.81	.95
			(1.12)	(.25)	(.25)	ſ		1	1	
	1	DDLO	.03	-	_	.39	.07	.23	.74	i -

.

Burma .	U.S.A.	LLƏ	-4.6 (.36) 78 (.49)	.33 (.20) .33 (.21)	- .18 (.21)		.08 .08	.15	.91 .73	.8 .84
		DDLƏ	02 (.02)	-	-	•51 (•23)	•08	.23	1.10	} -
	Japan	LLƏ	1.37 (.36)	.30 (.09)	-		.07	.32	1.1	.68
			-1.38 (.63)	29 (.25)	.62		.07	.32	1.29	.67
		DDLO	.001 (.02)	-	-	.27 (.15)	.08	.08	1.20	-
Taiwan	U.S.A.	LLƏ	.81 (2.3)	21	-		.04	.04	1.58	.46
			12.8 (3.8)	99	-2.49	}	.04	.44	1.41	.93
		DDLƏ	01 (.01)	-	-	-1.4 (1.03)	.05	.10	2.1	-
	Japan	LLO	.53 (.22)	.21	-		.04	.16	1.77	.79
		-	-1.25 (.25)	.03 (.13)	•24 (•13)	l	.04	.63	1.88	.53
		DDLO	.01 (.01)	-	-	.13 (.11)	•04	.08	2.1	-
		DDLO	.01 (.01)	-	-	.13 (.11)	•04	.08	2.1	

Table	τv	continued
Table	LA	concinaeo

		Variables		Exchange Change in				1		
Country	Partner	Dependent	Constant	Rate	lagged	Exchange	S.F	<b>2</b>	n.w.	
country	- ratenet	Dependent	COLF Lanc	Nate	Lagged	Kace Jub	0.00	<u>``</u>		
Korea	U.S.A.	LLO	-5.2	.91*	-		.05	.69	1.27	.87
			(.65)	(.11)				]		
		! !	-5.6	.84	•14*		.05	.77	1.11	.81
	1		(.67)	(.14)	(.14)					
		DDLO	.03	-	-	•59	.05	•46	1.16	-
			(.01)			(.16)				
	Japan	LLΘ	.03	.90*	-		.09	.94	1.94	.34
		) 1	(.04)	(.05)					1	1
			-4.6	13	1.15*	[	.08	.37	1.0	.94
			(1.11)	(.25)	(.25)	[			[	
		DDLO	.06	-	-	.27	.07	.24	1.88	-
			(.02)			(.12)				
Colombia	U.S.A.	LLO	-1.71	.72	-		.08	.12	1.65	.95
		1 1	(.43)	(.12)	ĺ	1				
		1 1	-3.02	.71	.38*		.04	.91	1.03	.86
			(.22)	(.11)	(.10)			(	[	ſ
		DDLO	•08	-	-	.34	.05	.14	1.2	-
			(.02)			(.21)				
	Germany	LLO	86	<b>.</b> 76*	-		.10	.19	1.52	.95
			(.36)	(.12)			••••	{ •••		
	1	1 1	-14.8	1.9	1.83		.09	.70	1.20	.69
			(1.08)	(.61)	(.62)	(	_			
		DDLO	.12	-	-	.20	.05	.05	.84	- 1
	1	1 1	(.02)			(.17)		1	1	

Indonesia	U.S.A.	LLO	-5.9	1.02*	-		.3	.98	1.79	15
			(.21)	(.04)			1	1	1	1
		1	-4.9	.68	.18		.14	.97	1.64	.71
			(.21)	(.04)	(.04)		ļ	1		1
		DDLO	.15	] -	-	.63	.33	1.71	1.01	-
			(.08)	l		(.10)				
	Japan	LLO	04	•08 <b>*</b>	-		.26	.99	1.71	37
		1	(.04)	(.03)	1 (		ĺ	1		{
		İ	-14.1	1.45	1.28		.69	.07	1.63	.89
			(8.8)	(2.2)	(2.2)			1		[
		1	.47	-	-	.39	.19	.83	1.79	.94
			(.45)			(.04)	1			Í
India	U.S.A.	LLO	66	.32	-		.05	.45	1.93	.55
		i	(.17)	(.08)	{ {			1		
		1	77	.16	.22		.04	.54	1.37	.66
		1	(.17)	(.08)	(.08)					1
		DDLO	.01	] -	-	.13	.05	.08	1.56	-
			(.01)			(.10)				
	Japan		1.5	.39	-		.05	.68	1.87	.68
			(.21)	(.06)	1 1			1	1	1
			-1.6	.12	.23		.06	.16	1.06	.76
	1		(.61)	(.21)	(.20)		Í	1	1	[
		DDLO	.03	] -	, – ,	.11	.05	.09	1.56	] -
		ļ	(.01)	l	!	(•08)			1	

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#### Footnotes

- Maddala (p. 283) gives a comparative study of all the procedures. Also since our data is annual ARI seems appropriate. Any other higher order may be appropriate for quarterly or monthly data.
- 2. For a large number of developing countries having fixed exchange rate, this problem is somewhat reduced. In IV technique, the improvement of results depend mainly on the use of suitable instruments uncorrelated with the error terms.
- 3. We have estimated the PPP relationship with budget deficit and money supply variables too. The estimates are not good due to a multicollinearity problem and so we do not report them here.
- 4. In order to avoid repetition, we are not analyzing the complete table at this point. A broader comparison has been made instead.
- 5. We have also estimated the price equations by using unofficial exchange rate. They do not vary too much from these estimates, and consequently, we do not report them here.

Chapter IV

#### Conclusion

In this chapter we make a few concluding remarks about our research and its implication for policy making in the less developed countries. In this work, we have attempted to fill an existing gap in the PPP literature, namely, the discussion of the PPP theory in the context of the developing countries. These countries are chosen to represent a variety of issues that are important for this theory and also they are from different geographic regions of the world. The current emphasis on the PPP discussion from the context of developed countries and the factors found responsible for the PPP not to work among them do not preclude its applicability for the less developed countries. In fact, the PPP theory holds for a majority of our sample countries contrary to what is commonly believed. The evidence on the factors, such as structural change, real shocks, trade restrictions, differences in productivity among different countries, lower substitutability between home and foreign goods, changes in terms of trade, price discrimination, transport cost, differences in weights in price index of different countries, changes in relative prices, capital movements, etc. traditionally held responsible for PPP not holding is not quite conclusive as can be seen from our discussion in Chapter III eventhough they may be pertinent in some cases.

We have also found that the PPP theory works better for those countries with a flexible exchange rate system as compared to those with fixed exchange rate systems. Other factors that help to sustain a certain official exchange rate deviating from the PPP rate for some countries were current account balance, capital account balance, foreign exchange balance and changes in reserves. Countries with flexible exchange rate system experienced different rates of growth of the money supply and inflation as compared to their trading partners whereas countries with fixed exchange rate in general experienced a lower rate of inflation as compared to the former group. This seems to support Johnson [1972] and Purvis [1979] in that under a fixed exchange rate system a country's price level is pegged to the world price level, and if the exchange rate is allowed to float, inflation rates may diverge. In general, the countries following flexible exchange rates experienced a higher rate of inflation. This will have implications on the issue of imported inflation and design and effectiveness of domestic macroeconomic policies.

If a country keeps its exchange rate floating, price level will be determined by domestic conditions like excess demand, money supply growth, internal policies of the government while the exchange rate will be determined by the PPP relationship. The governments can enjoy more freedom to pursue their expansionary policies. This seems to suggest that the high inflation rate commonly experienced by the countries following flexible exchange rate system may be due to their domestic policies.

The fact that PPP holds for those countries following flexible exchange rate system may imply that price and exchange rate policy are interrelated and can be coordinated for a better management of their economies. If the exchange rate deviates from the PPP rate, government intervention may help to bring it back in line with the PPP rate. Also in case of severe pressure on domestic prices due to some exogenous disturbance, the government, by allowing the exchange rate to float freely, may be able to neutralize some of the price pressure and can thus maintain desired internal price stability. In other words, governments can enjoy some freedom in controlling domestic inflation problem (which may be unpopular) by resorting to the adjustment of the exchange rate.

The PPP theory works for those countries with fixed exchange rate system when the unofficial exchange (black market) rate is used in the PPP estimation. This suggests that the market determined rates by the forces of demand for and supply of foreign exchange represent the true "equilibrium" or PPP rate for developing countries and they can be used to find out the extent of deviation of the official rate from the PPP rate. So in making a suitable adjustment of the exchange rate of a particular country our research can be helpful.

In our work, we tested various models of PPP using different estimation technique. This study can easily be extended by considering more countries having same characteristics. So a cross-section analysis can be done. We could not consider any complicated lag structure in our discussion due to a relatively lesser number of observations. Data for most of our sample countries are not available on a uniform basis before 1964. Another way of extending our research would be to carry out detailed policy analysis like testing the effectiveness of various policies of the government under various exchange rate systems and the insulation of the domestic economy from foreign disturbances. We have not attempted those in our study.

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# Appendix I

# OLS Estimates

#### Using IMF Exchange Rate (Official)

	Tradiog	Varia	bles	Price	Price Ratio	Difference				
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	ο
Turkey	U.S.A.	LS	2.3	1.09*	-	-	.19	.97	.79	-
			(.05) 2.4	(.05) .25	.95	-	.16	.98	1.25	-
		DLS	(.05) 001 (.06)	-	(.36)	1.16* (.26)	.17	.54	1.98	-
	Germany	LSG	1.11 (.05)	(.02)	-	-	.14	.98	1.23	-
1		1.SG	1.14	.81 (.24)	.33 (.26)	-	.14	.99	1.26	-
		DLS	•03 (•05)	-	-	.92* (.22)	.15	.51	2.01	-
Greece	U.S.A.	LS	3.3 (.03)	1.002* (.07)	-	-	.08	.32	1.27	-
			3.3	•43 (•35)	.71* (.42)	-	•09	.93	.73	-
		DLS	.02 (.02)	-	-	.73* (.26)	•08	.32	1.27	-
	Japan	LSJ	-2.5	1.6	-	-	•07	.98	1.81	-
			-2.5	1.6 (.33)	49* (.39)	-	.07	.98	2.04	-
		DLS	.01 (.03)	-	-	1.09* (.28)	.09	.46	2.9	-
		I 1			1			ļ		

Malaysia	U.S.A.	LS	1.06	•90*	-	-	.05	.88	.96	-
			1.06	1.23	- 32*	_	05	88	1 08	_
			(.02)	(.35)	(-34)		.03		1.00	
		DLS	003	-	-	.61*	-05	.17	1.82	_
			(.01)			(.33)				
	Japan	LSJ	-4.7	19	-	-	.09	.02	.99	-
			(.02)	(.3)					[	
		1	-4.7	.61	-1.03	-	•08	.31	1.02	-
		]	(.02)	(.4)	(.4)					
		DLS	01	-	-	•84*	.08	.25	2.8	-
			(.02)			(.35)				
Yugos lavia	U.S.A.	LS	2.6	1.06*	-	-	.21	.90	.56	-
	1		(.05)	(.08)		[	1	[		
		1	2.43	2.61	-1.67*	-	.15	.95	1.39	-
			(.05)	(.37)	(.4)	1	1	[	1	
		DLS	07	-	-	1.81	.14	.65	2.4	-
			(.05)			(.32)	[			
	Germany	LS	1.4	1.10	-	-	.13	.98	1.28	-
	-		(.03)	(.04)						
			1.27	2.1	-1.05*	-	.11	.98	2.08	-
			(.05)	(.34)	(.36)		1			
		DLS	03	-	- 1	1.36*	.14	.38	2.4	-
			(.07)		1	(.42)		1		
		l			1	Į		]		

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# Appendix I continued

# OLS Estimates

		Variables		Price	Price Ratio	Difference			:	
	Trading			Ratio	lagged	in Price		2		
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R	D.W.	ρ
					1					
Venezuela	U.S.A.	LS	1.5	02	] -	-	•02	.004	•11	-
			(.01)	(.07)						
			1.5	18	.25	-	•02	•14	.47	-
	]		(.01)	(.12)	(.16)					
	1	DLS	03	-	-	.06	.01	.18	1.18	-
	1		(.001)			(.03)				
		1.61	4.5	05+	}		14	<b>5</b> 2		
	Japan	Laj	-4.3	.00^	-	-	•14	.55	.43	- 1
	}		(.03)	(+19)	2/+	_	14	5.2	1.5	
			-4.2/	1.09	54*	-	•14	• • • • •	•45	-
	]	DI C	(.04)	(+53)	(.00)	774			1	
	1	DLS	.007	-	-	./2*	•09	•08	1.22	-
			(.02)			(.33)				
Egynt	IL-S-A-	LS	88	.18	-	-	.05	.11	.21	-
-874-			(.01)	(.12)	{					
			86	17	.56	- 1	-04	.39	.69	- 1
			(.01)	(.17)	(.56)	1				
		DLS	.01	.15	-	-	.14	.35	.40	_
			(.01)	(.09)		í i	•••			
			(001)	((()))		ł -				
	Japan	LSJ	-6.5	<b>•60</b> *	-	-	.14	.35	.40	-
			(.03)	(.19)		ĺ			f '	
	1		-6.5	.84	38	-	.15	.35	.36	-
			(.03)	(.42)	(.55)	[			1	
	[	DLS	.001	-	-	.58*	.09	.23	1.89	
			(.02)			(.26)			Í	
	l							i	l	l

.

	•08	.19	-
1.7 $.28$ $.16$ - $.20$	.09	.23	-
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	.23	2.17	-
Japan LSJ -4.3 1.8725 (.09) (.36)	.60	.42	-
$\begin{vmatrix} -4.3 & 1.05 & .90 & - & .25 \\ (.09) & (.71) & (.72) & & & \\ \end{vmatrix}$	•63	.49	-
DLS $.04$ $.61*$ .12 (.03) (.33)	.16	2.5	-
Taiwan         U.S.A.         LS         3.6        03         -         -         .03	.003	.19	-
3.614 0.9 - 0.03	.06	.25	-
DLS00307 .001	.09	2.5	-
Japan LSJ -2.1 1.57*12 (.04) (.29)	.61	.78	-
-2.1 $1.97$ $55*$ $-$ .12 (.04) (.59) (.66)	•65	.99	-
DLS .0157* .09 (.02) (.48)	.07	2.3	-

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#### Appendix I continued

# OLS Estimates

	ł	Variables		Price Price Ratio Difference				1		
	Trading	1		Ratio	lagged	in Price		,		
Country	Partner	Dependent	Constant	110	110(-1)	Ratio DDLO	S.E.	R <sup>4</sup>	D.W.	ρ
9. Korea	U.S.A.	LS	5.8	.86	-	-	.07	.96	.63	-
			(.02) 5.8 (.02)	(.04) .63	.24	-	.07	.96	.73	-
		DLS	.01 (.01)	-	-	•78* (•20)	•05	.46	1.67	-
	Japan	LSJ	01 (.03)	1.07* (.05)	-	-	.10	.97	1.35	-
			01 (.04)	1.03 (.34)	•06* (•35)	-	.11	.96	1.38	-
		DLS	.01 (.04)	-	-	.89* (.39)	.02	.24	2.8	-
10. Colombia	U.S.A.	LS	2.8 (.03)	.87 (.03)	-	-	.10	.97	.94	-
			2.9 (.04)	.73 (.37)	.10 (.39)	-	.06	.99	.79	-
		DLS	.11 (.02)	-	-	.04 (.14)	.09	.001	1.59	-
	Germany	LSG	1.6 (.05)	•98* (•04)	-	-	.16	.96	.47	-
			1.5 (.8)	2.23 (.67)	-1.34* (.70)	-	.13	.97	.77	-
		DLS	.14 (.06)	-	-	04 (.43)	.10	.001	1.83	-
			(,							

U.S.A.	LS	5.8	•95*	-	-	.3	.97	2.1	-
		5.6	1.64	46	1 -	.22	.97	.91	_
		(.06)	(.18)	(.13)	1			í	í
	DLS	07	-	-	1.14*	.43	.73	2.17	-
		(.11)			(.17)		1	1	
Japan	LSJ	.05	.99*	_	_	-28	.98	2.4	_
-		(.06)	(.04)						
		13	1.63	41	-	.18	.98	1.35	-
	DLS	06	-	-	1.14*	.44	.71	2,19	_
		(.12)	1		(.17)		1		
U.S.A.	LS	2.04	1.63*	-	-	1.11	-66	1.11	_
		(.03)	(.28)			1	1.00		
		2.06	•8	.61*	-	1.11	.52	1.06	-
		(.03)	(.6)	(.5)			1		
	DLS	03	] - ]	-	<b>.65</b> *	.11	.08	2.5	-
		(.03)			(.52)		[		
Japan	LSJ	-3.7	2.07	-	-	.14	.85	.94	-
-		(.03)	(.2)			1	1.02		
]		-3.7	1.46	.65	-	.14	.82	.86	-
		(.05)	(.74)	(.72)	(		ſ		
	DLS	.03	-	-	.83*	.12	.09	2.7	-
		(.04)			(.62)	1		[ ]	
	Japan U.S.A. Japan	Japan LSJ U.S.A. LS DLS Japan LSJ Japan LSJ DLS	U-S.A. LS 2.04 (.07) 5.6 (.07) 5.6 (.06) 07 (.11) Japan LSJ .05 (.06) 13 DLS06 (.12) U.S.A. LS 2.04 (.03) 2.06 (.03) DLS03 (.03) Japan LSJ -3.7 (.05) DLS .03 (.04)	$U.S.A.$ $LS$ $J.o$ $.55^{-0}$ $.55^{-0}$ $(.07)$ $(.04)$ $5.6$ $1.64$ $DLS$ $07$ $ U.S.A.$ $LSJ$ $.05$ $.99^{+}$ $(.11)$ $.05$ $.99^{+}$ $U.S.A.$ $LSJ$ $.05$ $.99^{+}$ $U.S.A.$ $LS$ $2.04$ $1.63^{+}$ $U.S.A.$ $LS$ $2.04$ $1.63^{+}$ $U.S.A.$ $LS$ $2.04$ $1.63^{+}$ $U.S.A.$ $LS$ $2.04$ $1.63^{+}$ $Japan$ $LSJ$ $03$ $ Japan$ $LSJ$ $-3.7$ $2.07$ $(.03)$ $(.23)$ $-3.7$ $1.46$ $DLS$ $.03$ $ DLS$ $.03$ $-$	$U.S.A.$ $LS$ $5.8$ $.95^{-n}$ $ (.07)$ $(.04)$ $5.6$ $1.64$ $46$ $DLS$ $07$ $  DLS$ $07$ $  (.11)$ $07$ $  Japan$ $LSJ$ $.05$ $.99*$ $ (.11)$ $06$ $  DLS$ $06$ $  (.03)$ $(.28)$ $2.06$ $.8$ $.61*$ $(.03)$ $(.60)$ $(.5)$ $03$ $ Japan$ $LSJ$ $-3.7$ $2.07$ $ Japan$ $LSJ$ $-3.7$ $2.07$ $ Japan$ $LSJ$ $-3.7$ $1.466$ $.655$ $DLS$ $.03$ $  -$	$U.S.A.$ $LS$ $5.8$ $.55^{-1}$ $  (.07)$ $(.04)$ $5.6$ $1.64$ $46$ $ DLS$ $07$ $  1.14*$ $(.17)$ $Japan$ $LSJ$ $.05$ $.99*$ $  DLS$ $07$ $  1.14*$ $(.17)$ $Japan$ $LSJ$ $.05$ $.99*$ $  DLS$ $06$ $   1.14*$ $DLS$ $06$ $  1.14*$ $(.17)$ $U.S.A.$ $LS$ $2.04$ $1.63*$ $  (.03)$ $(.28)$ $.61*$ $  .65*$ $Japan$ $LSJ$ $-3.7$ $2.07$ $  .65*$ $.52$ $Japan$ $LSJ$ $-3.7$ $2.07$ $  .65*$ $.65*$ $.65*$ $.65*$ $.65*$ $.65*$ $.65*$ $.65*$ $.65*$ $.65*$ $.65*$	$0.5.8.4$ $LS$ $5.8$ $.55^{-1}$ $   .3$ $Japan$ $LSJ$ $.05$ $.99^{+}$ $  .22$ $Japan$ $LSJ$ $.05$ $.99^{+}$ $  .22$ $Japan$ $LSJ$ $.05$ $.99^{+}$ $  .28$ $0LS$ $07$ $   .28$ $0LS$ $.05$ $.99^{+}$ $  .28$ $0LS$ $06$ $   .11$ $0LS$ $06$ $   .11$ $0LS$ $06$ $   .11$ $0LS$ $06$ $   .11$ $0LS$ $2.04$ $1.63^{+}$ $  .11$ $0.5 \times03$ $  .61^{+}$ $ .11$ $Japan$ $LSJ$ $-3.7$ $2.07$ $  .14$ $0LS$	$U.S.A.$ $LS$ $5.8$ $.99^{**}$ $  .3$ $.97$ $Japan$ $LSJ$ $.05$ $.99^{**}$ $  .22$ $.97$ $Japan$ $LSJ$ $.05$ $.99^{**}$ $  .222$ $.97$ $Japan$ $LSJ$ $.05$ $.99^{**}$ $  .28$ $.98$ $DLS$ $07$ $   .28$ $.98$ $Japan$ $LSJ$ $.05$ $.99^{**}$ $  .28$ $.98$ $DLS$ $06$ $   .114^{**}$ $.44$ $.71$ $U.S.A.$ $LS$ $2.04$ $1.63^{**}$ $  .111$ $.66$ $U.S.A.$ $LS$ $2.04$ $1.63^{**}$ $  .111$ $.52$ $DLS$ $03$ $  .61^{**}$ $ .111$ $.52$ $Japan$ $LSJ$ $-3.7$ $2.07$ $  .14$	U-SAX.       LS $3.3$ $.93^{**}$ $  .3$ $.97$ $2.1$ Japan       LSJ $(.07)$ $(.04)$ $46$ $ .222$ $.97$ $.91$ Japan       LSJ $.05$ $.99*$ $  .222$ $.97$ $.91$ Japan       LSJ $.05$ $.99*$ $  .28$ $.98$ $2.4$ Justic $.05$ $.99*$ $  .28$ $.98$ $2.4$ Japan       LSJ $.05$ $.99*$ $  .28$ $.98$ $2.4$ Justic $.065$ $.99*$ $  .114*$ $.44$ $.71$ $2.19$ U.S.A.       LS $2.04$ $1.63*$ $  .111$ $.66$ $1.11$ U.S.A.       LS $2.04$ $1.63*$ $  .111$ $.52$ $1.06$ Japan       LSJ $-3.7$ $2.07$ $  .14$ $.85$ $.94$

#### Appendix II

# Estimates by Using Dummy Variable

Most countries changed their exchange rate system from one kind of arrangement to another during the period of study. In order to see whether those changes had any effect on our estimates, we have done a separate set of estimates by using a dummy variable technique. The estimates are presented here. As can be seen, the dummy variable is not significant for most of the countries and the estimates do not change very much from our original estimates except for a few cases. For Greece and Malaysia, the dummy variable in the absolute version of the PPP theory is significant and the estimates change somewhat. Also the estimates of the relative version of PPP for India in relation to Japan has changed and the dummy variable has a coefficient significantly different from 0.

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# Appendix II

# Estimates by Using Dummy Variable

	Tradiog	1	Variables		Price	Price Ratio	Difference				
Country	Partner	Dependent	Constant	Dummy	110	110(-1)	Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	D
Turkey	U.S.A.	LS	2.3	18	1.16*	-	-	.15	.95	1.64	.43
			2.4 (.06)	23* (.11)	.47 (.29)	.81	-	.14	.94	1.83	.14
		DLS	01 (.07)	.05 (.10)	-	-	1.05* (.33)	.18	•54	1.99	.01
	Germany	LSG	1.1 (.06)	.03 (.12)	1.09* (.06)	-	-	.13	.98	1.67	.37
			1.1 (.07)	.03 (.12)	.82 (.25)	.31* (.28)	-	.13	.98	1.73	.34
		DLS	.03 (.06)	.04 (.09)	-	-	.84* (.27)	.16	.52	1.99	04
Greece	U.S.A.	LS	3.3 (.04)	3* (.06)	1.37 (.11)	-	-	•05	.98	1.29	.68
			3.3 (.05)	3* (.07)	1.11 (.21)	.29	-	<b>.</b> 05	.98	1.36	.67
		DLS	.01 (.03)	•05 (•06)	-	-	.50 (.36)	.08	.34	1.12	-
	Japan	LSJ	-2.5 (.02)	.03 (.04)	1.16 (.06)	-	-	.07	.98	1.99	.01
			-2.5 (.02)	•02 (•04)	1.63 (.38)	55* (.43)	-	.07	.98	1.94	13
		DLS	.02 (.02)	03 (.04)	-	-	1.20* (.31)	•08	•66	2.3	5
	1	1	1 1		1	1	1		1	l	1

Malaysia	U.S.A.	LS	1.1 (.02) 1.1 (.02)	11* (.03) 11* (.03)	.59 (.12) .90 (.28)	32 (.26)	-	.04 .04	.03 .94	1.94	.3 06
		0125	(.02)	(.02)	-	-	(.33)	•05	•17	1.84	-
	Japan	LS	-4.7 (.04)	•13* (•06)	.63 (.35)	-	-	.07	•96	2.1	.45
		1	-4.7 (.04)	.09 (.06)	.83 (.36)	66 (.36)	-	.07	.97	2.0	.45
		DLS	.01 (.03)	.004 (08)	-	-	•84* (•36)	•08	.26	2.8	-
Yugos lavia	U.S.A.	LS	2.6 (.19)	.04 (.15)	1.30* (.16)	-	-	.14	.77	1.61	.85
			2.5 (.04)	•27* (•08)	2.63	-1.49* (.30)	-	.12	.98	1.92	36
		DLS	09 (.06)	.06 (.06)	-	-	1.75 (.33)	•14	•67	2.3	-
	Germany	LSG	1.4 (.07)	03 (.13)	1.15* (.09)	-	-	.13	.94	1.57	.46
			1.2 (.05)	03 (.08)	2.48	-1.42* (.34)	-	.10	.99	1.86	08
		DLS	07 (.06)	.02 (.06)	-	-	1.55*	•14	•51	1.86	15

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#### Appendix II continued

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	Variables Trading				Price						
Country	Partner	Dependent	Constant	Dummy	110	110(-1)	Ratio DDLO	S.E.	r <sup>2</sup>	D.W.	ρ
Venezuela	U.S.A.	LS	1.5	04* (.003)	01 (.02)	-	-	.01	.97	1.97	.05
			1.5 (.002)	.04* (.003)	04 (.03)	.05 (.04)	-	.01	.94	2.0	.02
		DLS	•01 (•01)	02* (.01)	-	-	.02 (.02)	•004	.52	1.71	.88
	Japan	LSJ	-4.3 (.04)	•17* (•06)	.60 (.18)	-	-	.08	.95	1.89	.42
	1		-4.3 (.05)	•18* (•07)	•87 (•30)	43 (.38)	-	.08	.96	1.81	.45
	ļ	DLS	•01 (•03)	02 (.04)	-	-	.72* (.34)	.09	•22	1.95	04
Egypt	U.S.A.	LS	84 (.01)	09* (.009)	.08 (.05)	-	-	.02	.91	1.97	14
			84 (.01)	09* (.01)	•15 (•09)	11 (.15)	-	.02	.94	2.01	23
		DLS	01 (.01)	.001 (.009)	-	-	.17 (.09)	.02	•22	2.04	24
	Japan	LSJ	-6.6 (.07)	.04 (.08)	.54 (.20)	-	-	.08	.98	1.69	.73
			-6.6 (.2)	05 (.09)	.76 (.25)	49 (.32)	-	.08	.98	1.35	.85
		DLS	.02 (.03)	05 (.05)	-	-	•/5# (•29)	.09	.30	1.89	•08

Taiwan	U.S.A.	LS	3.7 (.004) 3.7 (.01)	05* (.01) 05 (.004)	.01 (.05) 09 (.05)	- .12 (.05)	-	.01 .01	•81 •99	1.99 1.98	002 34
		DLS	01 (.003)	•004 (•004)	-	-	11 (.05)	.01	.31	2.0	34
	Japan	lsj	-2.1 (.15)	22 (.12)	1.38* (.55)	-	-	•08	.82	1.77	.89
			-1.9	25* (.12)	1.53	51* (.42)	-	.08	.83	1.65	.91
		DLS	.02 (.03)	02 (.02)	-	_	•58 (•58)	.10	.07	2.0	31
Burma	U.S.A.	LS	1.75 (.20)	.005 (.09)	.43 (.23)	-	-	•08	.57	1.77	.93
			1.76	.03 (.09)	.62 (.26)	37 (.27)	-	•08	.63	1.55	.92
		DLS	.004 (.02)	•05 (•03)	-	-	.41 (.18)	•08	•33	2.12	16
	Japan	LS	3.9 (.32)	06 (.13)	.76* (.36)	-	-	.13	.84	2.03	.94
			-3.9	06 (.14)	.85 (.42)	20 (.43)	-	.13	.84	1.88	.94
		DLS	.03 (.03)	.03 (.04)	-	-	.49 (.29)	•12	.21	2.01	30
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### Appendix II continued

			Variables		Price	Price Ratio	Difference				1
Country	Trading Partner	Dependent	Constant	Dummy	Ratio 110	lagged 110(-1)	In Price Ratio DDLO	S.E.	R <sup>2</sup>	D.W.	ρ
Korea	U.S.A.	LS	5.8	08	.97*	-	-	.05	.99	1.29	.69
			(.04) 5.8	(.06) 09	(.09) 1.01	02*	-	•05	.99	1.30	.68
		DLS	(.04) .01 (.02)	(.07) 01 (.03)	(.25)	(.2)	.85* (.22)	•05	.50	1.94	.16
	Japan	LSJ	004 (.05)	01	1.08*	-	-	.10	.94	1.98	.33
	ĺ		02 (.04)	.04 (.12)	1.17	06 (.35)	-	•11	.93	1.98	.34
		DLS	.03 (.03)	03 (.04)	-	] -	•78* (•37)	.11	.23	2.1	41
Colombia	U.S.A.	LSJ	2.8	21*	1.01*	-	-	.09	.97	1.60	.11
			2.9	.09 (.05)	.34	•59* (•29)	-	.04	.98	1.48	.58
		DLS	.05 (.03)	.02 (.03)	-	-	.33 (.30)	•05	.15	1.53	.02
	Germany	LSJ	1.5	.03	<u>.94</u> *	-	-	.11	.32	2.3	.84
			1.6 (.13)	.05 (.08)	.64 (.40)	.22*	-	•08	.64	1.35	.87
		DLS	.05 (.03)	01 (.03)	-	-	.66 (.34)	•08	.43	2.4	63
	l	1	1		1	1	1			ł	1

India	U.S.A.	LS	1.9	•13* (•05)	1.36*	-	-	.09	.53	1.88	.18
			1.9 (.04)	•12* (•05)	1.09	•09* (•52)	-	.09	•56	1.65	.04
		DLS	.01 (.03)	.02 (.03)	-	-	1.01* (.45)	.11	.21	1.09	6
	Japan	LSJ	-3.8 (.04)	.23* (.07)	1.56 (.21)	-	-	.11	.91	1.89	•02
			-3.8 (.04)	.25* (.07)	1.61 (.57)	14* (.59)	-	.11	.89	1.71	08
		DLS	.04 (.04)	01 (.04)	-	-	.94 (.54)	.12	.12	1.32	44
Indones i a	U.S.A.	LS	5.6 (.10)	.21 (.13)	<b>.94*</b> (.04)	-	-	.28	.97	2.2	-
			5.5 (.12)	.12 (.13)	1.58 (.15)	39 (.11)		.18	.92	1.69	•56
		DLS	09 (.08)	.12 (.11)	-	-	1.05* (.09)	.34	.91	1.61	75
	Japan	lsj	05 (.09)	.17 (.13)	.98* (.04)	-	-	.29	.98	2.4	-
			16 (.09)	.07 (.12)	1.59 (.16)	38 (.12)	-	.18	.98	1.79	.32
		DLS	.04 (.08)	.05 (.11)	-		1.06* (.09)	.36	.90	1.55	.74 .
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## Appendix III

### Exchange Rate Arrangements

### A: Fixed Exchange Rate

- 1. Burma: The Burmese currency Kyat (k) was valued at 4.75 per U.S.\$ up until August 15, 1971. Kyat was linked to U.S.\$ at kl1.43 = £1. The Kyat began appreciating after the devaluation of U.S.\$ on December 18, 1971. The Sterling parity was also adjusted. In 1974, Kyat's link with the £ was severed and alo the tie with U.S.\$. From 1975, Kyat was linked to the SDR at a value of k7.74 and in 1977, SDR link was revised to k8.5, another devaluation. The Union of Burma Bank administers all currency matters and convertibility to other currency is strictly restricted. The Black market was quite active.
- 2. Egypt: The Egyptian Pound (LE) was devalued on May 7, 1962 resulting in a unified basic official rate of U.S.\$ 2.30. Following the February 73 devaluation of U.S.\$, the basic official rate of pound was realigned to U.S.\$ 2.555 per unit. Egypt followed multiple exchange rates, like the tourists rate which was different from official rate, similarly worker's remittances also had a different rate. Egypt followed a restrictive policy on currency convertibility. The Ministry of Economy and Foreign Trade is responsible for exchange control. Black market activity

was widespread.

- 3. Venezuela: The Venezuelan Bolivar (Bs) was pegged to U.S.\$ at Bs 4.5 per U.S.\$, up until 1971. After the devaluation of U.S.\$ in 1973, the rate was set at Bs 4.3 per U.S.\$. There are however, various other rates like petroleum rates and coffee rates. Residents can freely export and import national bank notes and can own foreign currencies. Black market activity was not very widespread. The Banco Central de Venezuela regulates all currency matters.
- 4. Taiwan: The New Taiwan Dollar (NT\$) was pegged to U.S.\$ at NT\$40 per U.S.\$ from 1963 and was revised upward to NT\$ 38 after U.S.\$ devaluation in 1973. However, the link was severed in 1978 and Taiwan maintained its par with respect to a basket of currencies including Japanese yen, Korean won and U.S.\$. Convertibility of domestic currency was restricted to certain amounts. The Central Bank of China manages the exchange rate. Black market was prevalent in Taiwan for long time and recently has become an officially tolerated one. Liberal currency convertibility was followed.

## Flexible Exchange Rate

1. Turkey: The Turkish Lira (LT) was pegged to U.S.\$ at LT9.0 per U.S.\$ until 1971 and with devaluation of U.S.\$, the lira devalued to LT15 per U.S.\$. After that the lira was adjusted frequently. There were other rates for remittance and travellers existed. After 1980, the exchange rate of lira was determined freely on a daily basis and currency value readjusted within European Monetary System. Import and export of national currency more than the equivalent of U.S.\$ 1,000 were prohibited. Residents cannot own foreign currency and currency cannot be converted.

Black market activity was strong during the fixed parity before 70's but during 70's due to massive inflow of foreign exchange by workers, the unofficial rate sometimes was less than official rates. Foreign exchange was managed by Ministry of Finance with the Central Bank.

2. Greece: The Greek Drachma had a par rate established at Dr. 30 per U.S.\$ which continued up to 1972. Since 1973 Greece has had a floating exchange rate and the tie with U.S.\$ was severed from 1975. Greece followed a liberal policy on currency convertibility and the maximum amount of export and import of currency was set at Dr. 3,000. The Banque de Greece administeres all currency controls. Greece is also a member of European Common Market

since 1981.

3. Malaysia: The Malaysian currency used to be called Malaysian Dollar was changed to Malaysian Ringgit (M\$) in 1975 and the exchange rate was fixed at M\$ 3.06 per U.S.\$. Following the U.S.\$ devaluation, the Malaysian currency appreciated and was placed on freely floating basis and adjusted from time to time based on a basket of unspecified currencies. Residents can own foreign currencies and followed liberal policy on currency convertibility. The Bank Negara Malaysia administers exchange controls.

There was no significant black market in Malaysian currency due to the absence of capital controls.

4. Yugoslavia: The Yugoslav Dinar (Din) was devalued from Din 12.5 per U.S.\$ to Din 15 per U.S.\$ in 1971 and then to Din 17 per U.S.\$ in 1973 and since then the Dinar was placed on floating basis. Residents cannot export or import more than Din 1500 in national bank notes. Foreign exchange is available for business trip abroad. The National Bank of Yugoslavia is responsible for currency administration. Black market activity varied in Yugoslavia from time to time. However, it was not very strong.

## Moderately Flexible

1. Colombia: The Colombian currency is Colombian peso. A multiple exchange rate structure exists for the peso in which the fluctuating official rate fluctuated every week. Colombian peso was pegged in U.S.\$ up to 1976, even though rates varied from time to time based on some formulae float.

Residents can freely import and export national bank notes. Black market activity virtually ceased after the legalization of free market trading in Colombian currency markets. However, it reappeared at the end of 1966 after the introduction of currency controls and black market activity was heavy in the 70's. However, the premium was not very high.

2. Korea: The Korean won was managed under a unitary floating system and was based on basic rate of W255 per U.S.\$ in 1964 but continued to adjust downward and in 1972 it was W399 per U.S.\$. By 1980 the fixed link with U.S.\$ was abandoned and the floating rate was established. Currency was linked to a basket of currencies with Korea's trading partners. Korea followed strict rules regarding convertibility of its currency and no resident can own foreign currency.

Black market in Korea was particularly strong for Japanese yen along with U.S.\$ at times when there were the rumors about future devaluation and significant capital controls. Ministry of Finance and Banking of Korea are in charge of exchange control.

- 3. Indonesia: Indonesian Rupiah (Rp) was pegged to U.S.\$ up to 1978. The rate was adjusted from time to time. There were other rates for exports and imports besides the official rate like Flexible Credit Foreign Exchange Rate and Export Bonus Certificate Rate. After 1978, the official rate was managed under a controlled floating basis and rupiah depreciated continuously. Residents cannot export or import more than Rp 50,000 in national bank notes. They can own foreign currencies Bank of Indonesia administers all foreign exchange and trade controls. Black market activity varied from time to time depending on the exchange controls. Such black market activity was done under the cover of corrupt administrators and was due to illegal import of gold and other hard currency. With the floating of rupiah, the black market premium virtually disappeared during the early eighties.
- 4. India: Indian Rupee (Re) has been aligned to both U.S.\$ and U.K.f and there were a few discrete devaluations before it was put on controlled floating basis in 1975 by breaking its tie with the U.K.f. It now linked to a basket of currencies with Japanese yen, German mark and the U.S.\$. Residents cannot import or

export national bank notes. The Reserve Bank of India administers the currency. Black market activities have continued on a large scale due to huge capital controls and import restrictions.

## Appendix IV

	1	Expe	orte	Tmp	* Growth in	
	Country	1960-1970	1970-1982	1960-1970	1970-1982	(1964-1983)
1.	Greece	10.8	9.4	10.8	4.5	20
2.	Turkey	1.6	4.0	5.5	2.0	36
3.	Malaysia	6.1	3.8	2.4	7.3	13
4.	Yugos lavia	7.7	4.8	8.8	4.9	28
5.	Colombia	2.6	2.2	2.4	7.3	23
6.	Korea	34.7	20.2	19.7	9.8	35
7.	Indones ia	3.5	4.4	1.9	12.3	40
8.	India	4.7	4.7	9	2.6	14
9.	Taiwan	23.7	9.3	17.9	9.1	23
10.	Egypt	3.9	3	9	9.6	15.9
11.	Burma	-11.6	1.9	-5.6	-2.3	10
12.	Venezuela	1.1	-7.2	4.4	9.2	10

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# Average Annual Rate of Growth % (1960-1981)

Source: World Bank \* Based on geometric rate - source IMF.

# Appendix V .

## Average of Trade Share with U.S.A., Germany and Japan. 1964-1983

Domestic Country		Total with Big Two	Share with U.S.A.	Share with Japan	Share with Germany
1.	Greece	14	7	7	
2.	Turkey	29	12		17
3.	Malaysia	34	13	21	
4.	Yugos lavia	21	7		14
5.	Colombia	47	35		12
6.	Korea	62	31	31	
7.	Indonesia	59	19	40	
8.	India	29	19	10	
9.	Taiwan	54	30	24	
10.	Egypt	17	13	4	
11.	Burma	27	5	22	1
12.	Venezuela	43	29	4	
		1	1	1	

Source: World Bank

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## Appendix VI

## Deviation of Official Exchange Rate from Unofficial Rate

			Percentage
	Country	Average Deviation	Premium of
1.	Greece	1.28 Drachma	1%
2.	Turkey	1.85 lira	1%
3.	Malaysia	0 Ringgit	1%
4.	Yugos lavia	0 Dinar	1%
5.	Colombia	1.09 peso	.7%
6.	Korea	33.8 won	6%
7.	Indonesia	18.8 rupiah	5%
8.	India	2.4 rupees	25%
9.	Taiwan	1.45 Taiwan \$	4%
10.	Egypt	.42 Egyptian pound	100%
11.	Burma	19 kyat	200%
12.	Venezuela	1.35 Bolivares	6%

Computed from Currency Year Book.

## Appendix VII

				Rate of Inflation*			
		Average Gr	owth Rate	(1964-1983) Base: 1980			
		(1960–1981)		Measured by	Measured by		
	Country	Agriculture	Industry	CPI	WPI		
1.	Greece	2.6	6.9	11.6	11.95		
2.	Turkey	2.8	7.8	24.6	23.5		
3.	Malaysia	5	9	4.43	6.1		
4.	Yugoslavia	3	6.5	20	15.24		
5.	Colombia	3.8	7.6	17.6	18.8		
6.	Korea	3.7	17.2	14.14	13.4		
7.	Indones ia	3.7	8.1	21	27		
8.	India	1.9	4.9	8	8.5		
9.	Taiwan	2.5	14.7	7.7	6.6		
10.	Egypt	2.9	6.5	8.8	7.9		
11.	Burma	4.4	4.1	7.95	6.45		
12.	Venezuela	4.5	3.6	6.5	7.12		
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Source: World Bank.

\* Source: IMF.

						Rate
		Percentage	Share of	Inflow of	Foreign	of Growth
		Agriculture	in Export	Capital (M	(illion \$)	of Foreign
<u></u>	Country	1960	1981	1970	1982	Capital
1.	Greece	81	28	164	1695	21.5
2.	Turkey	89	56	328	2196	17
3.	Malaysia	74	44	43	2883	42
4.	Yugos lavia	45	15	180	826	13.5
5.	Colombia	79	70	252	1218	14
6.	Korea	56	8	441	3982	20
7.	Indones ia	67	13	441	4250	21
8.	India	45	33	890	2405	8.6
9.	Taiwan	49	11	362	1077	20
10.	Egypt	84	23	302	2702	20
11.	Burma	95	86	16	402	31
12.	Venezuela	26	1	224	1924	20
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Source: World Bank

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