

**Competition and Exchange Rates:  
Theory and Empirical Evidence**

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## **ABSTRACT**

### **COMPETITION AND LONG RUN EXCHANGE RATES: THEORY AND EMPIRICAL EVIDENCE**

**This paper develops and tests a long run theory of the exchange rate based upon a classical approach to the theory of competition. The underlying theory of competition allows for differences in technology among firms within an industry, and for capital flows between industries. It is first applied to competition within one "nation" (i.e. one integrated common currency area), and then extended to the multi-currency case. The resulting model of exchange rates looks like Purchasing Power Parity (PPP) theory when relative inflation rates are high and/or when two countries produce similar baskets of tradables. But in other circumstances, international differentials in productivity, real wages, and in the price ratio of tradable to nontradable goods play an important role in determining the long run center of gravity of exchange rates. The theory is tested against data for the United States, Japan, Germany, the United Kingdom, and Canada.**

# COMPETITION AND EXCHANGE RATES: THEORY AND EMPIRICAL EVIDENCE

## Introduction

This paper develops and tests a long run theory of the exchange rate based upon a classical approach to the theory of competition. The resulting model of exchange rates looks like Purchasing Power Parity (PPP) theory when relative inflation rates are high, and/or when two countries produce similar baskets of goods. But in other circumstances productivity, the ratio of tradables to nontradables prices, and real wages play an important role in determining the long run center of gravity of exchange rates.

In what follows, we will first develop the underlying theory of competition as it applies to one integrated "common currency area", and then extend its arguments to the multi-currency case. The latter step results in a particular theory of the long run exchange rate whose implications are distinct from those of other theories. We will end by testing the theory against data for the United States, Japan, Germany, the United Kingdom, and Canada.

## I. The theory of competition

Industrial competition consists of two distinct processes: the rough equalization of selling prices within one industry for all generally tradable goods, modified by transportation costs, taxes, etc; and the rough equalization of profit rates between industries, brought about by the response of investment to interindustrial differences in profit rates.

Intra-industrial competition causes individual selling prices of a given generally tradable good to gravitate around some common price. But because the resulting (approximate) Law of One Price (LOP) is valid for any common price within an industry, it does not provide a theory of the level of this common price. An additional process is necessary.

Classical economics closed the theory by arguing that inter-industrial competition leads to the rough equalization of profit rates between industries. This second (and probably slower) process causes the common price established by the LOP to itself gravitate around a longer term price which the Classics called "natural price" and which Marx called the "price of production". Since I wish to use the term gravitation in the orbital sense rather than in the sense of eventual convergence, I will use the latter term rather than the more common "long run equilibrium price".

It is important to recognize that the above two processes are not immediately congruent. Intra-industrial competition forces the firms within an industry to sell at roughly common prices (after allowance for transportation costs and local taxes). But this means that differences among the

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cost structures of these firms will show up as differences in intra-industrial profit margins and profit rates. Thus the Law of One Price tends to disequalize profit margins and profit rates among firms within a given industry<sup>1</sup>.

On the other hand, investment flows across industries are motivated by expected rates of return for new capitals in these industries. Since existing capitals within an industry will have different profit rates at any common price, for reasons indicated above, which of these will serve as the barometer for new investment? The answer, I would argue, is the (expected) profit rate of the best (i.e. lowest cost) generally available method of production in any one industry. These regulating methods of production are the ones which newly entering capitals will tend to adopt. I will call the capitals which embody these methods the regulating capitals for each industry. For profit rates to be equalized across industries, it is only necessary that new investments accelerate relative to demand in industries with higher than average regulating rates of profit, and decelerate relative to demand in those with lower than average rates<sup>2</sup>. Such differential rates of investment will reduce prices in the former industries relative to those in the latter. The end result is a process which makes each industry's average price gravitate around a level which yields a roughly normal rate of profit for that industry's regulating capitals.

Three further points are important. First, the formation of a common price across firms within an industry does not require actual incursions (i.e. "exports" and "imports") into each others' territories. For generally tradable goods, the threat of such incursions, and/or the existence of common suppliers and buyers, is sufficient (McCloskey and Zecher 1985:66). Similarly, the formation of roughly equal profit rates across regulating capitals in different industries does not require actual capital flows from one industry (or region) to another. It is sufficient that there be differential rates of investment (from internal or external sources) tied to differentials in (expected) profit rates.

Second, the equalization of profit rates across industries does not require the corresponding equalization of wage rates. Flows of new capital into an industry can have a significant impact on supply and price without necessarily denting local wage rates. Where the mobility of labor is restricted for any reason, wage differentials can persist even though profit rates may be equalized

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<sup>1</sup>Firms with lower unit costs will have higher profit margins at any common selling price. Insofar as lower unit costs are due to more capitalized methods of production, as reflected in higher capital-output ratios (at normal levels of capacity utilization), profit rate differentials within an industry will be smaller than profit margin differentials (because the normal capacity profit rate is the profit margin on sales divided by the capital-output ratio, both at normal levels of capacity utilization).

<sup>2</sup>Since demand will generally be growing, the movement involved are relative to trend -- i.e. accelerations or decelerations.

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(Botwinick 1988).

Third, new flows of investment into an industry constantly bring in new methods and push out old ones. In a dynamic context, this inevitably leads to a range of vintages within each industry whose distribution will narrow or widen with changes in rates of investment and technical change. This explains the earlier assumption that even competition will be characterized by persistent differences in methods of production within any one industry.

### II. Competition within a common currency area

When discussing competition, it is common to first think of it as operating within something called a "nation" characterized by a common currency, integrated regional markets, and internal mobility of at least investment funds. For reasons which will become evident in the next section, we will refer to any such territory as a "single currency area".

Within such an area, intra-industrial competition requires that regional commodity markets for a given commodity be integrated by actual or potential arbitrage, and/or by common buyers and sellers. Because of the influence of transportation costs, taxes, etc., the resulting LOP should be understood as the proposition that there exists a "close correlation among [relevant] price levels brought about by the ordinary workings of markets" (McCloskey and Zecher 1985:66). Moreover, because the law represents something imposed upon the local pricing decisions of firms by the intended and unintended consequences of their actions, it implies some actual process of adjustment which differs from commodity to commodity and from region to region. In this approximate sense, over the medium run, the  $k^{\text{th}}$  producer of commodity  $i$  will have a price roughly equal to the average price in the industry.

1.  $p_{ik} \cdot p_i$

where  $p_{ik}$  = the  $k^{\text{th}}$  producer's price for commodity  $i$ , and  $p_i$  = the average price of commodity  $i$ <sup>3</sup>.

Inter-industry competition then operates on each average price  $p_i$ , forcing it to gravitate

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<sup>3</sup>If tariffs and taxes impede the equalization, we could write  $p_{ik} = m_k + n_k @ p_i$ , where  $m, n$  are rooted in transportation costs, taxes and tariffs. This can be viewed as a statement of the LOP in our sense, since for given coefficients  $m, n$  the firm's individual price will be perfectly correlated with the average price. Note that the relation need not be linear. However, if we do assume linearity, then the above form is the same as that in Kalecki's theory of price, although he would attribute the coefficients to monopoly power (Kalecki, 1952:12-13).

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around the price of production  $p_i^*$  of that industry's regulating capitals. Thus over a slower process than that of LOP, we have

$$2. p_i \cdot p_i^*$$

where  $p_i$  = the average price of commodity  $i$  and  $p_i^*$  = the price of production of its regulating capitals.

The final step is to determine prices of production themselves. They are given by the familiar system of equations below, modified to reflect the assumption that real wages and certain components of profit rates are determined exogeneously and can therefore differ across industries (e.g. if real wages differ by regions, and industries are composed of firms with different regional mixes). As is well known, equation system of the type below only determine the normal rate of profit  $r^*$  and relative prices of production. In what follows, we will assume that capital inputs (the elements of matrices  $A$  and  $K$ ) are tradable goods. The notation  $\langle x_i \rangle$  will be used to denote a diagonal matrix whose elements are  $x_i$ .

$$3. \mathbf{p}^* = \mathbf{u}^* + \mathbf{p}^* \mathbf{A}^* + \langle r^* + !_i \rangle \mathbf{p}^* \mathbf{K}^*$$

$\mathbf{p}^*$  = the row vector (1xn) of industrial prices of production for generally tradable goods (the analysis has been simplified by the assumption that only generally tradable goods enter into the production of such goods).

$\mathbf{u}^*$  = the row vector (1xn) nominal unit labor costs (wage rates times unit labor coefficients) of regulating capitals

$\mathbf{A}^*$  = the input-output matrix

$r^*$  = the general rate of profit

$!_i$  = given risk and other premia on sectoral rates of return

$\langle r^* + !_i \rangle$  = the diagonal matrix with elements  $r^* + !_i$ .

$\mathbf{K}^*$  = the matrix of capital goods coefficients

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Following Pasinetti (1977: ), we can rewrite this is terms of the vertically integrated labor coefficients vector  $\mathbf{v}$  and the capital coefficients matrix  $\mathbf{H}$ .

$$4. \mathbf{p}^* = \mathbf{v}^* + (r^* + !_i) \mathbf{p}^* \mathbf{H}^*$$

$\mathbf{v}^* = \mathbf{u}^* @ [\mathbf{I} - \mathbf{A}^*]^{-1}$  = the row vector of vertically integrated unit labor costs (1xn)

$\mathbf{H}^* = \mathbf{K}^* @ [\mathbf{I} - \mathbf{A}^*]^{-1}$  = the matrix of vertically integrated capital coefficients (nxn)

Equation 4 implies that the  $j$ th international price of production of tradables can be expressed as (see Shaikh 1984:..)

$$p_j^* = v_j^* + (r^* + !_j) h_j^* = v_j^* [1 + q_j^*]$$

where  $v_j^*$  = the nominal vertically integrated unit labor costs (vulc) in the  $j$ th sector, in units of common currency,  $h_j^* = \mathbf{p}^* @ \mathbf{H}_j^*$  = the money value of the vertically integrated capital stock per unit output of the  $j$ th international sector ( $\mathbf{H}_j^*$  is the  $j$ th column of  $\mathbf{H}^*$ ), in common currency, and  $q_j^* = [(r^* + !_j) h_j^*] / v_j^* =$  the vertically integrated profit-wage ratio of the  $j$ th international sector.

Note that we have not assumed that money wages  $w_j^*$  are the same across sectors, since neither the corresponding consumption baskets nor the local consumer price indexes need be the same (we assume that consumer goods include nontradables) across regions in which regulating capitals are located. It is sufficient that the local consumer prices and consumption baskets (i.e. the standards of living of the workers in the regulating capitals of each industry) be determined by local factors. The same is true for the profit rate "premia"  $!_i$ . On the above decomposition, we can write relative prices of production as

$$5. \frac{p_i^*}{p_j^*} = \frac{v_i^* [1 + q_i^*]}{v_j^* [1 + q_j^*]}$$

For the labor in any one sector, the vertically integrated unit labor costs  $v_i^* = p_{ci}^* v_{ri}^*$ , where  $p_{ci}^*$  is the local consumer price level, and  $v_{ri}^*$  is the local real vertically integrated unit labor costs. But since consumer goods include some nontradables, the local consumer price levels may differ across labor pools, since only the price of tradables are equalized by the LOP. Thus if we express each money vulc as  $v_i^* = (p_{ci}^* / p_{cti}^*) p_{cti}^* v_{ri}^*$ , where  $p_{cti}^* =$  the price index of tradable

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consumer goods, then  $p_{cti}^* = p_{ctj}^*$  from the LOP, and we can express equation 5 in a form which accounts for the presence of nontradable consumer goods in each region:

$$6. \frac{p_i^*}{p_j^*} = \frac{(p_{ci}^*/p_{cti}^*) v_{r_i}^*}{(p_{cj}^*/p_{ctj}^*) v_{r_j}^*} \frac{1 + q_i^*}{1 + q_j^*}$$

where  $v_{r_j}^*$  = the real wage in the  $j$ th sector and  $p_{cj}^*/p_{ctj}^*$  = the ratio of the price index of all consumer goods to that of tradable consumer goods, for labor in the  $j$ th international sector.

Finally, it is useful to derive an approximation to the above expression. In equation 6, the last term is the ratio of vertically-integrated profit-wage ratios  $q^*$ . But any vertically integrated profit-wage ratio  $q_j^*$  is a weighted average of the same set of direct profit-wage ratios, with different weights which sum to one (i.e. each vertically integrated profit-wage ratio is a convex combination of direct profit-wage ratios). For this reason, the dispersion of the  $q_j^*$ 's is much less than that of their direct counterparts. Moreover, this dispersion is even further dampened by being expressed as the ratio  $(1 + q_i^*)/(1 + q_j^*)$ . On this basis, we can view the last term in equation 4 as a disturbance term. Thus the ratio of real vertically-integrated unit labor costs, modified by the ratio of all consumer prices to tradable consumer prices, provides a simple but empirically powerful approximation to relative prices of production (see Shaikh 1984; Ochoa 1988; Bienenfeld 1988).

$$7. \frac{p_i^*}{p_j^*} \cdot \frac{(p_{ci}^*/p_{cti}^*) v_{r_i}^*}{(p_{cj}^*/p_{ctj}^*) v_{r_j}^*}$$

Combining equations 1, 2, and 7 gives us an operational theory of the determination of the price of tradables produced by any two firms in our common currency area, through a combination of the LOP, the law of equalization of profit rates across industries, and the specification of the dominant determinants of prices of production.

$$8. \frac{p_{ik}^*}{p_{jl}^*} \cdot \frac{(p_{ci}^*/p_{cti}^*) v_{r_i}^*}{(p_{cj}^*/p_{ctj}^*) v_{r_j}^*}$$



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Note that productivities, cost structures and profit rates will differ across firms within any one industry, since they embody different methods of production but sell at a roughly common price. Similarly, (skill-adjusted) real wage rates may differ across industries to the extent that they reflect regional mixes of firms. Only the regulating capitals in each industry will have roughly equal profit rates, and that only in some long-run orbital (oscillatory) sense. Since regions will generally differ in their mix of firms, they will differ in their average productivities, cost structures, profit rates, and real wage rates. No single region need have balanced commodity trade, although payments must balance (i.e., uses and sources of funds must balance, ex post).

Finally, even though each tradable good may sell at a roughly common price throughout the whole system, the average rate of change of tradables prices can differ across regions simply because regions produce different commodities. Indeed, since wage rates and prices of nontradable goods can differ across regions, so can general price levels. In other words, even when all regions operate under the same currency in a competitive environment, trade is not balanced, factor prices can differ, and purchasing power parity need not hold.

### III. Competition within a multi-currency currency area

We now consider the case where there exist many currencies in the area defined above. Without loss of generality, we may assume that the  $k^{\text{th}}$  firm in the  $i^{\text{th}}$  industry operates in currency  $i_k$ . Assuming one of the currencies (or some other money form such as gold, the SDR, or the ECU) to be the "world" money, the (micro-region) defined by the firm will have its own exchange rate  $e_{ik}$ . Of course, these exchange rates need not be all different. For instance, if some firms exist in the same macro-region (a nation or a common currency area), then they will all have the same exchange rate (that is, their  $e_{ik}$ 's will be the same).

The existence of a separate currency permits local prices to be determined in local currency. But under the law of one price, the local price of any tradable must conform to the world regulating price for that product, when transformed into world currency units. In other words, equation 1 for the LOP now reads

9.  $p_{ik} e_{ik} = p_i'$ , where now

$p_{ik}$  = the  $k^{\text{th}}$  producer's price for tradable commodity  $i$  in currency  $i_k$

$e_{ik}$  = the exchange rate of currency  $i_k$  relative to some reference ("world") money unit [world

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money/currency ik]

$p_i'$  = the average price of commodity i in world currency units.

Equation 2 remains unchanged, except that it is now interpreted in terms of world currency. And equations 3-7 are unchanged also, since in any case they only determine relative prices. But equation 8 now reads

$$10. \frac{p_{ik} e_{ik}}{p_{jl} e_{jl}} \cdot \frac{(p_{ci}^*/p_{cti}^*) v_{r_i}^*}{(p_{cj}^*/p_{ctj}^*) v_{r_j}^*}$$

What is true for each single firm is true for aggregates of these firms. Therefore the tradables prices in regions n, m will conform to equations 9-10, where all terms now refer to the basket of tradables produced in any given region. Thus we can write

$$11. p_n e_n \cdot p_n'$$

$$12. \frac{p_n e_n}{p_m e_m} \cdot \frac{(p_{cn}^*/p_{ctn}^*) v_{r_n}^*}{(p_{cm}^*/p_{ctm}^*) v_{r_m}^*}, \text{ where now}$$

$p_n$  = the local currency price of tradables in region n

$e_n$  = the exchange rate (relative to world currency) in region n  $p_n'$  = the average world currency price of tradables in region n

$v_{r_n}^*$  = the average real vertically-integrated real labor costs of the regulating capitals which produce the basket of tradables of region n.

We saw that under one common currency the operation of the LOP (equation 1) tells us that local prices of a given commodity will be equalized to some common price, but does not provide us with the determinants of this common price. This is why a further process, such as the equalization of profit rates (equations 2-3), is needed. Thus it is a valid criticism that, for exactly the same reasons, the multi-currency statement of the LOP in equations 9 and 11 cannot not by itself provide us with a theory of the exchange rate (Harrod 1933:62; Officer 1974:14). But when we complete the analysis by moving to equations 10 or 12, the story is different.

Taken just as it is, equation 12 provides us with a theory of the real exchange rate (which is the reciprocal of the left hand side, since  $1/p_n e_n = e_n'/p_n$ , where now  $e_n' = 1/e_n = n^h$  currency/world

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currency), through the determinants of the competitive cost structures of the "price leaders" (regulating capitals) of the tradables of the two regions. But we can go even further than that if we can argue two things: that local currency general price levels are determined by local conditions of effective demand, monetary policy, etc.<sup>4</sup>; and tradable goods local currency price levels largely reflect the same determinants as the general price levels. Then we can determine the long run nominal exchange rate through the combinations of local determinants of tradable goods price levels and the determinants of the competitive costs of price leaders of these same bundles of goods.

$$13. \text{ nominal exchange rate} = e_{nm} = \frac{e_n \cdot (\text{pcn}^*/\text{pctn}^*) v_{r_n}^*}{e_m \cdot (\text{pcm}^*/\text{pctm}^*) v_{r_m}^*} \quad (p_n/p_m)$$

$$13'. \text{ 1/(real exchange rate in terms of tradables prices)} = 1/e_{rnm} = \frac{\text{tradables price ratios in common currency} / p_n e_n / p_m e_m}{(\text{pcn}^*/\text{pctn}^*) v_{r_n}^*} \cdot (\text{pcm}^*/\text{pctm}^*) v_{r_m}^*$$

Equations 13' tells that even a tradables-price real exchange will not satisfy PPP, since in general the right hand side is not equal to one. But we can say even more:

-- in equation 13, if region n has a relatively high inflation rate, then its relative tradables price  $p_n/p_m$  must also be rising at a relatively high rate. In this case the rate of change of its exchange rate  $e_{nm}$  will be dominated by the relative inflation rate  $p_n/p_m$  in the denominator of the right hand side of equation 13, because the term in the numerator (the relative real costs of the regulating capitals) represents structural factors whose range of variation is much smaller than that of relative inflations rates. Thus the relative version of PPP will appear to be a good explanation of exchange rate movements. This explains the well known result that relative PPP works well in cases of high inflation (Barro 1984: 524, Table 20.4; Frenkel, 1978).

-- if region n and region m have similar baskets of tradables, then both have the same regulating capitals (so that the relative vertically integrated unit labor cost term in equation 13 is . 1). This situation arises when one country's production dominates that of the other. Officer (1976: 49) cites Canada as an example of such a case. Here, the ratio of relative nontradable to tradable consumer prices would be expected to dominate the bilateral real exchange rate  $e_{rnm}$ . Only if these relative prices behaved in similar ways in the two countries would a tradables-price PPP appear to be a good explanation of the long term bilateral exchange rate.

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<sup>4</sup>The determination of national price levels through local conditions is a common theme from Hume and Ricardo to Marx, Keynes, Kalecki, and Friedman.

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-- a region whose regulating capitals (which may or may not be its own capitals) undergo a secular decrease in relative real unit costs will experience a depreciation (a rise) of its real exchange rate in terms of tradables prices. If its relative inflation rate is modest, then the nominal exchange rate will also tend to depreciate (fall) over the long run. Note that in such cases PPP will not appear to work well.

Lastly, it should be noted that within a common currency area, competition amounts to the law of absolute costs. In effect, the theory proposed here extends this principle to the domain of international trade. The theory of exchange rates which results is determined by structural factors. As such, it cannot also serve the function of balancing trade or international payments. Rather, **persistent trade and payments imbalances are expected to be as normal in international trade as they are in national trade.**

### III. Empirical evidence

The preceding arguments have been based on the operation of two principles: the formation of a common selling price within each industry, and the formation of common profit rates across regulating capitals in different industries. The former requires that different markets for the same product be tolerably well integrated (arbitraged), whereas the latter requires that industries in which regulating rates of profit are higher grow more rapidly. It is interesting to note in this regard that none of this depends on whether the territory bounded by these rules is characterized by a common currency or by a multiplicity of currencies.

As far as the LOP is concerned, it is universally rejected as a short run mechanism (Giovannini 1988:65-66; Protopapadakis and Stoll 1986:350). But for in the longer run, McCloskey and Zecher (1985:65-73) argue that it holds in proximate form for prices and interest rates for United States, Britain, and Germany as far back as 1880-1913, during the Gold Standard<sup>5</sup>. More recently, Protopapadakis and Stoll (1986:336) find that for a variety of primary commodities and metal "the long-run LOP is a usable approximation of the behavior of commodity prices for macroeconomic purposes" with lagged adjustment coefficients which "imply that 90 percent of a deviation from the LOP would be expected to be eliminated within 10 weeks".

The law of equalization of profit rates is even more controversial. Although it was originally formulated as a central tendency of early capitalism, it has seldom been tested at any level. But for the United States in modern times, Semmler's exhaustive study concludes that the empirical

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<sup>5</sup>Their particular technique of correlating changes in price indexes in different countries would not necessarily work when national price levels have strong local inflationary components, as is so often the case in the modern era.

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evidence is quite "consistent with the theory of production prices" (Semmler 1984:192). Production prices in turn, and even market prices themselves, are well explained by vertically-integrated unit labor costs (Shaikh 1984; Ochoa 1984)<sup>6</sup>.

To test the proposition developed in this paper, we will utilize data on annual exchange rates  $e_n$ , producer price indexes  $p_n$ , and real unit labor costs  $ur_n$  (vertically-integrated real unit labor cost would be more appropriate, but are unavailable at the international level). The price level of tradable consumer goods  $pct$  will be approximated by the producer price index  $p_n$ . The countries involved are the United States, Canada, Japan, Great Britain, and Germany, with the first as the numeraire country (subscript US)<sup>7</sup>. The theory of the exchange rate developed here can be contrasted to the PPP hypothesis by noting that PPP expects the right hand side of equations 12 and 13' to be = 1. We will test this by regressing the left hand side of equation 13' (relative tradables prices in common currency) against the right hand side (relative real vertically integrated unit labor costs of the regulating capitals involved, corrected for the presence of nontradable consumer goods).

Because of the intrinsic difficulties of testing the law of one price in the presence of transportation and other costs (Aizenman 1986:25; Protopapadakis and Stoll 1986:337), we only expect that the regression of the relative (common currency) price ratio on adjusted real unit labor costs should yield a positive and significant coefficient  $b$  in an equation of high explanatory power (Officer 1976:32).

Lastly, it should be noted that the real unit labor costs in equation 13' are meant to be the (vertically integrated) unit labor costs of the regulating capitals which produce the types of commodities in the tradables bundle of country  $n$ . To construct these for each country, we would need to identify the price leaders for each type of commodity in a country's trading bundle, and then estimate their vertically integrated real unit labor costs. In the absence of this information, we have assumed that the countries in our sample, (U.S., Canada, Japan, Germany, and the U.K.) are their own regulating capital, and that vertically integrated unit labor costs can be approximated by direct unit labor costs. One could argue that the United States is the regulating capital for Canada, but since their unit labor costs move in very similar ways, the results would be the same.

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<sup>6</sup>Ochoa uses relative wage rates to weigh labor times, so his measure of total (direct and indirect) labor coefficients is really a measure of vertically-integrated unit labor costs (vulc's). He finds that the mean average deviation between these and actual market prices is about 12% over 1947-1972 -- so that vulc's account for 88% percent of the variation in market prices (Ochoa 1984:128).

<sup>7</sup>An alternate procedure would be to select Germany as the numeraire because its effective exchange rate is fairly stable in the 1970's-1980's, whereas that of the United States undergoes very large changes.

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Tables 1-4 present the results for our regressions. Serial correlation in the error term was addressed by estimating AR(1), MA(1) and ARMA(1,1) models for the error term and selecting the one with lowest standard error. Figures 1-4 compare the actual and predicted values of the relative tradables prices  $p_n'/p_m'$ . For all four countries, the explanatory power is quite good. Moreover, the PPP hypothesis, even in terms of tradables goods (which is the strongest case for it) can be easily rejected, since the b-coefficient is significant in all cases. All variables are relative to their US counterparts.

Regression:  $\ln p_n' = a + b \ln v1_n + \hat{a}$

where  $n = \text{Germany/US, Canada/US, Japan/US, and UK/US, and}$

$$p_n' = p_n e_n$$

$$v1_n = (pc_n^*/pct_n^*) ur_n^*$$

$p_n$  = local currency tradables prices in region n

$e_n$  = the exchange rate in region n (US dollar/n<sup>h</sup> currency)

$pc_n^*$  = consumer price index of regulating capitals for region n

$pct_n^*$  = tradable consumer goods prices of reg. capitals in region n

$ur_n^*$  = the average real unit labor costs of the regulating capitals which produce the basket of tradables of region n.

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TABLE 1: GERMANY/US

TABLE 2: CANADA/US

TABLE 3: JAPAN/US

TABLE 4: UK/US

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