

A STUDY ON GLOBAL INFLATION

世界性通貨膨脹之探討

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摘 要

國際市場的統合乃是和經濟理論以及經濟政策有着密切關係的一個問題，截至目前，經濟理論的各種模式和經濟政策大多是建立在各國市場相互獨立的假定。

本文的主要目的在於討論國際市場統合的某些含義，並以實際的資料加以印證，本文的討論乃以特定商品市場為範圍以及其資料搜集期間的長短兩方面進行，具體地分析各國市場統合的程度。

從總體經濟學的觀點而言，市場統合的概念有多種不同的意義，第一個意義是量的統合，第二個意義是各國物價變動趨勢相似的程度。

本文的討論分為四個部份，一是商品流動數量方面的調和，二是資源的移動和經濟整合，三是貨幣數量和利率水準，四是物價和經濟整合。從四個不同部份討論國際市場的統合，每一部份都提出實際資料並探討有關的研究結果，用以加強市場統合的意義，所有的討論和分析都堅強地支持市場統合的理論，因此通貨膨脹乃是世界性的整體現象，各國物價水準變動之差異，只是表示匯率變動的程度而已。

ABSTRACT

The integration of international markets is a subject which is very closely related to economic theory and thereby economic policy. At present, the preponderance of models of economic behavior as well as economic policies adhere to the assumption that individual countries' markets are principally independent of each other.

The purpose of this paper is simply to look at some of the implications of international market integration and to compare those implications with some of the data at hand. This paper is specifically to analyze the degree of

integration among countries according to two specific parameters (1) the specific commodity's market scope and (2) the time interval involved.

The concept of market integration can have several different meanings within a macro economic framework. The first sense of integration is quantity integration. The second is the extent to which price data among countries are similar.

This paper herewith includes four sections: (1) harmonic movement among quantity aggregates; (2) net flows of resources and economic integration; (3) monetary aggregates and interest rates; (4) prices and economic integration. In each section a sampling of data and research is surveyed in order to develop some sense of the degree to which markets are integrated. The overall results strongly support the integration hypothesis. In all, inflation is a one market world phenomenon and will differ among countries to the extent of changes in their exchange rates.

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The integration of international markets is a subject which is very closely related to economic theory and thereby economic policy. To the extent that worldwide markets are integrated, open economy models of economic behavior would appear to have substantial advantages over closed economy models, while the reverse appears plausible to the extent that worldwide markets are not integrated. At present — especially in the United States — the preponderance of models of economic behavior as well as economic policies adhere to the assumption that individual countries' markets are principally independent of each other. Put in other words, the assumption is that there is no such a thing as a unique world market. Thus, overall worldwide market segmentation has been assumed and its implications predestined.

The purpose of this paper is simply to look at some of the implications of worldwide market integration and to compare those implications with some of the data at hand. Obviously, much of the work has to be second-hand in nature and often the comparisons are at best suggestive. Nonetheless, the focus of the paper is specifically to analyze the degree of integration among countries according to two specific parameters: (i) the specific commodity's market scope and (ii) the time interval involved.

Different commodities may exhibit notably different degrees of market integration among countries. Both natural and manmade barriers to trade could account for major differences. Likewise, the degree to which a market for a commodity

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may be integrated could well depend upon the length of time chosen. In general, the longer the time interval selected, the more one would expect markets to be integrated.

Even the concept of market integration can have several different meanings within a macroeconomic framework. The first sense in which one country's market may be viewed as integrated with another country's market I will refer to as quantity integration. Internal quantity integration is higher, the more sympathetic quantity movements are within both countries. External quantity integration is higher the more demand and supply imbalances are offset by quantity flows between two countries. Truly integrated markets may display similar movements in quantity aggregates in specific markets. Thus, for internal quantity integration GNP, unemployment rates, money supplies, etc., may move in like manners in regions of an integrated worldwide market. While movements may not be similar within regions, market integration could result in quantity flows between regions. Thus, for external quantity integration potential or actual trade may well be the appropriate quantity measure of integration.

The second meaning for integration is the extent to which price data among countries are similar. This sense of integration is little more than the dual of quantity integration. With regard to the remainder of this paper, both senses of integration will be discussed.

While it is clearly possible for markets to be simultaneously integrated or not integrated using any sense of the word integration, it is by no means a necessity. Markets could have a large volume of transactions or even harmonic quantity movements and yet display little tendency for sympathetic movements in measured prices. Likewise, it is also possible for countries to show little in the way of the volume of trade or quantity harmony and yet display markedly similar patterns in price movements. Irrespective of the conceivability of divergences between these senses of market integration, one would expect that, in general, these senses would be closely related.

The remainder of the paper discusses i.) harmonic movement among quantity aggregates ii.) net flows of resources and economic integration iii.) monetary aggregates and interest rates and finally iv.) prices and economic integration. In each section a sampling of data and research is surveyed in order to develop some sense of the degree to which markets are integrated. The overall results strongly support the integration hypothesis. In quantity as well as price measures markets among the developed world are about as integrated as the data permit to be measured. Likewise integration appears to be about as complete and as fast as the quality of

the data permit to be measured.

1. Internal Quantity Integration

Early studies on the intercountry relationships between aggregate output and employment tend to find weak, yet noticeable, harmonic movements. In the case of major swings in GNP, unemployment or other measures of aggregate economic activity, the association among almost all of the developed countries was pronounced and clear. Yet, smaller movements were reflected in a great deal more dispersion.

The association among countries' fluctuations in aggregate output or employment could, of course, result from the fact that virtually all the countries experienced the same external stimulus, e.g., world wars, or because the initial shock was distributed throughout numerous countries by a closely integrated system of economic relationships. To the extent that world markets were fully integrated, of course, both common stimuli as well as international diffusion would lead to the observation of systematic covariance among countries' output, employment and other measures of economic activity.

Looking at Thorp's [17] description of business conditions in some 17 developed countries from 1890 through 1932, Moses Abramovitz attempted to measure the commonality of business cycles. Each country was classified for each year according to whether it was in the expansion, contraction, peak or trough phase of its business cycle. Peaks were given a weight of 10, expansions and contractions five, while troughs were given a weight of zero. While this measure is admittedly imprecise, compared to the more continuous measures of economic activity such as GNP, industrial production or unemployment rates, the descriptions in Thorp's *Annals* do leave little room for arbitrariness in classification. This is most notably true during periods of major swings.

An annual summary number for the world business cycle was calculated by averaging each country's numerical designation across each year. The war years 1915-1920 were not included in the sample. In the table below, the trough and the peak years, à la Abramovitz, are reported along with the value of the index. Insofar as there are 17 countries, it is quite clear that the values of the index reported are significantly different from independence — roughly an expected value of 5.0.

Abramovitz next proceeded to look at bilateral relationships. In these comparisons, two countries were designated as being in the same, adjacent or opposite phases of the business cycle. The number of times the two countries were in opposite phases was subtracted from the number of times they were in the same phase.

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This difference was then divided by the total number of times the countries were in the same or opposite phase. In the case of strict independence one would expect the above ratio to be roughly equal to zero. The higher the ratio, the more dependent the countries appear. In the table below, the U.S. and U.K. are compared with a number of countries. The table shows that during the period 1890-1932, the U.K. is far more highly integrated with other European countries than is the U.S.

Even when comparing the U.S. and the U.K. to the world cycle, it is evident that during this period, the U.K. was very highly integrated with the world economy while the U.S. was less so. Of 30 years' data, Abramovitz found that the U.S. had 15 years with the same phase, five years neighboring phase and 10 years with opposite phases. The U.K., on the other hand, had 20 years of the same phase, 10 years of neighboring phases and not one observation of an opposite phase.

In a paper written several years ago, Laffer updated the Abramovitz study for the period 1949 through 1960. Using the same weighting scheme as used by

Table 1. Index of the World Business Cycle

Year	Index	Year	Index
1893	1.4	1912	8.3
1899	8.3	1914	1.6
1901	2.4	1921	0.5
1906	8.2	1925	6.5
1908	1.0	1932	0.0

Table 2. Bilateral Cycle Comparison (1890-1932)

Countries	Ratio
U.K./France	.62
U.K./Germany	.78
U.K./Austria	.42
U.K./U.S.	.37
U.S./France	.27
U.S./Germany	.08
U.S./Austria	.00

Abramovitz, it again became clear that countries had highly synchronized cyclical phases. It was also evident that the U.S., while clearly sharing harmonic movements, was not nearly as synchronized as other developed economies. Using one measure of the degree to which a country is synchronized with the world cycle, the U.S. appears to be less synchronized than any other developed country, say Denmark.

In a study of the U.S., Canada, and Rest-of-World, Laffer and Ranson [11] compared real GNP growth rates over the period 1950-1971. Consistent with the earlier data, Canada and the United States were closely associated (correlation coefficient of .73) while both Canadian and the United States' growth rates were only weakly associated with the average of some 13 other developed countries.

Moving on to other measures of economic activity, we come to unemployment rates. While the data are not heavily analyzed for their covariation, Galenson and Zellner [6] report on unemployment rates dating back to 1900 and extending through 1950. The principal purpose of their study was to provide a detailed description and comparative analysis of the sources and definitions for the unemployment statistics. Nonetheless, crude observations can be made from the data they report. Unfortunately, the United States was not one of their nine subject countries. Judging from the data, the series do tend to move in conjunction with each other during large swings while smaller swings appear far less synchronized. The relationships appear to have shown substantial variations during different time periods.

Laffer and Ranson [11] also analyzed the unemployment rates for the U.S., Canada and Rest-of-Developed-World over the period 1959-1971. Here again, the Canadian and the United States' series are closely related (a correlation coefficient of .83), while both Canada and the United States appear to be only slightly correlated with the sum of the rest of the developed countries. From this, as well as from their real GNP growth rare comparisons, they conclude [11, p. 7]:

In sum, we find the oft-noted close association between macroeconomic fluctuations in the United States and Canada. However, these comparisons provide little evidence that the Rest-of-World economy is integrated with those of either Canada or the United States.

In a slightly broader context, comparable international unemployment rate data described in Sorrentino [15], and updated in Sorrentino and Moy [16], bring the comparisons up-to-date. The unemployment rate data cover the period from 1959 through 1973. As shown in table three below, the U.S. appears to be closely related to Canada, imperceptibly related to the other countries, while Canada

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appears only weakly related to the other countries. The other countries, France, Germany, U.K., Italy, and Japan do appear moderately closely related. These relationships are maintained whether one chooses to use the correlation matrix of the unemployment rates or changes in unemployment rates.

Another indicator of overall business conditions in a country is the stock market. This measure provides a proxy for following short-term fluctuations in the market value of a country's aggregate capital stock.

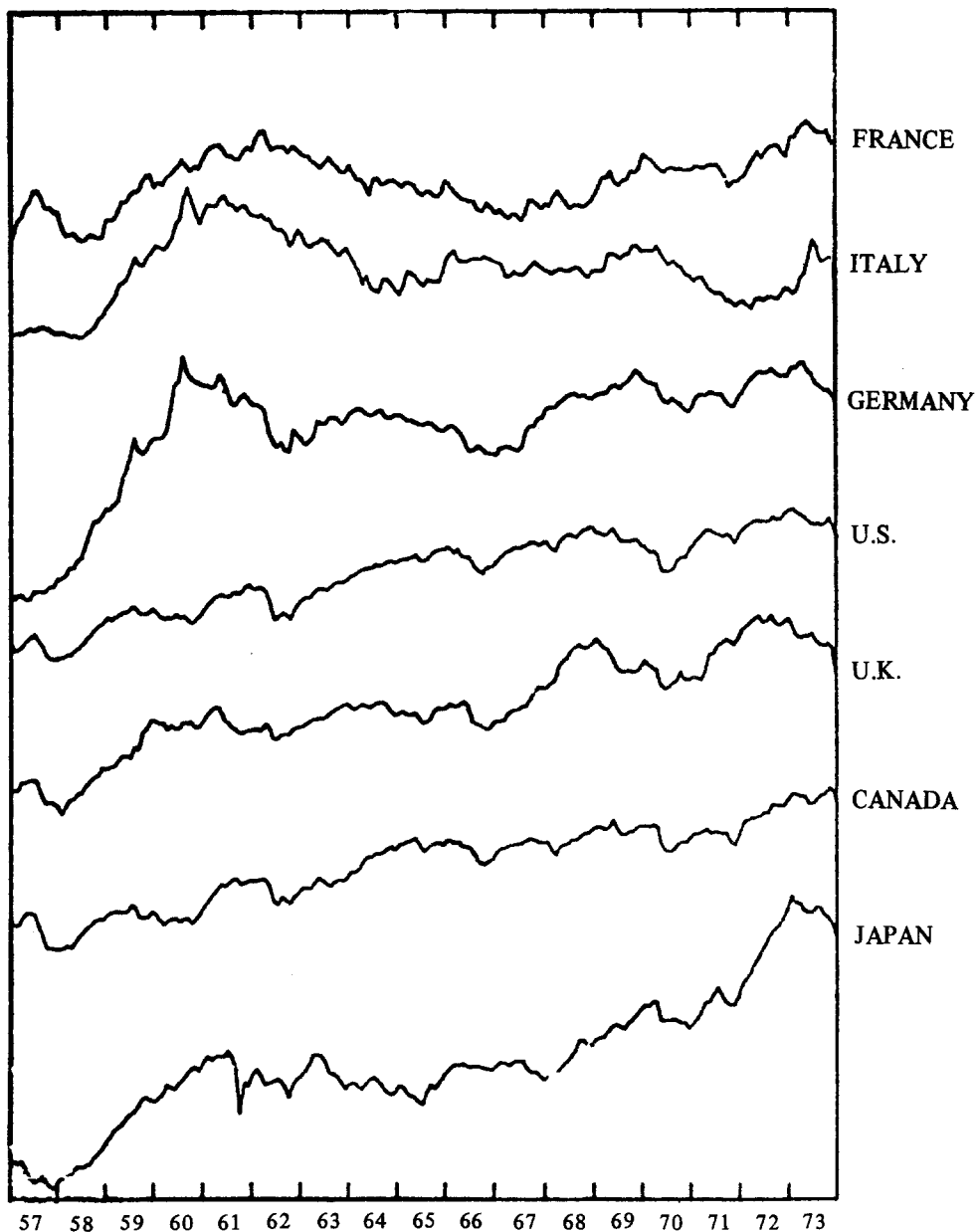
Agmon [1] found that stock prices in the United States, the United Kingdom, Germany and Japan behave as if there were one multinational stock market. Using the U.S. stock market index as a proxy for the world market, *Agmon* regressed foreign stock price changes on the world market price change. While he found a less than one-for-one correspondence in each case, the relationships were all highly significant statistically and essentially contemporaneous.

Table 3. Unemployment: Correlation Matrices (1959-1973)

Unemployment Rates						
	U.S.	Canada	France	Germany	U.K.	Italy
Canada	.83					
France	.01	.33				
Germany	-.13	.18	.65			
U.K.	.05	.21	.76	.32		
Italy	-.11	.04	.26	.67	-.14	
Japan	.37	.40	.13	.60	-.18	.81
Changes in Unemployment Rates						
	U.S.	Canada	France	Germany	U.K.	Italy
Canada	.73					
France	.07	.28				
Germany	.19	-.20	.65			
U.K.	.27	.23	.45	.40		
Italy	-.33	-.41	.25	.42	-.00	
Japan	-.02	-.19	.39	.61	.42	.77

Chart 1 displays the behavior of stock market indices for the seven major developed countries, using data published by the International Monetary Fund. A modest degree of congruence is visible. The United States and Canadian indices

Chart 1. Stock Market Indexes of Seven Major Countries
Monthly, 1957-73. Staggered semilog scale



Note: The graph is scaled so that the distance between the plot for each country at the right hand side is 1.0 — that is, one factor of 10.

Source of data: IMF, *International Financial Statistics*, line 62.

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track each other quite closely.

This picture is confirmed by the correlation matrix of percentage changes in stock market indices, shown in Table 4. The correlation coefficient for the U.S. and Canada is .82 while those for other pairs of countries are much smaller.

In all, whether we view the aggregate data from an unemployment economic activity or stock market basis, we come to roughly the same inference: The inference appears to remain roughly the same now as it did in an historical context. From these data and using these measures, the U.S. and Canada are definitely highly intertwined in their economic relationships. In the same sense, but to a slightly lesser extent the principal countries of Western Europe are economically integrated. From these data, however, one is not able to reject the hypothesis of substantial independence between the regions of North America and Western Europe and perhaps with an additional independent region being Japan. The careful reader should note that while dependence appears quite well established between say, the U.S. and Canada, the failure using these measures to find substantial dependence between Western Europe and North America does not establish independence. This measure is only one of several possible measures.

**Table 4. Percentage Changes in Stock Market Indices:
Correlation Matrix (monthly, 1957-73)***

	U.S.	Canada	France	Germany	U.K.	Italy
Canada	.82					
France	.27	.25				
Germany	.36	.31	.33			
U.K.	.45	.44	.19	.29		
Italy	.17	.16	.25	.34	.18	
Japan	.23	.32	.14	.13	.20	.14

* Source of data: IMF, *International Financial Statistics*, line 62 of the respective country pages.

2. External Quantity Integration

An alternative indicator of the degree of economic integration is the extent to which relative divergences in markets are accommodated by intercountry goods flows. Thus, within integrated markets, goods should move so as to off-set demand and supply imbalances. The net flow of goods, or net absorption, is nothing more than the difference between income and total expenditures. Thus, to the extent that a country increases its demand for goods without a corresponding income increase,

then it would be likely to absorb goods net from the Rest-of-World. One major drawback to this approach to integration is that one must specify the factor or factors that affect net absorption. The measures, therefore, become as much of a test of the specific formulation of the absorption relationship as they are of integration.

The principal measure of a country's short-run incipient excess demand for goods has generally been postulated as its growth rate. This corresponds very closely to the traditional view that expenditures on imported goods depend upon a country's income, while a country's exports depend upon total foreign income. In a testable formulation, Laffer introduced growth rates into the relationship and tested the proposition of world goods market integration. Covering much of the postwar period and some 15 countries, goods flows were found to be moderately sensitive to incipient excess demands as determined by changes in relative rates of growth. The specific cross-section test was to look at five-year changes in a country's trade balance/GNP ratio in relation to the change in that country's growth rate.

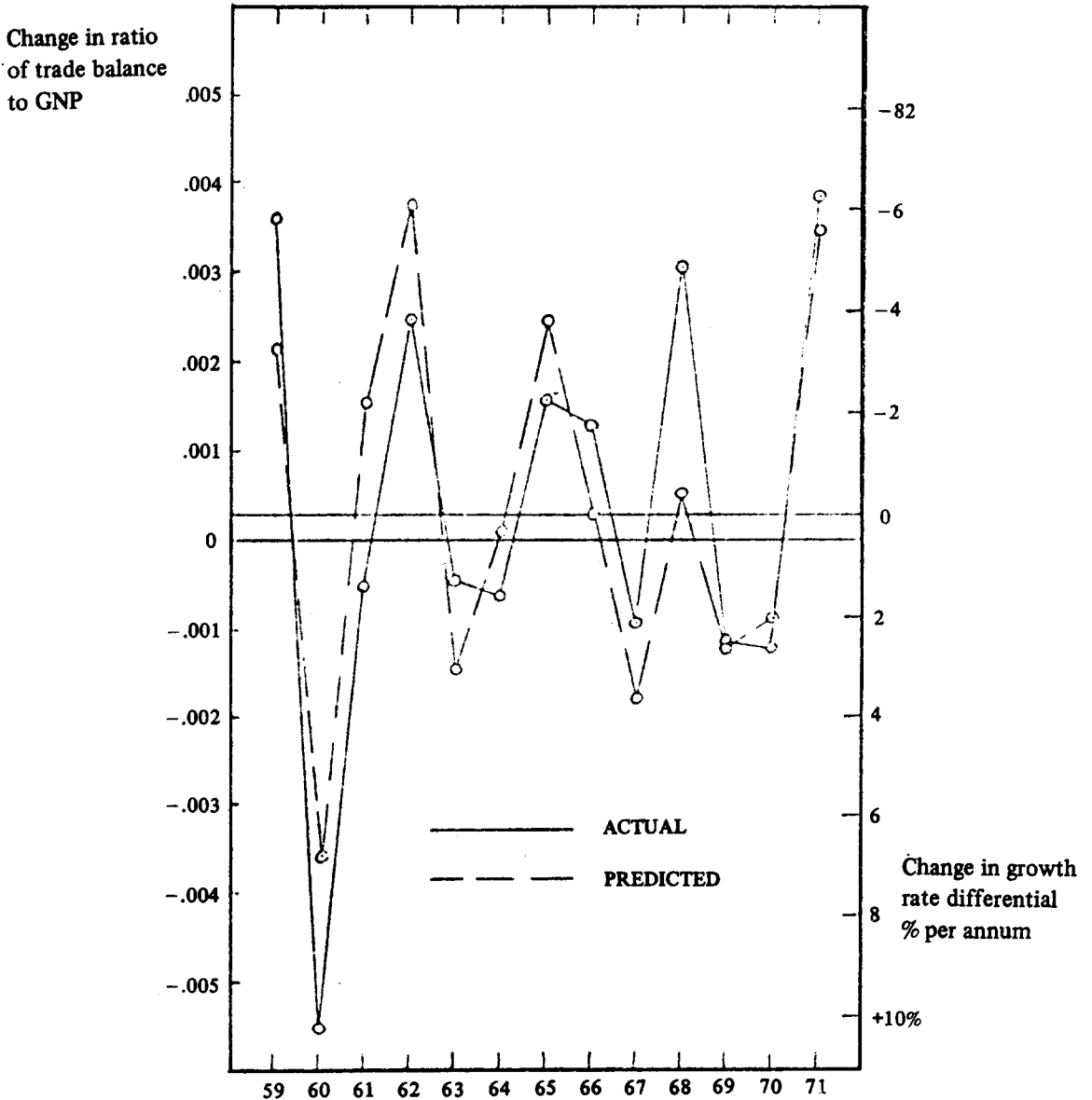
In a later paper, Laffer and Ranson [11] attempted to include other factors along with growth in their measures of economic integration of the U.S., Canada and Rest-of-World. The other factors looked at were fiscal policy measures and exchange rates.

While the exchange rate and fiscal factors did not prove very helpful, the overall results were successful. The relationship between the U.S. and Rest-of-World was exceedingly close and displayed a close degree of economic integration. In the chart below, the U.S./Rest-of-World relationship is shown. As is quite apparent, the measure of excess demand is very closely correlated with actual trade flows. In a second chart, also below, the relationship is also close between net goods flows and excess demands between Canada and the Rest-of-World. While the results were unimpressive for the U.S./Canada relationship, this arises because there is so little difference in their growth rates (see Section 1).

Prior to leaving this subject area, it is worth noting that Laffer [9] reports that these same relationships hold for the U.S./Rest-of-World, Japan/Rest-of-World, EEC/Rest-of-World and U.K./Rest-of-World. While the level of integration is striking, it is also noteworthy as to just how quickly these responses occur. It requires little in the way of formal regressions to see the rapidity of the responsiveness and the amount of variation explained. Another surprise is just how little is left over for the exchange rate changes to explain.

In all, a look at absorption fills in several of the gaps left in the previous sec-

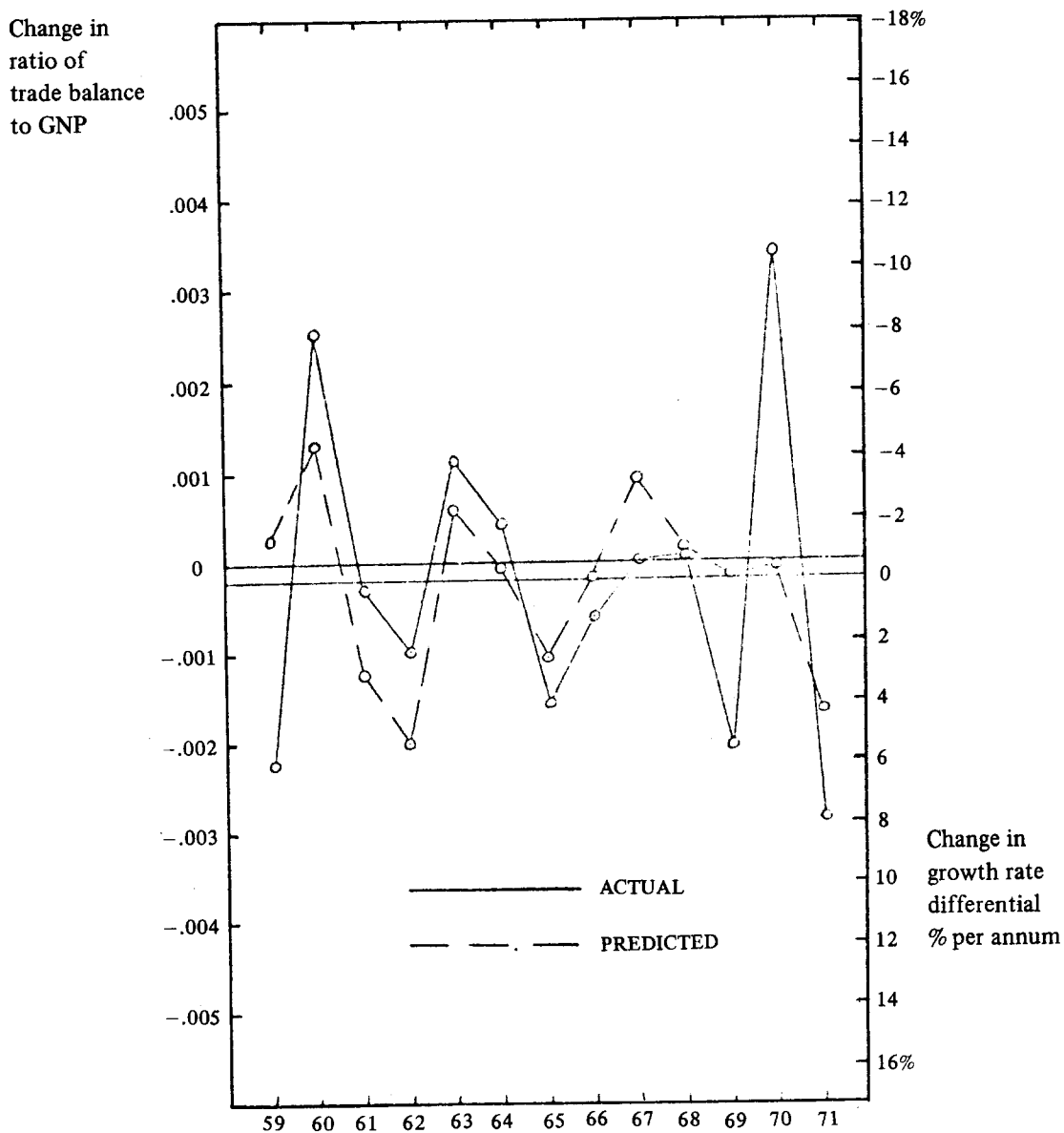
**REST-OF-WORLD BILATERAL TRADE BALANCE
WITH THE UNITED STATES**



Note: The vertical scales have been so arranged that the dashed line represents either the explanatory variable (right scale), or the prediction of the dependent variable derived from the regression (left scale).

Source: Laffer-Ranson [11, p. 14].

CANADIAN BILATERAL TRADE BALANCE WITH THE REST-OF-WORLD



Note: The vertical scales have been so arranged that the dashed line represents either the explanatory variable (right scale), or the prediction of the dependent variable derived from the regression (left scale).

Source: Laffer-Ranson [11, p. 17].

tion. In that section, Canada and the U.S. were found to be very closely integrated while there was little evidence of the North American region being closely integrated with say, Europe or Japan. In this section, the bulk of the evidence points to a very close degree of integration between both Canada and the United States with the Rest-of-World. Using net absorption measures, these areas are closely integrated and over very short periods. Goods move as if there were only one market.

3. Money Markets, Interest Rates and Economic Integration

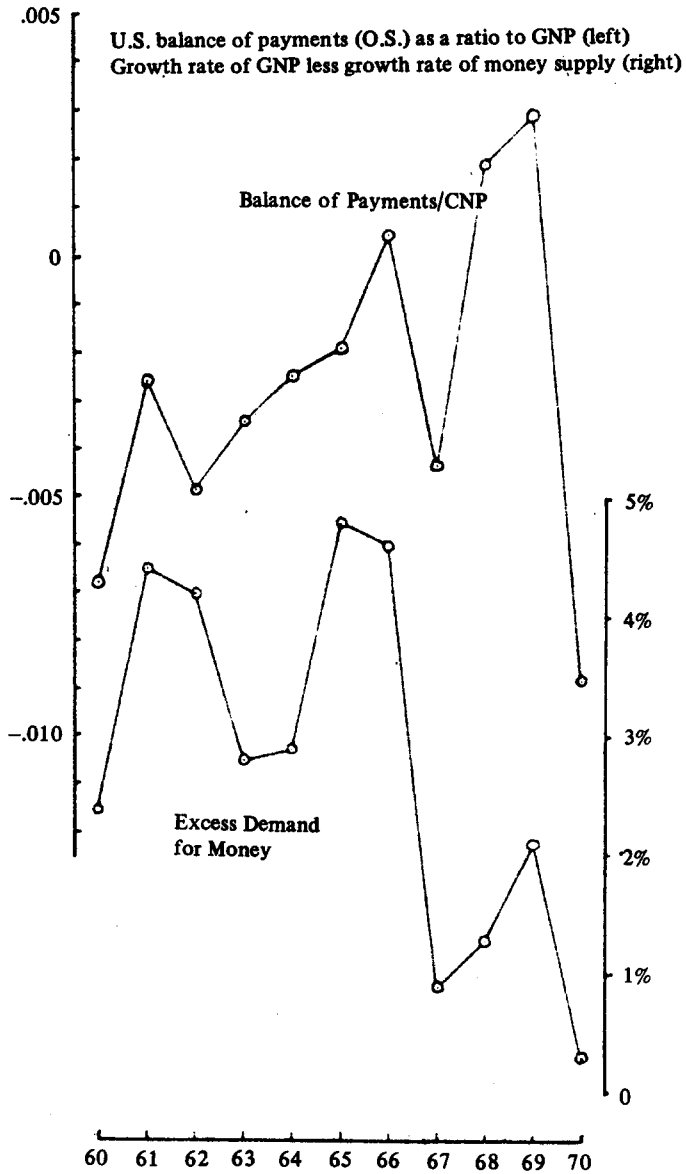
The recent revival of the monetary approach to the balance of payments represents to a large extent a rejection of the segmentation hypothesis. This theory postulates a fully integrated world economy where demand and supply imbalances in the money markets are accommodated by intercountry money flows. Within this framework, the overall balance of payments is little more than the net flow of money (or reserves of the banking system) between countries. Countries with incipient excess demands for money would tend to run balance of payments surpluses while countries with excess supplies of money would have deficits. Under flexible exchange rates, excess demands for money would result in currency appreciation and excess supplies of money in currency depreciation.

While this theory of the balance of payments dates well back into the late 18th and early 19th centuries, it suffers from the same practical drawbacks as the absorption approach to goods market integration. Prior to actually testing whether the theory itself holds, the model must also postulate an explicit excess demand for money. Therefore, empirical tests become as much a test of the specific money demand and supply functions as they are of the full economic integration hypothesis. Nonetheless, a number of studies have been successful in integrating balance of payments theory with domestic monetary theory and showing numerical support.

Empirical studies have usually assumed that the demand for nominal money balances depends upon the level of current nominal income. They have also assumed that changes in the supply of money can result from internal as well as external credit creation.

Covering historical periods, McCloskey and Zecher [13] for the United Kingdom and Williamson [18] for the United States, find that money markets during the 19th century were highly integrated. Money, via the balance of payments,

THE BALANCE OF PAYMENTS AND THE EXCESS DEMAND FOR MONEY*



*Source: Laffer [8].

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flowed quickly to areas where income (and hence money demand) was growing and away from areas where it was falling. Gold discoveries resulted in overall deficits (or lower surpluses) for the gold discovering (money creating) nations and led to balance of payments surpluses elsewhere.

Studies of more recent periods also tend to corroborate the view that money markets are highly integrated across countries. In a series of papers, Laffer [8], looks at the monetary approach with special reference to the United States. Here the results are quite striking in their consistency with the theory. Using quarterly data for the later postwar period, the balance of payments was found to be quite closely related to changes in U.S. income, changes in U.S. velocity, and changes in the U.S. money supply. The U.S., being viewed as the world's producer of money, tended to have larger balance of payments deficits when income rose more slowly, velocity rose more slowly and when changes in the domestic stock of money were great. In the chart below, a graphic representation shows the closeness of the relationship on an annual basis.

Guitian [7] with regard to Spain, Porter [14] for Germany found similar results. In each of these studies, the monetary approach to the balance of payments appears to have borne out well. Money flows moved swiftly to neutralize potential imbalances in the demands for and supplies of money. Lags were not found to be appropriate and the proportion of variance explained was quite great in each case. Laffer and Ranson [11] however were not successful in recreating a model that corroborated the monetary approach between Canada and the United States.

One interesting implication of these studies and looked at specifically in Guitian [7] is the effect of devaluation on the overall balance of payments. According to the monetary approach, a devaluation will lead to a sufficiently great increase in domestic prices so as to bring them back into line with foreign prices. This rise in the domestic price level has the effect of reducing real money balances relative to real income and therefore, leaving the country short of money. One implication of the monetary approach is that a devaluation would lead to a once-and-for-all surplus in the overall balance of payments, while the country in question reacquired the requisite money balances. The important points to note here are that the improvement occurs because of a money market effect and that the improvement is strictly temporary.

4. Prices and Economic Integration

From the standpoint of economic theory, no evidence can be as convincing of

integration as adherence to the law of one market price. In the literature on pure trade theory, complete economic integration implies factor-price equalization. Incorporating money markets into the analysis, economic integration also implies some forms of the purchasing power parity doctrine.

From a theoretical standpoint, the concept of a fully integrated world market, assuming utility maximization, leads one directly to the view that only one market price should hold. All commodities' prices should be fully arbitrated in each and every numeraire at each and every moment in time. If this were not true, then exceptional profit opportunities would arise for anyone who wished to arbitrage the discrepancies. Thus, if one market price does not hold, either profit maximization does not hold, or markets are, via either natural or artificial barriers, segmented. One of the earliest of the modern versions of purchasing power parity is to be found in Cassel [4].

Formally, efficient integrated markets, along with profit maximization, imply that the price of any one commodity in any one country's numeraire will equal that same commodity's price in any other numeraire times the exchange rate between the two numeraires:

$$P_{i/A} = P_{i/B} \cdot P_{B/A} \quad (1)$$

for all commodities i and currencies A and B , where $P_{x/y}$ is the price of x in terms of y .

Conceptually, it is an easy jump from this requirement to the implied behavior of overall price indexes, although empirically the task is more difficult. Let me define the inflation rate for country A as an index $I_{A,t}$ of the rates of change $\frac{d}{dt} \log P_{i/A,t}$ of the prices of the individual goods i :

$$I_{A,t} \equiv \sum_i w_{i,A,t} \cdot \frac{d}{dt} \log P_{i/A,t} \quad (2)$$

where the weights $w_{i,A}$ are based on the value aggregates of the various goods, and sum to unity. The time subscript t will be omitted throughout.

The relationship between I_A and the corresponding inflation rate for country B depends on the behavior of the relative prices of the goods. First, define the relative price P_i of good i in terms of its rate of change by subtracting the rate of change of the inflation index I_A from the rate of change of the currency price $P_{i/A}$:

$$\frac{d}{dt} \log p_i \equiv \frac{d}{dt} \log P_{i/A} - I_A \quad (3)$$

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Now B's rate of inflation

$$I_B \equiv \sum_i w_{i,B} \cdot \frac{d}{dt} \log P_{i/B}$$

can be expanded as

$$\sum_i w_{i,B} \cdot \frac{d}{dt} \log P_{i/A} + \frac{d}{dt} \log P_{A/B} \quad (4)$$

by using equation (1), where $P_{A/B}$ is the currency exchange rate. By substituting (3) into (4) so as to eliminate the term in $P_{i/A}$, the complete formula for the relationship between the inflation rates of two countries is obtained:

$$I_B \equiv \sum_i w_{i,B} \cdot \frac{d}{dt} \log p_i + I_A + \frac{d}{dt} \log P_{A/B}, \quad (5)$$

This expression can be greatly simplified if the following explicit assumption is made about the behavior of the relative prices.

If at time t , the rates of change of relative prices $\frac{d}{dt} \log p_i$ vary independently with the weights (both A's and B's) from one good to another, then the summation term cancels to zero approximately.*

Finally, working with the expected value of I_B over a period of time instead of the exact value at time t , an exact relationship

$$\epsilon_t I_B = \epsilon_t I_A + \frac{d}{dt} \log P_{A/B} \quad (6)$$

is obtained.

If index weights are not systematically associated with relative price changes, the following propositions hold for an integrated efficient market:

- (a) Individual commodity prices in a common numeraire move together.
- (b) Percentage changes in the price of foreign exchange will result in correspondingly greater domestic percentage price index increases than abroad.
- (c) Inflation rates will tend toward equality during periods when exchange

* This result follows from the theorem that the expectation of a product of independent variables equals the product of the expectations. The canceling is exact if the weights and rates of relative price change are orthogonal; but in practice, the sample size is finite and independence implies only a tendency toward orthogonality. Of course, the greater the number of goods, the smaller the sampling error, and the closer we get to orthogonality.

rate changes do not occur.

While the conceptual issues are, on the surface at least, relatively straightforward, there are numerous empirical complications. In the first place, many of the available data consist of list prices and not transactions prices. Second, many of the data are imputed and not measured directly. Third, there are obvious problems in standardization of product across time and among countries. Fourth, individual prices are often measured with considerable error and not at the same moments in time. Fifth, there are differences among countries in taxes, price controls, and transport costs. Yet it is still worthwhile to survey the data while recognizing their shortcomings.

In a recent study, Hans Genberg made several tests of the first proposition. Using specific internationally traded commodities, Genberg established beyond any reasonable doubt that these commodities at least move very closely together. Genberg looked at quarterly rates of change for Cacao, Copra, Jute, Rubber, Tin and Copper in several specific markets. In attempting to look for leads or lags, his results were not encouraging because even when such possibilities were accommodated, the concurrent effect was virtually everything. The coefficients also approximated unity. Other studies on specific prices have been carried on in several other contexts.

With regard to devaluations, revaluations and covariation among rates of inflation, we have papers by Laffer [10], Laffer-Ranson [11], Gaillot [5] and the monumental work by Moon Hoe Lee [12]. Laffer's two papers are concerned primarily with the postwar experiences of a limited number of highly developed countries. He found that in general using wholesale prices, countries that devalued

Table 6. Percentage Price Increases in Dollar Indexes (1961-1971)

Country	Consumer Prices	Wholesale Prices	Exports Prices
U.S.	53	21	24
Japan	88	18	15
Germany	55	31	40
Italy	53	35	20
France	38	23	23
Canada	35	26	25
Britain	37	24	29

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tended to experience more rapid inflation than they had prior to the devaluation and also than the countries they devalued against. In his other study, he looked at price performances of a few of the largest industrial countries during the period 1960 through 1970. Converting all the indexes to a dollar base, there was little, if any, evidence for systematic loss of competitive position by any one country. Different indexes, however, displayed notably different behavior. In the table below, the percentage changes in the dollar converted price levels are displayed for the Consumer Price Indexes, Wholesale Price Indexes and Export Price Indexes.

Hans Genberg compared the overall rate of inflation in Sweden with a proxy for the world's rate of inflation. The data were quarterly and covered the period 1950 through 1970. Genberg found that Sweden's rate of inflation was closely related to that of the world and that the coefficient was not significantly different from unity. Laffer and Ranson [11] found similar results in their study of the U.S., Canada and Rest-of-World. They, too, used quarterly data that covered the period 1948/II to 1970/IV. Using both ordinary least squares and generalized least squares, they found, as did Genberg, little evidence for systematic lags or leads; a very significant association among countries; and finally, that the relationships of the percentages were insignificantly different from unity.

The Lee results are perhaps the most impressive evidence to date on the issues at hand. Lee collected data for whole-sale prices from 1900 to 1972 annually. The countries covered included the United States, the United Kingdom, Canada, France, Germany, Italy, Japan, Netherlands and Switzerland. He basically viewed the data in three ways. First, he related each non-U.S. country's rate of inflation to both the U.S. rate of inflation and to the rate of change of the exchange rate. Second, he related what he called excess inflation (a country's rate of inflation less the U.S. inflation rate) to the rate of change of the exchange rate. The third and final set related the rate of change of the exchange rate to the country's excess inflation. These tests were carried out using both annual data as well as three year averages. The tests also looked at two years' worth of both lags and leads in addition to solely concurrent relationships. Finally, the tests reported the results using both ordinary least squares and generalized least squares.

In Table Seven is his compilation on the tests of means. The first column tells the country's average annual excess inflation and average annual rate of change of the exchange rate. The second column reports the "means," while the third, the "standard deviations," and the fourth the size of sample. The results are self-evident.

Putting the relationships in a far more informational manner, Lee regressed the rate of inflation in each country by year on the rate of inflation in the United

**Table 7. Means of the Inflation Rate and Exchange Rate Change Data*
Annual Rates, 1900-72.**

Country	Mean	Standard Deviation	Sample Size
CANADA			
Excess Inflation	-.001	0.04	72
Exchange Rate Change	.0001	0.03	72
FRANCE			
Excess Inflation	-.063	0.12	72
Exchange Rate Change	-.064	0.20	72
GERMANY			
Excess Inflation	-.044	0.21	61
Exchange Rate Change	-.044	0.23	61
ITALY			
Excess Inflation	-.066	0.22	72
Exchange Rate Change	-.064	0.22	72
JAPAN			
Excess Inflation	-.073	0.23	72
Exchange Rate Change	-.070	0.25	72
NETHERLANDS			
Excess Inflation	-.001	0.09	66
Exchange Rate Change	.001	0.07	66
SWITZERLAND			
Excess Inflation	.002	0.08	58
Exchange Rate Change	.005	0.07	58
UNITED KINGDOM			
Excess Inflation	-.009	0.07	72
Exchange Rate Change	-.009	0.07	72

* Source: Lee [12]

States and the percentage change in the country's exchange rate (the dollar price of a unit of the country's currency). The results for both the concurrent as well as the lag-lead pooled data are reported in Table Eight.

The above results are consistent with an integrated world economy. In each of Mr. Lee's other forms used for testing, he obtained similar results. In the case where no lags were assumed, there is a close relationship between the inflation rate in the non-U.S. region and the rate of inflation in the and *vice versa*. Likewise, Mr. Lee's

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Table 8. Regression Analysis with Foreign Inflation as Dependent Variable*
Annual Data, 1900-72

U.S. Inflation						Change in Exchange Rate					R ²	D-W
Const	t-2	t-1	t	t+1	t+2	t-2	t-1	t	t+1	t+2		
.015	...	...	.75	...	...	...	...	-.71	...	...	.70	1.79
(3.54)			(17.4)					(29.6)				
.002	-.05	.05	.72	.18	.21	.08	-.23	-.53	-.13	-.09	.79	1.62
(0.5)	(1.3)	(1.1)	(17.7)	(4.5)	(5.3)	(3.3)	(8.3)	(19.9)	(5.0)	(3.8)		

* Source: Lee [12]

results show a close association between changes in a country's exchange rate and its inflation rate. A country's inflation rate relative to the U.S. is found to rise when it devalues and falls when it revalues. In this form, some 70 percent of a country's inflation rate can be "explained" by the U.S. rate of inflation and changes in the country's exchange rate with the dollar.

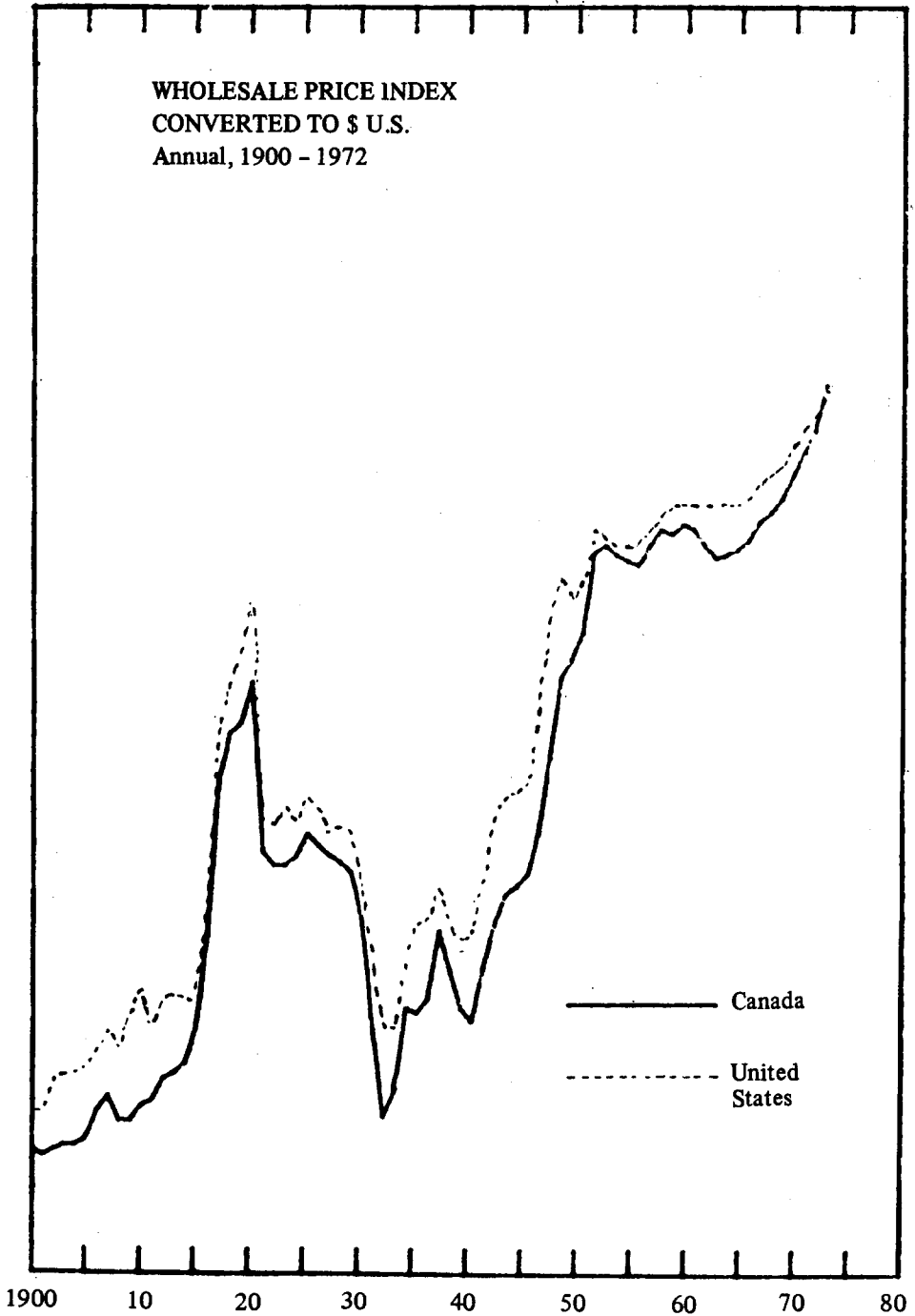
Going to his results using leads and lags, we are struck by the significance maintained by the concurrent variables. While some leads and some lags turn out to be statistically significant, by far the majority of the variance explained is due to the concurrent variables. Given the numerous numerical problems as well as the gross nature of the relationship postulated, it is a strong evidence for an integrated world economy as could be imagined.

If one sums the coefficients across each variable, there is little evidence that the coefficients differ from unity in the case of U.S. inflation or minus unity in the case of changes in the exchange rates. The actual sums are 1.11 and -.90, respectively. It is also worthy of note that the constant term, while significant in the simple equation, turns out to be statistically insignificant in the lags and lead equation. To date, the Lee results appear to be the single most definitive work on the subject of economic integration internationally.

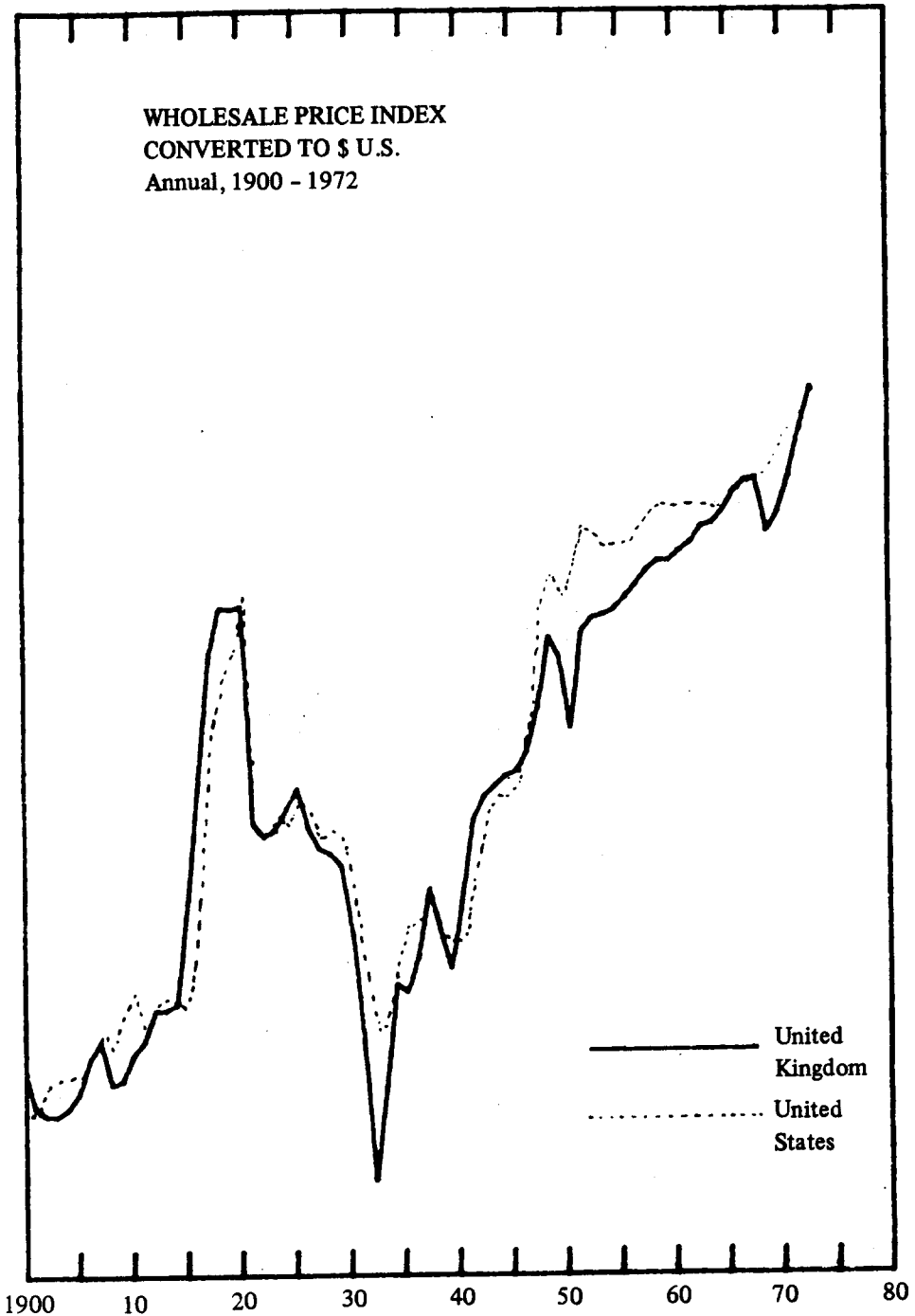
To see the relationship visually, in the charts below Mr. Lee's data are plotted for bilateral comparisons of the U.S. wholesale price index with the dollar-converted wholesale price indexes for Canada, the United Kingdom, Japan, France and Italy, respectively.

In all, there appears to be little, if any, reason to presume independence among

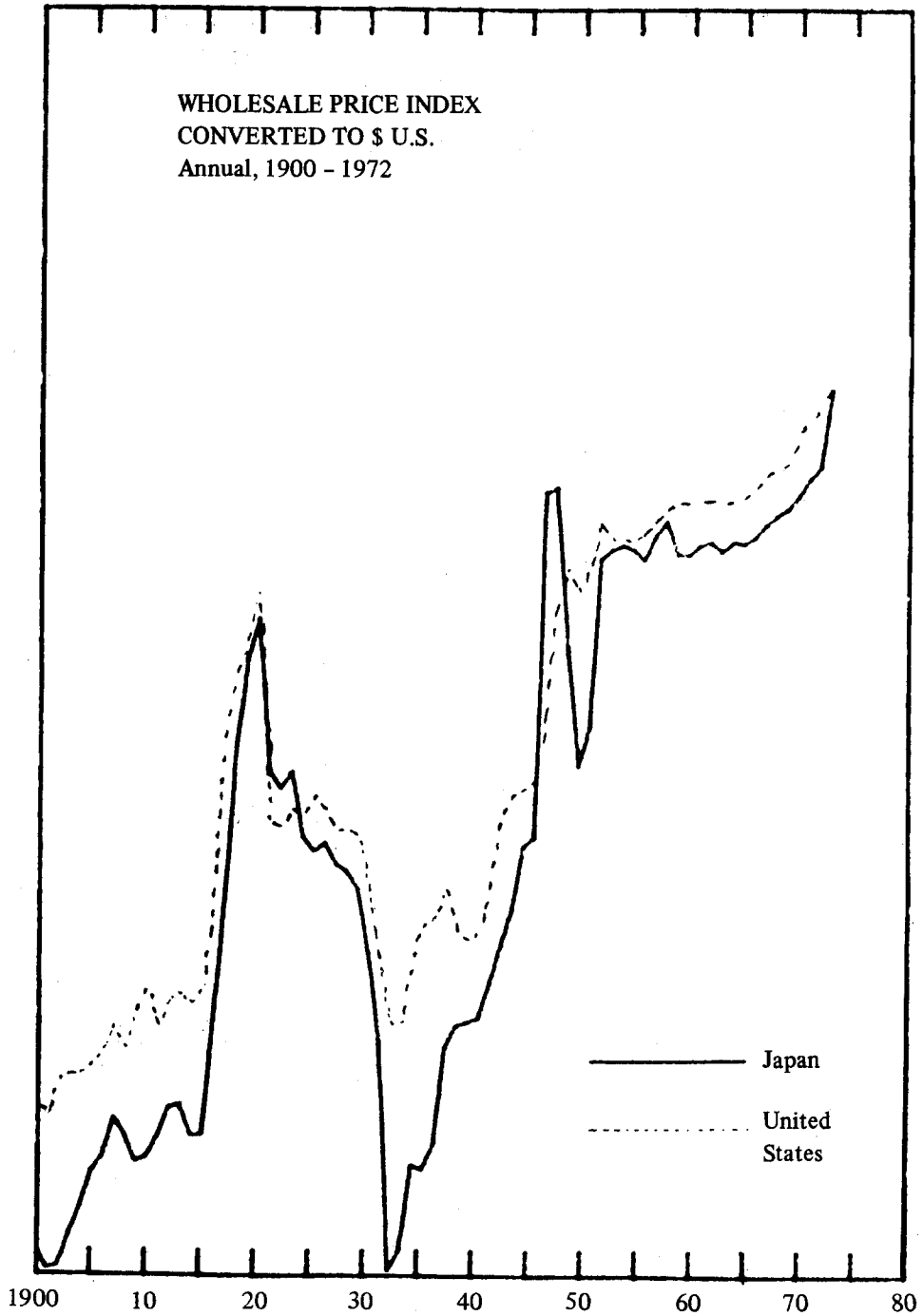
CANADA



UNITED KINGDOM

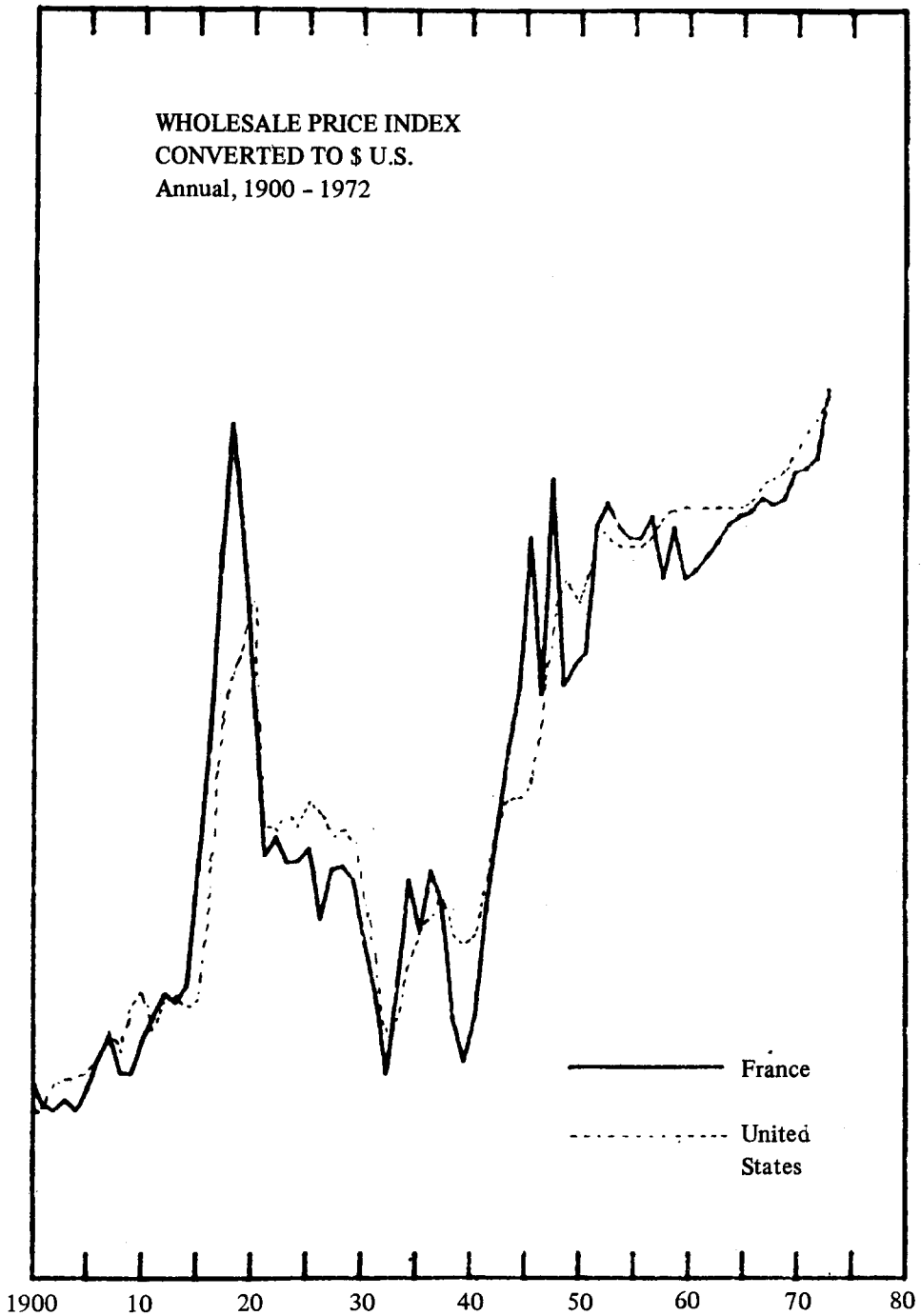


JAPAN

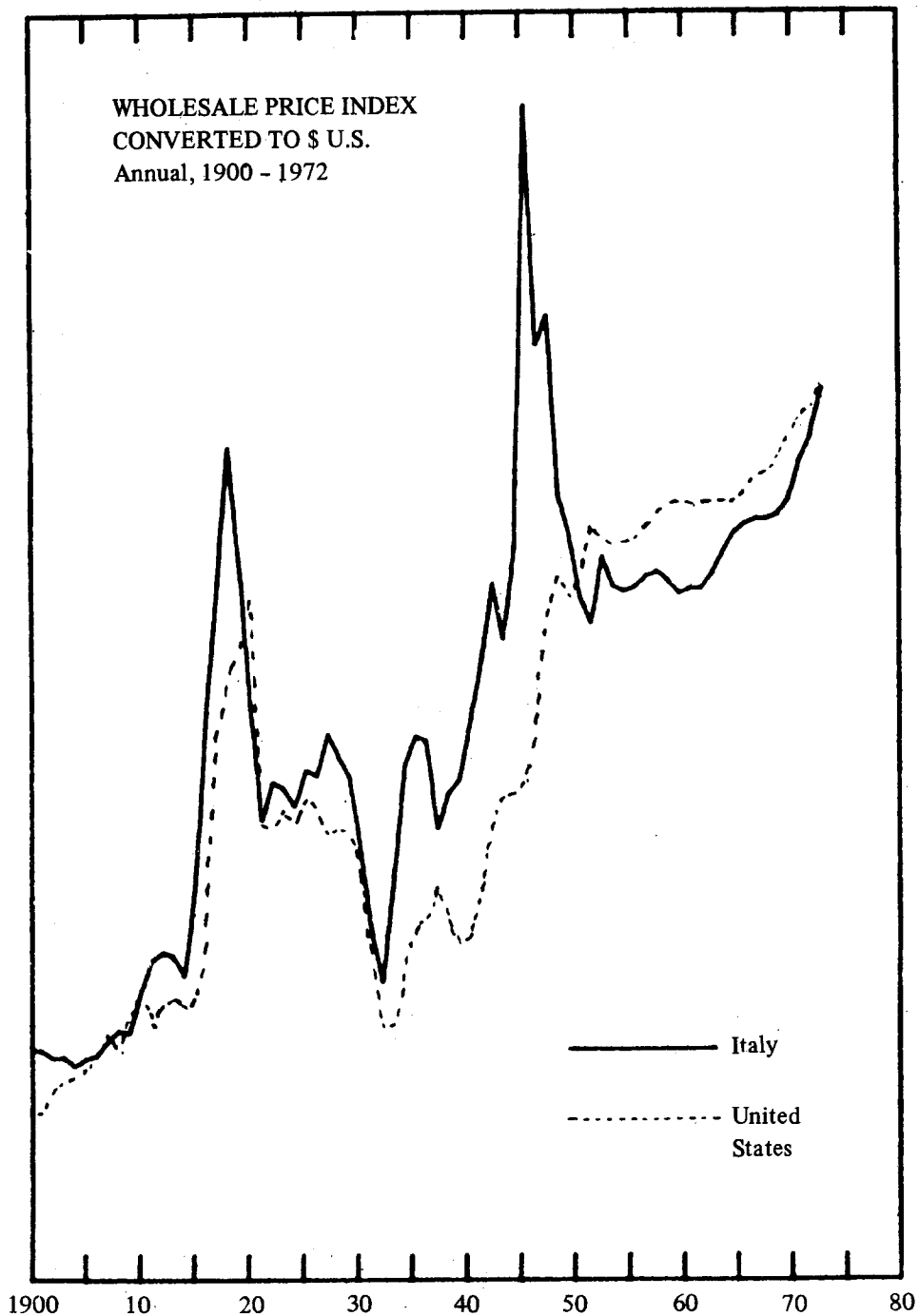


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FRANCE



ITALY



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countries' rates of inflation or other price data. Adjustments appear quick and complete to the extent that data exist. Inflation is a one market world phenomenon and will differ among countries to the extent and to the full extent of changes in their exchange rates.

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