95-F-17

# A Dynamic Model of Exchange Rate and Japanese Exchange System

## Management Dynamics of the Free-Fall in Dollar's Exchange Value

by

Vipin Gupta
University of Pennsylvania

and

Takahiro Fujimoto
University of Tokyo

May 1995

# A Dynamic Model of Exchange Rate and Japanese Exchange System[1]

*Management Dynamics of the Free-Fall in Dollar's Exchange Value*

**Vipin Gupta**

**and**

**Takahiro Fujimoto**

**University of Tokyo**

**May 1995**

---

[1] This research significantly benefited from many discussions on this topic held with Dr. Masaru Yoshitomi, Vice Chairman, Research Institute of Long Term Credit Bank.
The research was funded through a fellowship grant by The Japan Foundation to Vipin Gupta.

**Abstract**

This paper uses a general systems approach to develop a dynamic model to determine exchange rate. Given the breakdown of orthodox exchange rate theories to explain recent exchange rate volatilities, and the priority given to stable exchange rates in the World Trade Organization Act, this paper highlights how insights obtained from micro-systems management models can be generalized to explain exchange rates at the macro level. The model is authenticated through a case study of Japan, with a particular focus on the causative forces in recent exchange rate volatilities and quantification of impact of these volatilities on potential value of world trade. Finally policy recommendations for the increasing threat of hollowing-out in Japan are given.

## I Strategic Overview

1990s have witnessed severe exchange rate volatilities at regional (European Monetary System and North American Free Trade Agreement) as well as global levels with the US dollar witnessed a virtual free fall of 15-20% in its exchange value against Japanese yen and German mark in early 1995. The orthodox exchange rate theories and models have not been able to explain these volatilities, leave alone predicting exchange rates and developing an approach to ensure stable and orderly function of exchange system.

The orthodox models of exchange rate determination follow a common approach, which may be termed as "Quantity Approach". The most common technique is to model exchange rates as a function of domestic factors - in particular equilibrium relative domestic prices amidst sluggish domestic wages. The most widely believed theory of exchange rate determination is "Purchasing Power Parity" (PPP), according to which the ratio of domestic to foreign prices determine the "fundamental" or "equilibrium" exchange rate:

E = lambda (Pf/Pd)

where E is foreign price of one unit of domestic currency (i.e. Exchange rate)

Pf is an index of foreign prices

Pd is an index of domestic prices

lambda is a constant.

The above form of PPP has always been rejected empirically as tests show that the above form does not hold exactly for any pair of countries over any period.

Since the early 1980s, it has been noted that exchange rates and prices are non-

stationary. Therefore researchers have followed an approach that tests for three conditions: (a) whether E, Pf, and Pd are cointegrated, (b) whether Pf and Pd are symmetric, and (c) whether Pf/Pd and E are proportional. This approach relaxes the strict condition that PPP should hold at each moment, and recognizes that there may be temporary or cyclical time-spectral effects on exchange rates over a given period.

Procedures based on systems methods (see for example, Johansen (1991) and Stock and Watson (1993)), have found evidence for cointegration of E, Pf, and Pd. However, the estimated cointegrating vectors have typically violated the symmetry and proportionality conditions implied by PPP (see for example, Patel, 1990; Fisher and Park, 1991; Johansen and Juselius, 1992; Crowder, 1992, and Cheung and Lai, 1993).

Amidst failure of above approach also, there has been a search, and consequent proliferation, in the auxiliary variables that can explain empirical failure of the PPP equation (see, for example, Edison, 1987, Edison and Klovland, 1987, and Perron and Vogelsang, 1992). None of these variables - that vary from domestic stock market prices to impact of derivatives and speculation - have found systematic conceptual base or universally applicable empirical validation.

The only systematic and relatively universal validation of PPP has come from studies that use a time-period spanning over 50-70 years (see, for example, Edison and Klovland, 1987, and Ardeni and Lubian, 1991). However the orthodox theory has found it difficult to explain the specific causative factors in such long-term operation of purchasing power parity effects.

Now the international exchange system is operating under the aegis of a new institution World Trade Organization (WTO), that is supported by World Bank and

International Monetary Fund. In the Uruguay Round of General Agreement on Tariffs and Trade (GATT), international community strongly endorsed its confidence that "Greater exchange rate stability, based on more orderly underlying economic and financial conditions, should contribute towards expansion of trade, sustainable growth and development, and correction of external imbalances" (The Legal Texts, 1994, p. 442). This statement strongly suggests that exchange rate is an important factor in realization of exchange potential among various entities - whether organizations or nations.

There is therefore a need to understand exchange rate and its role in the exchange system from a broader perspective. This paper shows that from a General Systems Approach, the essential dynamics of exchange is same at any given level - ranging from very micro such as product development in an organizational division, to very macro such as aggregate trade value of nations. The rate at which an entity engages in exchange is essentially of the same nature at all these levels - though the rate is termed as "price" or "opportunity cost" at the very micro level, and as "exchange rate" at the very macro level.

Thus from a general systems perspective, the analytical concepts used for investigation and determination of micro level exchange rate and exchange system can with appropriate modification be applied flexibly to develop a model for macro level exchange rate and exchange system. There is a well-developed stream of literature for the micro-level systems for determining evolutionary dynamics of organizational exchange system. These models include inter-organizational exchange models given in contingency theory (Thompson, 1967) and transaction costs theory (Williamson, 1975); inter-temporal industrial life-cycle models (Abernathy, 1978), inter-temporal technology

life-cycle models (Tidd and Fujimoto, 1995), and intra-organizational temporal exchange through learning etc. (Nelson and Winter, 1982).

Till now there has not been any systematic attempt to model the micro-factors in a way that can be flexibly applied to all levels of exchange system, within the rubric of general systems perspective. There are some models of exchange such as social network models that have been applied in a variety of settings including industrial exchange (e.g. Burt, 1992). Unfortunately, theoretical foundations of social network models are not fully compatible with the international norms of mutual gains through exchange system as enunciated under the World Trade Agreement.

This paper therefore fills the gap in the current literature by bridging micro and macro exchange models using a general systems perspective. It develops a model that explains the higher-order dynamics of an exchange rate and exchange system, and shows its broader applicability. The model is then authenticated through a case study of exchange rates and exchange system of Japan, with a particular focus on the impact of recent exchange rate volatilities on global trade and the causative factors in these volatilities.

**II Preliminaries**

In order to construct a general systems model to explain higher-order dynamics of exchange rate and exchange system at all levels, there are some steps that must be taken to modify the foundations of the orthodox approach of exchange rate determination.

The first step in the construction of a general systems model of exchange rate and exchange system is use of "Value Approach", instead of the orthodox "Quantity Approach. The model recognizes that the ratio of domestic to foreign prices can

determine equilibrium exchange rate only if the base quantity is comparable. If quantities of various exchange transactions are not comparable, then the prices must be weighted with the quantities to obtain a value-based index (which is proportional to total value itself). This requirement is most basic of any unit of measurement - one can not appropriately add prices of apples with prices of oranges however careful is the process of construction of price and quantity indices. This issue is all the more important in the international exchange system, for the orthodox trade theory holds that exchange occurs primarily in distinct goods and services - where distinctiveness may come from inter-industry factors, and intra-industry factors such as product differentiation, market segmentation, etc. Therefore the orthodox approach of investigating exchange rates based on differences in domestic product and factor prices across nations is incompatible with the micro-systems conditionalities.

The second step in construction of new model is adoption of an Ontological Approach that derives dynamic equilibrium exchange rate by correcting observed exchange rate with impediments to its equilibration, instead of conventional Phenomenological Approach that adjusts a notional equilibrium rate given by purchasing power parity with adjustment lag effects to obtain expected equilibrium market exchange rate. A balance of payments equilibrium condition demands that all inflows equal all outflows. Therefore disequilibrium factor is appropriately computed by the proportionate disparities in the value of outflows and inflows. The dynamic exchange rate is one where inflows and outflows are equal. If value of inflows does not equal value of outflows, then underlying market exchange rate is not free-floating exchange rate and need to be adjusted with the correction factor equivalent to dirty-float effect.

The third step in construction of new model is appreciation of the strategic role of institutions such as corporate management or World Trade Organization. These institutions play an important heavy-weight role in determining approach of an organization or nation towards its exchange system. A sustained disequilibrium in exchange values in the absence of appropriate heavy-weight role results in accumulation of stock inflation, while a sustained equilibrium in exchange values led by heavy-weight role ensures equivalence in purchasing power of various nations. This third step has been found to be very critical in the research on micro systems dynamics. While most of the dynamic models in micro-systems literature have investigated first-order dynamics character within the rubric of evolutionary models, some have analyzed the second-order dynamics. These models account for diversities in organizations (and by natural implication in exchange system) using variables such as coordination (see in particular Aoki, 1995) and heavy-weight management integration (see in particular Fujimoto, 1989). The model derived in this paper uses a modification of Fujimoto's (1994) model that gives a dynamic analysis of heavy-weight management integration.

## III Parameters of a Dynamic Exchange Model

Backward and Forward Linkages

The values of incoming and outgoing quantities may be termed as backward linkages and forward linkages respectively from a systems perspective.

*Backward Linkage (Intrinsic) BL* = (Value of net borrowed money +*

*Value of bought goods)/Gross Domestic Product*

*= (Liabilities + Imports)/ Gross Domestic Product*

*Backward Linkage BL = BL*/Sample Average BL**

"Forward Linkages" may similarly be defined as follows

*Forward Linkage (intrinsic) FL* = (Value of invested capital + Value of disposed goods)/ Total Linkage*

*= (Assets + Exports)/Total Linkage*

*Forward Linkage FL = FL*/Sample Average FL**

Dynamic Exchange Equilibrium

An exchange system remains in a dynamic equilibrium as long as the value of forward linkages is equal to the value of backward linkages. The rate of exchange that ensures this equality may be termed as "Dynamic Exchange Rate". This rate can be obtained by adjusting the exchange rate during a given period with the disequilibrium factor of divergence in the values of backward and forward linkages.

*Intrinsic Break-even Parallel Linkage (BE*) = FL*/BL**

*Break-even Parallel Linkage (BE) = FL/ BL*

As an exchange system comprises of many organizations, break-even rate at which any two nations should ideally be willing to engage in bilateral exchange is given by their relative investment power. An excess of forward linkage over backward linkage may be termed as "Incremental Value per unit of exports and investments". A higher incremental value relative to other nations acts as an appreciating force on the current market exchange rate of any country, the power of this force being proportional to the relative incremental value of the nation. Therefore, an exchange system is in a dynamic exchange equilibrium if all the organizations have a Unity Parallel linkage:

*Dynamic Exchange Rate = Market Exchange Rate between Organizations 1 & 2/ Bilateral BE*

*Bilateral BE = BE of Nation 1/ BE of Nation 2*

Impediments to Dynamic Exchange Equilibrium

Impediments may be defined as follows:

*Impediments = Market Exchange Rate - Dynamic Exchange Rate*

Causative Factor for Impediments

The servicing potential function of a nation is a function of two values: purchasing power parity value and dynamic exchange value. The former represents current domestic value of goods, services and investments, while the latter represents current exchange value of goods, services, and investments. If purchasing power value is greater than the dynamic exchange value, then the notional inflated value of purchasing power can be translated into real value through global exchange. Such an exchange reduces domestic costs, and so the resulting linkage may be termed as "Ascending Linkage", which equals the servicing potential of overseas nations. However as the Dynamic Exchange Value is an imputed value that manifests itself externally in the Market Exchange value, in reality there might arise a divergence between these two values not the least because of false notions about dynamic exchange value. Under such a divergence, potential benefits from utilization of opportunities for overseas servicing potential theoretically also signify opportunity cost of domestic endowment unemployment. Therefore the unity between global servicing potential and local social benefits is broken, and the following sets of relationships emerge:

*Social Benefits = Purchasing Power Value - Dynamic Exchange Value*

*Social Costs = Purchasing Power Value - Market Exchange Value*

*Social Benefit-cost ratio = Social Benefits/ Social Costs*

Under the above condition, if market exchange value (as represented by market exchange rate) can be made greater than the dynamic exchange value (as represented by dynamic exchange rate) the social benefit-cost ratio is improved. Therefore the government might, under influence of theory effects that promote notions that greater diversities in manpower productivity (e.g. through division of labor and comparative costs), material quality (e.g. through technology gap) and marketing value (e.g. through product differentiation) with other nations promote greater exchange value, decide to make compensating investments for creating and then perpetuating impediments to equilibration of market exchange value with dynamic exchange value, and fail to utilize global opportunities for improving their real standards of living. Therefore the incentives offered by the value of social costs may also be termed as "Descending Linkages".

**IV International Norms for Dynamic Exchange System**

An integral part of any mathematical exchange system are the international norms for the exchange system. These norms are presently contained in the WTO Act:

*a) Global Integration Test for "Human Standards of Living":*

The mission of WTO, as stated in the preamble to the Marrakesh Agreement establishing the WTO, is to ensure that the relations of international community in the exchange system are "conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world's resources..." (p. 6, The Legal Texts, 1994). Thus WTO Act is designed to ensure that all nations realize a **"Supreme Exchange System"**

where the gap between purchasing power and dynamic equilibrium value is consistently reduced.

*b)National Servicing Potential Test for Restrictive "Technical Standards"*

Article 2 of Agreement on Technical Barriers to Trade stipulates that "technical regulations shall not be more trade-restrictive than necessary to fulfill a legitimate objective, taking into account the risks non-fulfillment would create." (The Legal Texts, p. 139). In addition, Article 12 Para 7 states that, "Members shall, in accordance with the provisions of Article 11, provide technical assistance to developing country Members to ensure that preparation and application of technical regulations, standards and conformity assessment procedures do not create unnecessary obstacles to the expansion and diversification of exports from developing country Members." (The Legal Texts, p. 153).

*c) Local Impediments test for "Compensation":*

WTO Act prohibits any sort of direct or indirect compensation by the government or its special institutions if such compensation is in law or in fact contingent on export performance, or if it acts directly or indirectly to promote exports and inhibit of the given nation injuring production/ exports in other nations (Para 1 of Article XVI of GATT 1994, The Legal Texts, p. 508). Annex I of Agreement on Subsidies and Countervailing Measures illustrates some of the prohibited subsidies as follows: "(k) The grant by governments (or special institutions controlled by and/ or acting under the authority of governments) of export credits at rates below those which they actually have to pay for the funds so employed (or would have to pay if they borrowed on international capital markets in order to obtain funds of the same maturity and other credit terms and denominated in the same currency as the export credit), or the payment by them of all or

part of the costs incurred by exporters or financial institutions in obtaining credits, in so far as they are used to secure a material advantage in the field of export credit terms; (l) Any other charge on the public account constituting an export subsidy in the sense of Article XVI of GATT 1994." (The Legal Texts, p. 305).

**V Conditionalities**

The potential exchange value of all nations can be obtained through the following *"Dynamic Exchange System Equations":*

*(i) Dynamic Exchange Potential Equation*

Servicing Potential = Purchasing Power Rate - Dynamic Equilibrium Rate

*(ii) Dynamic Exchange Impediments Equation*

Impediments = Market Exchange Rate - Dynamic Equilibrium Rate

*(iii) Dynamic Exchange Value Equation*

Exchange values are fully determined by four dynamic factors - two constants and two variables in the following descending-order of global incremental value:

(i) *Global Integration,* that is based on overlapping structures of equality in purchasing power values and promotes multilateral gains, and so is a dynamic constant.

(ii) *Servicing Potential,* that represents changing servicing potential of a nation as a result of its exchange system and promotes bilateral gains, and is a dynamic variable.

(iii) *Impediments,* that represents compensation investments by the governments for promoting unilateral local gains, and is a dynamic variable.

(iv) *Purchasing Power Test,* which represents either monopoly effects of opportunistic corporate investments or hollowing-out effects of over-consumption, each of which result in a zero-sum exchange system.

The constant in the regression gives global integration effect - i.e. equal purchasing power effect. The two variables give servicing potential and impediment effect. The residual gives the remaining effect: i.e. dynamic equilibrium effect.

The following sections investigate Japanese exchange system at all the four levels in order to identify the causative forces in the free fall in the exchange value of dollar, and to highlight appropriate corrective policy actions consistent with the international norms. The investigation uses a sample of 27 nations given in Table 1 that account for about 80% of the international gross domestic product and international investment flows, and over 70% of the world export and import flows during the five year period 1989-93 over which the figures have been averaged to even-out annual time-spectrum effects. The data is primarily from IMF, with supplementary data on purchasing power parity exchange rate (1992 data) from World Bank and on gross domestic product from OECD (1989-93 data). The sample has been selected based on value of trading exchange and availability of complete data. Conversion into yen is based on average annual market exchange rates.

**VI Dynamic Modeling of Japanese Exchange Rate**

Table 2 shows results of dynamic modeling of Japanese Exchange Rate. Nations with greatest forward linkage are Panama (5.739), Malaysia (3.922), Ireland (3.553) and Netherlands (3.046). These four nations also have a high backward linkage, indicating a high integration of these nations in the global exchange system. Japan has a backward linkage of 0.480 and a forward linkage of 0.668; Germany has 1.340 and 1.489, and the US 1.906 and 1.767. Thus Japan has a proportionately weaker integration with the global exchange system given the value of its domestic purchasing power.

Furthermore, break-even parallel linkage for Japan is greatest among all nations at 1.394, highlighting that Japan's policies have greatest monopoly gains effect. This is followed by Venezuela at 1.329, Ireland 1.269, and Norway 1.250. Germany (1.112) and Netherlands (1.166) are other nations with greater than double-digit growth in break-even parallel linkage, representing rate of appropriation of international exchange value and corresponding actual (disproportionate consumption case) or potential (monopolistic investment case) hollowing-out. The bilateral parallel linkage of Japan shows that rate of return on Japanese overseas investments (forward linkage) per unit of Japanese incoming investments (backward linkage) is 1.642 times that of the US and 1.254 times that of Germany. The return is high of 2.258 times that of Pakistan and 2.044 times that of Mexico, indicating source of Mexican exchange crises of December 1994 and highlighting a potential threat of similar crises in Pakistan in near future.

Dynamic equilibrium exchange rate can be obtained by dividing average exchange rate of Yen with currencies of various nations during 1989-93 by Japan's bilateral parallel linkage. The average rate of Yen has been computed by weighting annual average exchange rate of various nations with their aggregate annual trade values. The modeling shows that the dynamic equilibrium ¥/$ exchange rate is 79.290 and DM/$ rate is 1.269.

The purchasing power parity rate is then computed using the 1992 data in latest World Tables published by the World Bank. The inflation factor is computed by dividing purchasing power parity with dynamic exchange rate. Aggregate domestic costs in the US are only 45% of those in Japan, while the domestic costs in Germany are 61.5% of those in Japan. The domestic costs in most European Community nations are

at a level similar to that in Germany, except UK where domestic costs are half the Japanese level. Thus there exist vast unutilized servicing potential overseas for both Germany as well as Japan, highlighting a need for urgent policy action for reducing material quality gaps with other nations in order to meet technical standards test.

Table 1 shows that top five nations with within 10% of appreciation of their currencies relative to Japan whose currency has appreciated most since the end of 1994 are: Austria (0.947), Germany (0.921), Netherlands (0.921), and Finland (0.915). Of these Germany (0.798) and Netherlands (0.837) are also among the top five nations besides Japan (1.000) that showed greatest inflation of their purchasing powers, i.e. highest domestic costs by international standards. Given the relative weight of Japan and Germany in global exchange value, the utilization of global servicing potential will be greatest if Japanese and German exchange policies are in line with the three WTO tests.

Impediment factor may be computed by dividing dynamic equilibrium rate with average market exchange rate. The greatest impediments are being imposed by Japan, manifested in greatest rate under-valuation in the value of yen. The impediments by Germany are 80% of that posed by Japan. In bilateral terms, Japan has been imposing impediments of 40% of bilateral exchange value on its exchange with the US, and impediments of around 20-25% of bilateral exchange value on West European nations.

Finally a comparison with current level of exchange rates shows that 1995 rates are closest of all exchange rates to the dynamic equilibrium values. This shows that impediments to exchange system have significantly declined in 1995. Further an accentuated disparity of market rates with the purchasing power parity rates authenticate the correction factor in computation of exchange rates as identified by this investigation.

## VII Dynamic Modeling of Japanese Exchange System

Table 3 gives all the four effects - global integration, national servicing potential, local impediments and individual country parallel linkages - for each nation obtained through an OLS regression of overall trading effect (trade/gross domestic product) on servicing potential and impediments. As the servicing potential and impediments are measured in terms of yen/ local currency unit, a correction factor equivalent to the reciprocal of average market exchange rate of yen has been applied so as to convert all the values into a common yen denominator.

First, net value of the hollowing-out effects is a negative 18.9% of overall gross domestic product. As the overall trade constitutes 34.9% of the gross domestic product, it implies that monopolistic policies are reducing potential world trade value by 54.2% or ¥710 trillion ($8.87 trillion at ¥80=$1). The effect of these monopolistic strategies is to weaken the overlapping structures among various nations, because of a disequilibrium between forward and backward linkages. The greatest monopoly effects are of Japan equivalent to ¥153.4 trillion or 34.8% of its domestic income. The greatest hollowing-out effect has been on the US valued at ¥244.3 trillion, equivalent to 32.9% of its domestic income.

Secondly, the negative effect of local impediments on international trade during 1989-93 was 0.4% of global GDP or 1.14% of two-way trade. This was equivalent to ¥ 8.25 trillion ($103 billion at ¥80=$1) of reduction in overall trade for the sample nations and ¥ 11.33 trillion ($141 billion at ¥80=$1) for the world as a whole.

Thirdly, the positive effect of local servicing potential on international trade is 0.4% of gross domestic product, indicating that the value of international trade can be

boosted by 1.14% or by ¥8.08 trillion ($101 billion at ¥80=$1) for the sample nations. If such local opportunities are fully utilized by the international community, then total trade of the US, UK and Australia will be boosted by 0.4% of their respective GDPs, and the trade of Germany, France and Italy will rise by 0.3% of their respective GDPs. In terms of GDP, greatest increase in value would occur in the developing nations, such as Chile 1.8% in Latin America, and Pakistan 3.6% in Asia.

Finally, global integration effects are a high of 53.8% of domestic incomes, highlighting that exchange potential under zero manpower productivity, material quality and marketing value gaps is greatest of all conditions. However in reality the actual trade realized has been only 34.9% of domestic incomes because of monopolistic or hollowing-out oriented forces.

On an aggregate basis if there is a 100% opportunity utilization where all hollowing-out is eliminated, impediments are avoided, and full servicing potential is tapped so that there are no gaps among nations, the overall world trade would increase by 38.4% of global domestic product. Currently only 45.2% of the overall potential of exchange is being allowed by the global exchange system. The world trade can be boosted by 121% or ¥1323 trillion ($16.5 trillion at ¥80=$1) under the ideal case of fully over-lapping structures and perfect global integration. In relative terms, greatest gainer from such free exchange condition would be Japan, whose trade value would rise by 366.6% or by ¥306.8 trillion ($3.8 trillion at ¥80=$1). The second biggest gainer would be US whose trade would rise by ¥496 trillion ($6.2 trillion at ¥80=$1) or by 321%. The other large gainers in trade would be Italy ($508 billion), France ($282 billion), Spain ($262 billion), Germany ($234 billion) and Mexico ($223 billion).

**Japanese Balance of Exchange System**

Table 4 quantifies the four effects on the balance of trade as percentage of GDP. The analysis confirms that balance of trade is a result of either monopoly-investment strategies or disproportionate consumption. In all cases, except Finland, constant country effects are over 99% of the total potential for balance of trade value. Only Finland has a balanced trade account, and as a result it gains 6.1% in balance of trade because of its integration in the global system.

**VIII Impact of Early 1995 Exchange Rate Volatilities on Trade**

The early 1995 period, especially the months of March and April, have witnessed severe volatilities in the international exchange rates. Table 5 estimates the effect of changes in market exchange rates, and thus of impediments, on the value of world trade. The results show that the overall value of trade (whether exports or imports) is estimated to increase trade of the sample nations by 0.63% or ¥5.08 trillion ($62.56 billion at $1=¥80); as compared to 1.14% that under zero impediment condition.

The Table shows that trade of all nations is expected to grow substantially, with no nation losing in terms of value. In terms of value the top three nations with over half $5 billion or half a trillion yen gains would be the US (increase of ¥1806 billion or $22.25 billion), Italy (increase of ¥633.75 billion or $7.8 billion), and Turkey (¥548.27 billion or $6.75 billion). The exchange rate volatilities per se will have no significant impact on the value of Japanese trade - whether exports or imports.

**VIII Investigation of Causative Forces**

Table 6 conducts a social benefit-cost analysis of compensation investments by Japanese and German governments and monetary institutions, in order to authenticate

presence of perceived benefits. Japanese social benefits during 1989-93 were positive in relation to all other nations in the sample. In respect of 17 out of 26 nations in the sample, the social benefit-cost ratio (SBCR) of supporting impediments to equilibration of market exchange rates was greater than the break-even parallel linkage value of 1.355 for Japan (Table 1). The SBCR ratio was over 2 in respect of Australia, Austria, Canada, Italy, Spain, UK and the US. Similarly in respect of 16 out of 26 nations, the German SBCR was greater than the break-even parallel linkage value of 1.081 for Germany. The SBCR ratio was over 5 in relation to many European nations such as France, Italy, Spain and the UK, as well as in relation to Australia, US and Canada.

The Bundesbank annual report for 1994-95 released in end April 1995 shows that European central banks spent around DM 40 billion, or $29.2 billion, supporting their currencies against a rising DM in the first quarter of 1995 alone. Most of these currencies subsequently strengthened after bottoming out in the first week of March. The total amount of yen used by the Bank of Japan and other central banks to buy the dollar in the first quarter 1995 is estimated at ¥39.4 trillion (The Daily Yomiuri, 1995 April 14, p. 16). Between April 1 and 21 alone, the total value of BOJ's intervention was $7 billion (Gawith, 1995). Further, Bundesbank cut its interest rates at the end of March 1995 to reduce corrective upward pressures on its currency, as did Bank of Japan in mid-April that reduced its discount rate from 1.75% to an historical as well as global low of 1%, against 6% in the US. The objective of discount rate cut was stated by the Finance Minister Masayoshi Takemura as follows, "Our latest action (to cut discount rate) is an additional measure that has become necessary because of the recent changes in economic conditions due mainly to further drastic surge of the yen and the stock market

hovering at a low level" (quoted by The Japan Times, April 15, 1995, p. 12)

Just a few hours before discount rate was cut in Japan on April 14, the Japanese government introduced a supplementary special fiscal package worth nearly ¥5 billion, that according to the Prime Minister Tomiichi Murayama "included 'every possible measure' to counter the yen's appreciation against foreign currencies" (quoted by The Daily Yomiuri, April 15 and May 9, 1995, p. 1).

The consequences of these compensating factors have been quite adverse. These compensating factors promoted a sharp decline in the stock market capitalization in Japan, and indirectly led to increased bad debts of the Japanese security companies estimated at about $2 billion for the current fiscal year alone (The Japan Times, May 19, 1995). In addition the impact of compensating factors on weakening of exchange impediments has reduced the value of foreign-currency denominated loans and investments of Japan to an order of many billions of dollars (the global surplus of Japan as of 1993 was over $700 billion).

## IX Conclusions

Exchange Rate

The dynamic model based on a general systems approach shows that (a) dynamic equilibrium exchange rate of dollar is currently ¥79.290 and DM 1.269. Therefore even the recent global low of dollar (¥79.75 and DM 1.345) in reality represents an over-valuation of dollar, and an undervaluation of yen and DM, (b) The differences between market exchange rates and dynamic equilibrium rates represent impediments to dynamic equilibration. Such impediments hampered potential value of world trade during 1989-93 by 1.14% or about $141 billion annually, (c) Early 1995 exchange rate volatilities

globally have taken the market exchange rates closer to their dynamic equilibrium rates. These volatilities represent decline in effective impediments to dynamic equilibration, and as a result are likely to raise value of trade by 0.63%, which amounts to about $62 billion for the sample nations. The trading gains arising from current volatilities would be distributed equally between imports and exports.

Exchange System

The investigation further reveals that (a) The dynamic equilibrium is different from purchasing power parity because Japan is currently deriving greatest incremental value per unit of its overseas investments and exports, i.e. 39.4%; against 11% of Germany and -15% of the US. Japan's incremental value is 64.2% more than that of the US. Such inter-nation disparities in incremental value are hampering the current value of world's one-way trade by 54.2% or $4.4 trillion annually, (b) proportionate impact of exchange rate volatilities per se on Japan's trade will be quite marginal. Japan will realize only marginal benefits of low-cost imports because of substantial gaps in technical standards of Japanese and foreign firms. Therefore intermediate parts as well as finished products of foreign nations are not likely to meet Japanese standards. These quality gaps are against the international norms given in World Trade Organization Act, whose article 2 of Agreement on Technical Standards discourages quality standards higher than what firms from other nations can meet, and prohibits government policies that have a direct or indirect effect on promoting disproportionate standards. The modeling shows that if all the quality gaps at the global level were to be eliminated completely, two-way trade would rise by 1.15% (over $100 billion for the sample nations alone), (c) During 1989-93, social benefit-cost ratio of indirect investments was 2.11 for Japan and 6.43 for

Germany. Therefore these nations put a greater proportionate significance on indirect investments for financing exports, including compensation to support dollar value, than on direct overseas investments. The current proportionate benefits from indirect overseas investments are indicated by incremental value per unit of exports and investments. Accumulated proportionate dominance of indirect overseas investments is indicated by excess of purchasing power parity over dynamic equilibrium rate (i.e. quality gaps), or purchasing power inflation which over the last 5 years was about twice relative to the US prices. A present proportionate significance of indirect investments (or exports) adds to accumulated inflation, as indirect investments result in unilateral gains in contrast to direct investments that result in bilateral or multilateral gains.

Compensating Techniques

The principal causative factor in impediments is compensation-effect of the government policies in Japan and Germany, which promote supply of their currency and demand of compensated currency. The policies that have compensation effects include exchange rate intervention for keeping the value of yen and DM low, expansionary monetary policies to promote indirect investments overseas for financing overseas imports, and expansionary fiscal and monetary policies to promote direct investments at home. Such compensation is equivalent to prohibited subsidy under WTO Act, as it involves interest rates below international standards and charge on public account that directly or indirectly supports local exports and hampers foreign exports. Furthermore, such compensation has been the main reason for "financial hollowing-out" of Japan and Germany, despite their substantial global surpluses.

Catalyc Manipulating Power

The compensating power is intended to be finance debt of the overseas nations, or the US, other EC nations, and developing nations. There are many factors that neutralize power of such investments. In early 1995 accentuation in inflated purchasing power was promoted by Mexican $50 billion crises that enhanced overseas servicing potential, by over $100 billion destruction by Hanshin Earthquake a part of which being financed through fiscal expenditure boost, and by $1 billion Barings losses whose corresponding gains in stock transactions accrued to Japanese investors. Such natural forces create additional non-value adding demands, that hamper the value of compensation force. This promotes gradual erosion of impediments. The effect of natural forces is augmented by a reciprocal adverse effect on the value of overseas direct and indirect foreign-currency-denominated investments by Japan under conditions of rising domestic exchange rate. As such exchange losses of the investors are increased. A similar adverse effect of weakened compensation occurs on domestic stock markets, because compensation promotes stock inflation. The exchange losses as well as stock market losses reduce ability as well as willingness to make overseas investments. The situation is further hampered by bad debts on yen-denominated loans both domestically to export dependent firms and internationally to developing and other nations.

Consequential Value

As the inflation factor in Japanese purchasing power became about twice that of the US, the gains from indirect overseas investments (exports) became equal to the gains from direct overseas investments (transfer of funds) at the corporate level. Any further accentuation in inflation factor, makes the servicing potential of the foreign nations free because the current value of endowment is much higher when used abroad, then when

converted into goods and exported overseas for cash. Thus when the value of American servicing potential exceeded the Japanese servicing potential by a factor more than 2, an equilibration in exchange rates occurred. The value of dollar has shown a somewhat rising trend since reaching its global low because of negative potential effects of American trade restrictions on Japanese incremental value.

Recommendations

A top priority is therefore required in Japan on reducing domestic costs, that are over twice the American level, given that yen is now under-valued rather than over-valued. Even before the recent rise in value of yen, Prime Minister Murayama in his Policy Speech on January 20, 1995 observed that, "The yen's rapid appreciation, the disparity between Japanese and overseas prices, and other factors have made Japan a high-cost economy". "Specifically, this means first reducing and rectifying the disparity between Japanese and overseas prices. This disparity is an impediment to better living and erodes Japanese industry's competitiveness."

Therefore a top priority is urgently needed to an overall strategic survey of Japanese overseas investments, and tactical approach to perpetuate additional investments in channels with greatest potential to reduce high domestic costs. Such investments can be initially financed through a strategic re-channelization of Japan's global surplus of over $700 billion (OECD 1993 debt survey) from low incremental value indirect investments (because of a low integrative management input), to high incremental value direct investments (because of a high integrative management input) overseas. Such direct investments involve creative and innovative linkages with the foreign firms and foreign nations in form of foreign direct investment and strategic assistance for

upgrading overseas capabilities for meeting Japanese standards. Such overseas endowment-development efforts at corporate, local, national and global levels were the main causative factor in Japan's postwar miracle growth. It is only by rediscovering this factor that Japanese government and MNCs can ensure further dynamic upgradation of their own standards and quality, while at the same time ensuring 100% conformance with the international norms.

*References*

Abernathy, W. J., The Productivity Dilemma, John Hopkins, Baltimore (1978).

Aoki, Masahiko, "An Evolutionary Parable of the Gains from International Organizational Diversity", mimeo, Stanford University (1995).

Ardeni, Pier Giorgio, and Diego Lubian, 1991, "Is There Trend Revision in Purchasing Power Parity?", European Economic Review, v. 35, pp. 1035-1055.

Asian Wall Street Journal, Market Exchange Rates, April 20, 1995.

Burt, R. S., Structural Holes: The Social Structure of Competition, Cambridge: HUP (1992).

Cheung, Yin-Wong, and Kon S. Lai, 1993, "Long-run Purchasing Power Parity During the Recent Float", Journal of International Economics, v. 34, pp. 181-192.

Crowder, William J., 1992, "Purchasing Power Parity over the Modern Float: An Application in Higher Order Cointegration", Economic Letters, v. 40, p. 313-318.

Edison, Hali J., 1987, "Purchasing Power Parity in the Long Run: A Test of the Dollar/Pound Exchange (1890-1978)," Journal of Money Credit and Banking, v. 19, pp. 376-387.

Edison, Hali J., and Jan T. Klovland, "A Quantitative Reassessment of the Purchasing

Power Parity Hypothesis: Some Evidence on Norway and the United States", Journal of Applied Econometrics, v. 2, pp. 309-334.

Fisher, Eric O., and Joon Y. Park, 1991, "Testing Purchasing Power Parity Under the Null Hypothesis of Co-integration", Economic Journal, v. 101, pp. 1476-84.

Fujimoto, Takahiro, "Organizations for Effective Product Development: The Case of the Global Automobile Industry", Doctoral Dissertation, Graduate School of Business, Harvard University (1989).

Fujimoto, Takahiro, "Reinterpreting the Resource-Capability View of the Firm: A Case of the Development-Production Systems of the Japanese Auto Makers", Discussion Paper 94-F-20, Research Institute for the Japanese Economy, University of Tokyo (1994).

Gawith, P., "It's all or nothing for central banks", The Japan Times, May 1, p. 15 (1995).

International Monetary Fund, Balance of Payments, 1994.

International Monetary Fund, International Financial Statistics, March 1995.

Johansen, Soran, 1991, "Estimation and Hypothesis Testing of Cointegration Vectors in Gussian Vector Autoregressive Models", Econometrica, v. 59, pp. 1551-1580.

Johansen, Soren, and Katarina Juselius, 1992, "Testing Structural Hypotheses in a Multivariate Cointegration Analysis of the PPP and UIP for UK", Journal of Econometrics, v. 53, pp. 211-44.

Nelson, R., and S. Winter, An Evolutionary Theory of Economic Change, Belknap, Harvard University Press, Cambridge (1982).

Organization for Economic Cooperation and Development, reported in The Daily Yomiuri, "Third World Debt reaches $1.6 trillion", p. 9, Dec. 14, 1994 (1993).

Organization for Economic Cooperation and Development, National Accounts (1994).

Patel, Jayendu, 1990, "Purchasing Power Parity as a Long-run Relation", Journal of Applied Econometrics, v. 5, pp. 367-379.

Perron, Pierre, and Timothy J. Vogelsang, 1992, "Nonstationarity and Level shifts With an Application to Purchasing Power Parity", Journal of Business and Economic Statistics, v. 10, pp. 301-320.

Stock, James H., and Mark W. Watson, 1993, "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", Econometrica, v. 61, pp. 783-820.

The Daily Yomiuri, "Heavy BOJ intervention could harbor inflation", p. 16, April 14 (1995).

The Daily Yomiuri, "Govt OK's emergency economic package: BOJ follows with cutting rate to historical low of 1%", p. 1, April 15 (1995).

The Legal Texts: The Results of the Uruguay Round of Multilateral Trade Negotiations, GATT Secretariat, Geneva, June (1994).

The Japan Times, Murayama's Policy Speech to 132nd Session of Diet, January 21, 1995.

The Japan Times, "Discount rate cut to record low 1%", p. 12, April 15, 1995.

Administration, Harvard University, 1989.

The Japan Times, "Japanese security houses post largest losses", p. 1, May 19, 1995.

The World Bank, World Tables, 1994.

Thompson, James D., Organizations in Action, New York: McGraw-Hill (1967).

Tidd, Joe and Takahiro Fujimoto, "Work Organization, Production Technology and Product Strategy of the Japanese and British Automobile Industries", Current Politics and

Economics of Japan, v. 4 n. 4, pp. 241-280 (1995).

Williamson, Oliver E., Markets and Hierarchies, New York: Free Press (1975).

**For Additional Reading:**

Bilson, John F O and Richard C. Marston, eds., Exchange Theory and Practice, National Bureau of Economic Research, The University of Chicago Press (1984).

Branson, W., Financial Capital Flows in the US BOP, North-Holland (1968).

Dornbusch, R., "Expectations and Exchange Rate Dynamics", Journal of Political Economy, December (1976).

Dornbusch, R., "Exchange risk and the macroeconomics of exchange rate determination", in International Financial Management (ed. R. Hawkins et. al.), Conn.: JAI Press (1982).

Frankel, J., "Monetary and Portfolio Balance Models of Exchange Rate Determination", In International Economic Policies and their theoretical foundations: A Source book, II Edition, ed. John M. Letiche, Academic Press: Calif., pp. 793-825 (1992).

Frenkel, J. and Razin A., "The International Transmission and Effects of Fiscal Policy", American Economic Review, May (1986).

Mann, C., "Prices, Profit Margins, and Exchange Rates", Fed. Res. Bulletin, June (1986).

Tobin, J., "A General Equilibrium Approach to Monetary Theory", JMCB, v 1, pp. 1-29 (1969).

Table 1

1989-93 Average Country-wise Balance of Payments

(In Billions of Yen)

| | Gross Domestic Product | Increase in Assets | Increase in Liabilities | Total Exports | Total Imports | Yen Exchange Rate End 1994 | Yen Exchange Rate April 19, 1995 |
|---|---|---|---|---|---|---|---|
| Australia | 37936 | 455.5 | 2122.2 | 6592.1 | 6881.2 | 77.481 | 59.598 |
| Austria | 21284 | 1197.5 | 1182.5 | 8387.3 | 8159.9 | 8.990 | 8.514 |
| Canada | 73608 | 1152.2 | 4313.5 | 19236.5 | 19752.3 | 71.102 | 59.142 |
| Chile | 4577 | 130.7 | 220.4 | 1435.3 | 1338.5 | 0.248 | 0.211 |
| Finland | 14866 | 480.0 | 1225.5 | 3698.4 | 3695.7 | 21.029 | 19.232 |
| France | 155230 | 10997.4 | 11314.7 | 37075.7 | 35538.6 | 18.657 | 16.702 |
| Germany | 224196 | 14956.1 | 13069.5 | 57690.3 | 54133.6 | 64.401 | 59.306 |
| Indonesia | 15338 | 168.1 | 628.4 | 4254.4 | 3955.8 | 0.045 | 0.036 |
| Ireland | 5877 | 881.0 | 530.4 | 3661.5 | 3151.0 | 154.313 | 134.582 |
| Israel | 7855 | 288.1 | 193.1 | 2275.0 | 2865.1 | 33.050 | 27.780 |
| Italy | 139535 | 4903.4 | 8044.9 | 27932.2 | 27200.1 | 0.061 | 0.047 |
| Japan | 441057 | 18284.1 | 9489.3 | 45859.7 | 37838.0 | 1.000 | 1.000 |
| Korea South | 36348 | 769.5 | 1040.9 | 10700.5 | 10915.9 | 0.126 | 0.106 |
| Malaysia | 6500 | 518.3 | 628.4 | 5028.6 | 4932.3 | 38.996 | 32.936 |
| Mexico | 36892 | 754.6 | 2625.8 | 5139.4 | 6264.5 | 18.668 | 13.304 |
| Netherlands | 37256 | 4993.1 | 3717.1 | 19692.8 | 18051.6 | 57.485 | 52.915 |
| Norway | 13565 | 325.1 | 185.5 | 5907.8 | 4943.8 | 14.751 | 13.267 |
| Pakistan | 5399 | 65.3 | 311.1 | 972.6 | 1417.7 | 3.243 | 2.657 |
| Panama | 724 | 209.4 | 180.0 | 694.6 | 667.0 | 99.740 | 81.220 |
| Philippines | 6206 | 132.6 | 359.3 | 1698.2 | 1988.3 | 4.085 | 3.121 |
| Portugal | 9854 | 588.2 | 472.9 | 2759.9 | 3548.1 | 0.627 | 0.567 |
| Spain | 64176 | 2105.1 | 4346.2 | 11257.1 | 13050.3 | 0.757 | 0.655 |
| Sweden | 28753 | 2144.0 | 2881.1 | 8746.9 | 8354.5 | 13.368 | 11.155 |
| Turkey | 19454 | 353.6 | 605.0 | 2798.5 | 3331.2 | 0.003 | 0.002 |
| UK | 126059 | 18563.8 | 21080.6 | 29906.4 | 32676.1 | 155.849 | 130.810 |
| US | 742860 | 12953.6 | 21077.7 | 72229.1 | 82149.9 | 99.740 | 81.220 |
| Venezuala | 6839 | 426.7 | 275.7 | 2114.4 | 1690.0 | 0.587 | 0.346 |
| Oveerall | 2282243 | 98797 | 112122 | 397746 | 398491 | | |
| % of World | 79.61% | 79.13% | 80.12% | 72.86% | 72.86% | | |

Sources:

Computed from Balance of Payment Statistics, IMF

Market Exchange Rates from International Financial Statistics, IMF.

GDP from National Accounts, OECD, 1994 and from IMF.

Table 2
Dynamic Modeling of Japanese Exchange Rate

| | Unadjusted Breakeven | Adjusted FL | Adjusted BL | Adjusted BE | Japanese BE | Dynamic Equil Exch Rate ¥ | Trade-Weighted Exchange Rate in ¥ | Impediments in ¥ | Purchasing Parity ¥ | Inflated Power | Impediment Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 0.783 | 0.854 | 1.061 | 0.805 | 1.731 | 56.644 | 98.074 | 41.429 | 130.898 | 0.433 | 0.578 |
| Austria | 1.026 | 2.070 | 1.962 | 1.055 | 1.321 | 8.436 | 11.145 | 2.709 | 13.214 | 0.638 | 0.757 |
| Canada | 0.847 | 1.273 | 1.461 | 0.871 | 1.600 | 67.912 | 108.643 | 40.731 | 139.514 | 0.487 | 0.625 |
| Chile | 1.005 | 1.573 | 1.522 | 1.033 | 1.349 | 0.281 | 0.379 | 0.098 | 1.447 | 0.194 | 0.741 |
| Finland | 0.849 | 1.292 | 1.480 | 0.873 | 1.596 | 18.635 | 29.745 | 11.111 | 28.739 | 0.648 | 0.626 |
| France | 1.026 | 1.423 | 1.349 | 1.055 | 1.321 | 17.521 | 23.144 | 5.623 | 28.855 | 0.607 | 0.757 |
| Germany | 1.081 | 1.489 | 1.340 | 1.112 | 1.254 | 62.439 | 78.284 | 15.845 | 101.484 | 0.615 | 0.798 |
| Indonesia | 0.965 | 1.325 | 1.336 | 0.992 | 1.405 | 0.047 | 0.066 | 0.019 | 0.086 | 0.546 | 0.712 |
| Ireland | 1.234 | 3.553 | 2.800 | 1.269 | 1.098 | 186.188 | 204.503 | 18.315 | 298.540 | 0.624 | 0.910 |
| Israel | 0.838 | 1.500 | 1.740 | 0.862 | 1.617 | 34.222 | 55.343 | 21.120 | 79.534 | 0.430 | 0.618 |
| Italy | 0.932 | 1.082 | 1.129 | 0.958 | 1.455 | 0.068 | 0.099 | 0.031 | 0.125 | 0.549 | 0.687 |
| Japan | 1.355 | 0.668 | 0.480 | 1.394 | 1.000 | 1.000 | 1.000 | 0.000 | 1.000 | 1.000 | 1.000 |
| Korea South | 0.959 | 1.450 | 1.470 | 0.986 | 1.413 | 0.123 | 0.174 | 0.051 | 0.299 | 0.413 | 0.708 |
| Malaysia | 0.998 | 3.922 | 3.824 | 1.026 | 1.359 | 35.845 | 48.702 | 12.857 | 200.588 | 0.179 | 0.736 |
| Mexico | 0.663 | 0.734 | 1.077 | 0.682 | 2.044 | 21.572 | 44.100 | 22.528 | 123.514 | 0.175 | 0.489 |
| Netherlands | 1.134 | 3.046 | 2.612 | 1.166 | 1.195 | 58.317 | 69.698 | 11.381 | 86.350 | 0.675 | 0.837 |
| Norway | 1.215 | 2.112 | 1.690 | 1.250 | 1.115 | 17.862 | 19.922 | 2.060 | 19.911 | 0.897 | 0.897 |
| Pakistan | 0.600 | 0.884 | 1.431 | 0.617 | 2.258 | 2.389 | 5.394 | 3.005 | 35.806 | 0.067 | 0.443 |
| Panama | 1.067 | 5.739 | 5.229 | 1.098 | 1.270 | 101.536 | 128.932 | 27.395 | 398.101 | 0.255 | 0.788 |
| Philippines | 0.780 | 1.356 | 1.691 | 0.802 | 1.738 | 2.920 | 5.074 | 2.154 | 22.358 | 0.131 | 0.575 |
| Portugal | 0.833 | 1.562 | 1.824 | 0.856 | 1.628 | 0.545 | 0.886 | 0.342 | 1.782 | 0.306 | 0.614 |
| Spain | 0.768 | 0.957 | 1.212 | 0.790 | 1.765 | 0.673 | 1.187 | 0.514 | 1.631 | 0.412 | 0.567 |
| Sweden | 0.969 | 1.741 | 1.747 | 0.997 | 1.398 | 14.804 | 20.699 | 5.895 | 19.826 | 0.747 | 0.715 |
| Turkey | 0.801 | 0.745 | 0.904 | 0.824 | 1.692 | 0.015 | 0.026 | 0.011 | 0.067 | 0.228 | 0.591 |
| UK | 0.902 | 1.767 | 1.906 | 0.927 | 1.503 | 146.992 | 220.949 | 73.958 | 294.034 | 0.500 | 0.665 |
| US | 0.825 | 0.527 | 0.621 | 0.849 | 1.642 | 79.290 | 130.228 | 50.938 | 176.182 | 0.450 | 0.609 |
| Venezuala | 1.293 | 1.708 | 1.285 | 1.329 | 1.048 | 2.028 | 2.126 | 0.098 | 7.824 | 0.259 | 0.954 |

Note: FL = Forward Linkage; BL = Backward Linkage; BE = Breakeven Factor

Table 3

Dynamic Effects of Incremental Value on Trading Exchange

(Effects as % of GDP; Values in Billion Yen)

| | Trade/GDP | Integration Effect | Servicing Effect | Impediments Effect | Country Effect | Potential Trading Effect | Potential Utilization | Potential Integration | Potential Servicing | Potential Impediment | Potential Country | Potential Trade | Potential Growth | Potential Growth bn $ | Growth Percen |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 0.355 | 0.538 | 0.001 | -0.006 | 0.181 | 0.729 | 0.487 | 20395 | 169 | 215 | 6875 | 27653 | 14180 | 177.25 | 105.24 |
| Austria | 0.777 | 0.538 | 0.003 | -0.003 | 0.241 | 0.784 | 0.992 | 11442 | 54 | 69 | 5121 | 16686 | 139 | 1.74 | 0.84 |
| Canada | 0.530 | 0.538 | 0.004 | -0.005 | -0.007 | 0.553 | 0.957 | 39572 | 285 | 370 | 498 | 40725 | 1736 | 21.70 | 4.45 |
| Chile | 0.606 | 0.538 | 0.018 | -0.003 | 0.054 | 0.613 | 0.989 | 2460 | 83 | 16 | 247 | 2806 | 32 | 0.40 | 1.15 |
| Finland | 0.497 | 0.538 | 0.002 | -0.005 | -0.037 | 0.582 | 0.855 | 7992 | 30 | 75 | 553 | 8650 | 1256 | 15.70 | 16.98 |
| France | 0.468 | 0.538 | 0.003 | -0.003 | -0.069 | 0.613 | 0.763 | 83453 | 446 | 506 | 10779 | 95185 | 22571 | 282.13 | 31.08 |
| Germany | 0.499 | 0.538 | 0.003 | -0.003 | -0.039 | 0.582 | 0.857 | 120530 | 656 | 609 | 8753 | 130548 | 18724 | 234.05 | 16.74 |
| Indonesia | 0.535 | 0.538 | 0.003 | -0.004 | -0.002 | 0.547 | 0.979 | 8246 | 53 | 59 | 30 | 8389 | 178 | 2.23 | 2.17 |
| Ireland | 1.159 | 0.538 | 0.003 | -0.001 | 0.620 | 1.162 | 0.998 | 3159 | 19 | 7 | 3641 | 6827 | 14 | 0.18 | 0.21 |
| Israel | 0.654 | 0.538 | 0.005 | -0.005 | 0.117 | 0.665 | 0.985 | 4223 | 38 | 40 | 920 | 5221 | 80 | 1.01 | 1.57 |
| Italy | 0.395 | 0.538 | 0.003 | -0.004 | -0.142 | 0.687 | 0.575 | 75015 | 463 | 585 | 19761 | 95824 | 40692 | 508.65 | 73.81 |
| Japan | 0.190 | 0.538 | 0.000 | 0.000 | -0.348 | 0.885 | 0.214 | 237116 | 0 | 0 | 153419 | 390535 | 306837 | 3835.46 | 366.60 |
| Korea South | 0.595 | 0.538 | 0.006 | -0.004 | 0.055 | 0.603 | 0.987 | 19541 | 215 | 143 | 2003 | 21901 | 285 | 3.56 | 1.32 |
| Malaysia | 1.532 | 0.538 | 0.020 | -0.004 | 0.978 | 1.539 | 0.995 | 3495 | 129 | 23 | 6360 | 10007 | 46 | 0.58 | 0.46 |
| Mexico | 0.309 | 0.538 | 0.014 | -0.007 | -0.235 | 0.793 | 0.390 | 19833 | 501 | 253 | 8677 | 29264 | 17860 | 223.25 | 156.6 |
| Netherlands | 1.013 | 0.538 | 0.002 | -0.002 | 0.475 | 1.017 | 0.996 | 20029 | 88 | 82 | 17709 | 37908 | 163 | 2.04 | 0.43 |
| Norway | 0.800 | 0.538 | 0.001 | -0.001 | 0.263 | 0.803 | 0.997 | 7293 | 8 | 19 | 3569 | 10889 | 38 | 0.47 | 0.33 |
| Pakistan | 0.443 | 0.538 | 0.036 | -0.007 | -0.124 | 0.705 | 0.628 | 2902 | 196 | 40 | 668 | 3807 | 1417 | 17.71 | 59.20 |
| Panama | 1.881 | 0.538 | 0.014 | -0.003 | 1.333 | 1.887 | 0.997 | 389 | 10 | 2 | 965 | 1366 | 4 | 0.05 | 0.30 |
| Philippines | 0.594 | 0.538 | 0.022 | -0.006 | 0.040 | 0.605 | 0.981 | 3337 | 140 | 35 | 246 | 3757 | 71 | 0.88 | 1.91 |
| Portugal | 0.640 | 0.538 | 0.008 | -0.005 | 0.100 | 0.651 | 0.984 | 5297 | 81 | 51 | 981 | 6410 | 102 | 1.27 | 1.60 |
| Spain | 0.379 | 0.538 | 0.005 | -0.006 | -0.158 | 0.706 | 0.537 | 34502 | 304 | 373 | 10125 | 45304 | 20997 | 262.46 | 86.3 |
| Sweden | 0.595 | 0.538 | 0.001 | -0.004 | 0.060 | 0.602 | 0.987 | 15458 | 41 | 110 | 1713 | 17321 | 220 | 2.75 | 1.2 |
| Turkey | 0.315 | 0.538 | 0.012 | -0.005 | -0.229 | 0.784 | 0.402 | 10459 | 228 | 107 | 4451 | 15245 | 9115 | 113.94 | 148.7 |
| UK | 0.496 | 0.538 | 0.004 | -0.004 | -0.041 | 0.587 | 0.846 | 67771 | 492 | 566 | 5114 | 73944 | 11361 | 142.02 | 18.1 |
| US | 0.208 | 0.538 | 0.004 | -0.005 | -0.329 | 0.876 | 0.237 | 399369 | 3244 | 3899 | 244335 | 650847 | 496468 | 6205.85 | 321.5 |
| Venezuala | 0.556 | 0.538 | 0.016 | -0.001 | 0.003 | 0.558 | 0.998 | 3677 | 109 | 4 | 23 | 3813 | 8 | 0.11 | 0.2 |
| **Overall Sampl** | **0.349** | **0.538** | **0.004** | **0.004** | **0.227** | **-0.004** | **0.089** | **1226956** | **8082** | **8259** | **517534** | **1760830** | **964594** | **12057.424** | **121.1** |
| **World** | | | | | | | | | | | | **2416679** | **1323872** | **16548.40** | |

Note: The trade value in dollars in the second last column is computed at $1=¥80.

Table 4
Dynamic Effects of Linkages on Balance of Trade

| | Balance of Trade/GDP | Integration Effect | Servicing Effect | Impediment Effect | Country Effect | Potential BOT Effect | Potential Utilization | Global Potential | Servicing Potential | Impediment Potential | Country Potenti |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | -0.008 | -0.000 | -0.000 | -0.000 | -0.008 | 0.008 | 1.000 | 0.2% | 0.0% | 0.0% | 99.8 |
| Austria | 0.011 | -0.000 | 0.000 | 0.000 | 0.011 | 0.011 | 0.998 | 0.1% | 0.0% | 0.0% | 99.9 |
| Canada | -0.007 | -0.000 | -0.000 | -0.000 | -0.007 | 0.007 | 1.000 | 0.2% | 0.0% | 0.0% | 99.8 |
| Chile | 0.021 | -0.000 | 0.000 | 0.000 | 0.021 | 0.021 | 0.999 | 0.1% | 0.0% | 0.0% | 99.9 |
| Finland | 0.000 | -0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.878 | 6.1% | 0.0% | 0.0% | 93.9 |
| France | 0.010 | -0.000 | 0.000 | 0.000 | 0.010 | 0.010 | 0.997 | 0.1% | 0.0% | 0.0% | 99.9 |
| Germany | 0.016 | -0.000 | 0.000 | 0.000 | 0.016 | 0.016 | 0.998 | 0.1% | 0.0% | 0.0% | 99.9 |
| Indonesia | 0.019 | -0.000 | 0.000 | 0.000 | 0.019 | 0.019 | 0.999 | 0.1% | 0.3% | 0.2% | 99.4 |
| Ireland | 0.087 | -0.000 | 0.000 | 0.000 | 0.087 | 0.087 | 1.000 | 0.0% | 0.0% | 0.0% | 100.0 |
| Israel | -0.075 | -0.000 | -0.000 | -0.000 | -0.075 | 0.075 | 1.000 | 0.0% | 0.0% | 0.0% | 100.0 |
| Italy | 0.005 | -0.000 | 0.000 | 0.000 | 0.005 | 0.005 | 0.995 | 0.2% | 0.2% | 0.2% | 99.4 |
| Japan | 0.018 | -0.000 | 0.000 | 0.000 | 0.018 | 0.018 | 0.999 | 0.1% | 0.0% | 0.0% | 99.9 |
| Korea South | -0.006 | -0.000 | -0.000 | -0.000 | -0.006 | 0.006 | 1.000 | 0.2% | 0.1% | 0.1% | 99.6 |
| Malaysia | 0.015 | -0.000 | 0.000 | 0.000 | 0.015 | 0.015 | 0.998 | 0.1% | 0.0% | 0.0% | 99.9 |
| Mexico | -0.030 | -0.000 | -0.000 | -0.000 | -0.030 | 0.030 | 1.000 | 0.0% | 0.0% | 0.0% | 100.0 |
| Netherlands | 0.044 | -0.000 | 0.000 | 0.000 | 0.044 | 0.044 | 0.999 | 0.0% | 0.0% | 0.0% | 100.0 |
| Norway | 0.071 | -0.000 | 0.000 | 0.000 | 0.071 | 0.071 | 1.000 | 0.0% | 0.0% | 0.0% | 100.0 |
| Pakistan | -0.082 | -0.000 | -0.000 | -0.000 | -0.082 | 0.082 | 1.000 | 0.0% | 0.0% | 0.0% | 100.0 |
| Panama | 0.038 | -0.000 | 0.000 | 0.000 | 0.038 | 0.038 | 0.999 | 0.0% | 0.0% | 0.0% | 100.0 |
| Philippines | -0.047 | -0.000 | -0.000 | -0.000 | -0.047 | 0.047 | 1.000 | 0.0% | 0.0% | 0.0% | 100.0 |
| Portugal | -0.080 | -0.000 | -0.000 | -0.000 | -0.080 | 0.080 | 1.000 | 0.0% | 0.0% | 0.0% | 99.9 |
| Spain | -0.028 | -0.000 | -0.000 | -0.000 | -0.028 | 0.028 | 1.000 | 0.0% | 0.0% | 0.0% | 99.9 |
| Sweden | 0.014 | -0.000 | 0.000 | 0.000 | 0.014 | 0.014 | 0.998 | 0.1% | 0.0% | 0.0% | 99.9 |
| Turkey | -0.027 | -0.000 | -0.000 | -0.000 | -0.027 | 0.027 | 1.000 | 0.0% | 0.7% | 0.6% | 98.7 |
| UK | -0.022 | -0.000 | -0.000 | -0.000 | -0.022 | 0.022 | 1.000 | 0.1% | 0.0% | 0.0% | 99. |
| US | -0.013 | -0.000 | -0.000 | -0.000 | -0.013 | 0.013 | 1.000 | 0.1% | 0.0% | 0.0% | 99. |
| Venezuala | 0.062 | -0.000 | 0.000 | 0.000 | 0.062 | 0.062 | 1.000 | 0.0% | 0.0% | 0.0% | 100. |

Table 5

Estimated Effect of Early 1995 Exchange Rate Volatilities on Trade

(Effects as % of GDP; Values in Billion Yen)

| | Impediment Effect end 94 | Impediment Effect April 95 | Trading effect 94 | Trading Effect 95 | Estimated Trade 94 | Estimated Trade 95 | Growth | Growth in Billion ¥ | Growth in Billion $ |
|---|---|---|---|---|---|---|---|---|---|
| Australia | -0.004 | 0.001 | 0.357 | 0.360 | 13552 | 13663 | 0.82% | 111.67 | 1.37 |
| Austria | -0.001 | -0.000 | 0.780 | 0.781 | 16599 | 16614 | 0.09% | 14.99 | 0.18 |
| Canada | -0.001 | 0.002 | 0.534 | 0.537 | 39315 | 39506 | 0.49% | 190.77 | 2.35 |
| Chile | 0.002 | 0.004 | 0.611 | 0.614 | 2798 | 2810 | 0.44% | 12.20 | 0.15 |
| Finland | -0.002 | -0.000 | 0.501 | 0.502 | 7446 | 7462 | 0.22% | 16.51 | 0.20 |
| France | -0.001 | 0.001 | 0.470 | 0.472 | 72993 | 73222 | 0.31% | 229.06 | 2.82 |
| Germany | -0.000 | 0.001 | 0.501 | 0.502 | 112341 | 112592 | 0.22% | 250.54 | 3.08 |
| Indonesia | 0.001 | 0.004 | 0.540 | 0.543 | 8277 | 8329 | 0.63% | 52.03 | 0.64 |
| Ireland | 0.003 | 0.005 | 1.163 | 1.166 | 6836 | 6850 | 0.20% | 13.95 | 0.17 |
| Israel | 0.000 | 0.003 | 0.660 | 0.663 | 5184 | 5205 | 0.40% | 20.70 | 0.25 |
| Italy | 0.002 | 0.006 | 0.401 | 0.405 | 55935 | 56569 | 1.13% | 633.75 | 7.80 |
| Japan | 0.000 | 0.000 | 0.190 | 0.190 | 83698 | 83698 | 0.00% | 0.00 | 0.00 |
| Korea South | -0.000 | 0.002 | 0.598 | 0.601 | 21747 | 21840 | 0.42% | 92.24 | 1.14 |
| Malaysia | -0.001 | 0.001 | 1.535 | 1.537 | 9977 | 9992 | 0.15% | 14.75 | 0.18 |
| Mexico | 0.002 | 0.008 | 0.318 | 0.324 | 11734 | 11964 | 1.97% | 230.64 | 2.84 |
| Netherlands | 0.000 | 0.001 | 1.015 | 1.017 | 37833 | 37877 | 0.12% | 43.80 | 0.54 |
| Norway | 0.003 | 0.005 | 0.804 | 0.806 | 10909 | 10933 | 0.23% | 24.65 | 0.30 |
| Pakistan | -0.004 | -0.001 | 0.447 | 0.449 | 2412 | 2423 | 0.49% | 11.78 | 0.15 |
| Panama | 0.000 | 0.003 | 1.884 | 1.887 | 1364 | 1366 | 0.17% | 2.25 | 0.03 |
| Philippines | -0.004 | -0.001 | 0.596 | 0.599 | 3698 | 3717 | 0.50% | 18.37 | 0.23 |
| Portugal | -0.002 | -0.001 | 0.644 | 0.645 | 6342 | 6354 | 0.19% | 12.19 | 0.15 |
| Spain | -0.001 | 0.000 | 0.383 | 0.385 | 24584 | 24703 | 0.48% | 118.76 | 1.46 |
| Sweden | 0.001 | 0.004 | 0.600 | 0.603 | 17253 | 17338 | 0.49% | 84.75 | 1.04 |
| Turkey | 0.066 | 0.095 | 0.387 | 0.415 | 7530 | 8078 | 7.28% | 548.27 | 6.75 |
| UK | -0.001 | 0.002 | 0.500 | 0.503 | 63053 | 63358 | 0.48% | 305.38 | 3.76 |
| US | -0.003 | -0.000 | 0.210 | 0.213 | 156234 | 158041 | 1.16% | 1806.87 | 22.25 |
| Venezuala | 0.033 | 0.065 | 0.590 | 0.622 | 4034 | 4254 | 5.46% | 220.13 | 2.71 |
| Sample | | | | | **803678** | **808759** | **0.63%** | **5081.02** | **62.56** |

Note: The trade value in dollars in the last column is computed at $1=¥80.

Table 6

Social Benefit-Cost Analysis of Compensation Investments

| | Japan | | | Germany | | |
|---|---|---|---|---|---|---|
| | AL-Japan | DL-Japan | SBCR-Japan | AL-FRG | DL-FRG | SBCR-FRG |
| Australia | 74.25 | 32.82 | 2.26 | 0.38 | 0.01 | 10.33 |
| Austria | 4.78 | 2.07 | 2.31 | -0.00 | -0.01 | |
| Canada | 71.60 | 30.87 | 2.32 | 0.29 | -0.01 | [*] |
| Chile | 1.17 | 1.07 | 1.09 | 0.01 | 0.01 | 1.04 |
| Finland | 10.10 | -1.01 | [*] | -0.02 | -0.10 | |
| France | 11.33 | 5.71 | 1.98 | 0.00 | -0.01 | [*] |
| Germany | 39.05 | 23.20 | 1.68 | 0.00 | 0.00 | 1.00 |
| Indonesia | 0.04 | 0.02 | 1.95 | 0.00 | 0.00 | 19.27 |
| Ireland | 112.35 | 94.04 | 1.19 | -0.04 | 0.33 | [*] |
| Israel | 45.31 | 24.19 | 1.87 | 0.24 | 0.08 | 3.07 |
| Italy | 0.06 | 0.03 | 2.24 | 0.00 | -0.00 | [*] |
| Japan | 0.00 | 0.00 | 1.00 | -0.01 | -0.00 | |
| Korea South | 0.18 | 0.12 | 1.41 | 0.00 | 0.00 | 1.35 |
| Malaysia | 164.74 | 151.89 | 1.08 | 1.40 | 1.35 | 1.04 |
| Mexico | 101.94 | 79.41 | 1.28 | 0.87 | 0.65 | 1.33 |
| Netherlands | 28.03 | 16.65 | 1.68 | -0.08 | -0.04 | |
| Norway | 2.05 | -0.01 | [*] | -0.09 | -0.06 | |
| Pakistan | 33.42 | 30.41 | 1.10 | 0.31 | 0.28 | 1.11 |
| Panama | 296.56 | 269.17 | 1.10 | 2.30 | 2.28 | 1.01 |
| Philippines | 19.44 | 17.28 | 1.12 | 0.17 | 0.16 | 1.12 |
| Portugal | 1.24 | 0.90 | 1.38 | 0.01 | 0.01 | 1.42 |
| Spain | 0.96 | 0.44 | 2.16 | 0.01 | 0.00 | 5.82 |
| Sweden | 5.02 | -0.87 | [*] | -0.04 | -0.07 | |
| Turkey | 0.05 | 0.04 | 1.26 | 0.00 | 0.00 | 1.26 |
| UK | 147.04 | 73.08 | 2.01 | 0.54 | 0.07 | 7.25 |
| US | 96.89 | 45.95 | 2.11 | 0.47 | 0.07 | 6.43 |
| Venezuala | 5.80 | 5.70 | 1.02 | 0.04 | 0.05 | 0.89 |

Notations: AL = Ascending linkages (PP-DE) in yen or DM;

DL = Descending linkages (PP-Market Rate) in yen or DM;

SBCR= Social Benefit Cost Ratio = AL/DL

Note: Blanks => social costs > social benefits.

[*] => SBCR is favorable, but officially available data not sufficient for quantification.