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CONTENTS

OUTWARD DIRECT FOREIGN INVESTMENT AND STRUCTURAL ADJUSTMENT IN A SMALL OPEN ECONOMY

Chung H. LEE*

I. Introduction

In recent years, the world has witnessed increasing flows of direct foreign investment (DFI) from Korea and Taiwan to other developing countries of Asia. What is noteworthy about this outward direct investment is that it is out of labor-intensive industries in which these countries are losing comparative advantage and is thus related to structural change taking place in their economies. Their outward DFI in fact resembles Japanese DFI in developing Asian countries in the 1960s and 1970s which was then carried out largely by firms in labor-intensive industries (Kojima 1973 and 1978). It now seems that Korea and Taiwan are replicating the investment experience of the Japan of the 60s and 70s when its manufacturing sector went through a structural change from labor-intensive to capital-and knowledge-intensive industries.

Current outward DFI from Korea and Taiwan as well as the past Japanese DFI thus pose some interesting questions on the relationship between structural change and DFI. What are the factors motivating DFI out of those industries in which a country is losing its comparative advantage? Does this outward DFI facilitate structural adjustment in the country's economy? If so, is the country better off as a result, and who gains and who loses?

Much of the literature on DFI and the multinational enterprise (MNE) is silent on these questions as its focus has been on microeconomic issues relating to DFI. In fact, the "modern" theory of DFI is called the theory of internalization according to which the MNE is an institution developed to overcome market imperfections and thus to bypass markets in order to economize on the transaction cost (Rugman 1980). Being microeconomic in its orientation, however, the theory of internalization is

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incapable of explaining the relationship between a country's structural change and its DFI. Furthermore, in discussing the gains from DFI the literature has focussed on DFI's effect on allocative efficiency, x-efficiency, and technology transfer in the case of the host country and on allocative efficiency, output, and employment in the case of the more advanced home country. It is largely silent on how DFI may reduce the cost of and thus facilitate structural adjustment in the latter.

If much of the literature on DFI has ignored the relationship between structural change and DFI, the part of the literature on international trade which has examined the problem of structural adjustment has in turn ignored DFI (e. g., Mussa 1982, Neary 1982). There are now, however, empirical studies which show that by investing abroad in response to changing comparative advantage Japanese firms have facilitated structural adjustment in the Japanese economy (Hara 1989 and 1990, Urata 1989).

The purpose of this paper is to examine the relationship between a structural change brought about by a change in the terms of trade and DFI in a small open economy and find the role that outward DFI may play in facilitating its structural adjustment. Given that the pioneering work in this area of inquiry has been done by Kojima, section II begins with a brief re-examination of Kojima's macroeconomic theory of DFI. The paper then presents a simple model of a small open economy and shows a relationship between structural change and returns on capital. Section III compares intersectoral and international mobility of capital and discusses why capital movement takes place in the form of DFI and not as an arm's-length market transaction. Section IV discusses the effect of labor-market conditions on capital mobility and section V concludes the paper.

II. Structural Change and Direct Foreign Investment

Kojima's Macroeconomic Theory of Direct Foreign Investment

How a country's outward DFI may be related to its comparative advantage was first addressed by Kojima in his macroeconomic theory of DFI (Kojima 1973). A key point in his theory is that Japanese DFI is from the industries in which Japan has a comparative disadvantage and thus contrasts with U.S. DFI which is from the industries in which the United States has a comparative advantage. Given that the conventional theory of DFI explains DFI as being motivated by the firm's possession of firm-specific intangible capital, Kojima apparently found it incapable of explaining Japanese DFI.

To explain DFI out of the industries in which Japan has a comparative disadvantage Kojima proposes a "correspondence principle." According to this, a country's "comparative profitability" (or the ratio of profit rates in two industries) is high in an industry, relative to its counterpart in the other country, in which the country has a comparative advantage. It is then argued that capital will move out of the industry with a low relative profit rate in one country to the industry with a high relative profit rate in the other. It then follows that international capital movement will be from the industry in which one country has a comparative disadvantage to the industry in which the other country has a comparative advantage. This correspondence principle suffers, however, from three major conceptual problems.

The first is that a firm's investment decision is not guided by comparative profitability or the ratio of profit rates but by a comparison of absolute profit rates. To see this point, suppose that profit rates are higher in one country in all industries in comparison with the other country. Then, although there may be a difference in comparative profitability capital will move out of all industries in the second country to be invested in the first country.

The second problem with the correspondence principle is that it is formulated in terms of static comparative advantage and disadvantage. The pretrade difference in cost in the theory of comparative advantage refers to a difference in a static equilibrium, and consequently the profit rate is the same for all industries whether they are comparatively advantaged or disadvantaged. Thus even if one accepts comparative profitability as the determinant of the direction of capital movement, one cannot use it to explain the direction of capital movement as there will be no difference in comparative profitability. The profit rate may, however, differ between countries and consequently there may be capital movement from one country to the other. But, being the same across all industries within each country the profit rate cannot be a determinant of which industry will be investing at home or abroad.

The third problem with the correspondence principle is that it is a symmetric relationship between a pair of countries. Since the relationship between the two is specified only in terms of comparative advantage and comparative profitability with no reference to absolute profit rates, it follows that the flow of DFI must be bilateral. One country's comparatively disadvantaged industry with a comparatively low profit rate is the other country's comparatively advantaged industry with a comparatively high profit rate, and conversely. Consequently, if one country's outward DFI is from its comparatively disadvantaged industry, it receives at the same time DFI in its comparatively advantaged industry from the other country's comparatively disadvantaged industry. Clearly, empirical evidence contradicts this bilateral flow of DFI. Japan which has invested in labor-intensive industries of developing Asian countries has not receive DFI from them in its capital- and knowledge-intensive industries.

Even though the preceding discussion demonstrates that the correspondence principle has serious problems, empirical evidence shows that Kojima's observation of the pattern of Japanese DFI is by and large correct (e. g., Lee 1980)[1]. Furthermore, since the pattern of the recent outward DFI from Korea and Taiwan seems to resemble that of Japan in the 1960s and 1970s his insight into Japanese DFI and his macroeconomic theory of DFI can be a fruitful starting point for further research in the relationship between structural change and DFI.

Structural Change and Returns on Capital

Implicit in Kojima's theory of DFI is the assumption that the firm in an industry in which the country has comparative disadvantage transfers abroad new funds for investment and it maximizes returns on these funds wherever they may be invested. What is, however, more likely to be taking place is that the firm, experiencing declining or low returns on its existing stock capital, is interested in regaining higher returns by transferring it abroad where factor prices are favorable to the technology embodied in the capital. In other words, a firm in a declining industry becomes multinational by reallocating its existing stock of capital across national boundaries and not by investing only new funds abroad. This reason for DFI has been, however, neglected in the "modern" as well as Kojima's theory of DFI.

To demonstrate this relationship between structural change and the incentive for transferring abroad currently employed capital we assume a small open economy consisting of exportables and importables sectors. In this economy exportables, X, and importables, M, are produced under a perfectly competitive condition in all markets and subject to constant returns to scale. Capital is sector-specific in the short run whereas labor is perfectly mobile between sectors but immobile between countries.[2] Consequently, labor is subject to diminishing returns in each sector.

Figure 1, which combines certain features of the diagrams used by Mayer (1974), Mussa (1974), Neary (1978), and Corden and Neary (1982), depicts such an economy. The total supply of labor is the horizontal distance, O_MO_X, and the vertical axis measures the wage rate in terms of X. V_M is then the value of the marginal product of labor schedule in sector M and V_X the value of the marginal product of labor schedule in sector X. At the initial terms of trade profits are

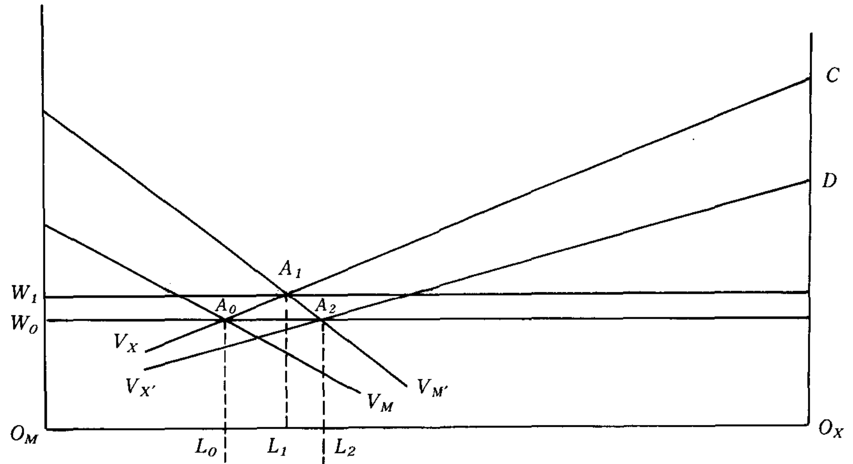
1) For a more detailed discussion of Kojima's macroeconomic theory of direct foreign investment, see Lee(1990).

2) For a more fully specified model of trade and investment with specific factors see Ikemoto (1975). It should be, however, pointed out that in his model direct foreign investment means simply the international movement of sector-specific capital.

maximized at the point of the intersection of these two schedules, A_0. The distance $O_M L_0$ is then the amount of labor employed in sector M and the distance $O_X L_0$ the amount employed in sector X. The equilibrium wage rate is W_0, and the incomes of capital for the two sectors are the triangular areas between the wage line and the respective value of marginal product curves.

The effect of a deterioration in the country's terms of trade is to shift V_M proportionately upward to $V_M{}'$ with new equilibrium at A_1. It follows then that employment increases by $L_0 L_1$ in sector M but decreases in sector X by the same

Figure 1



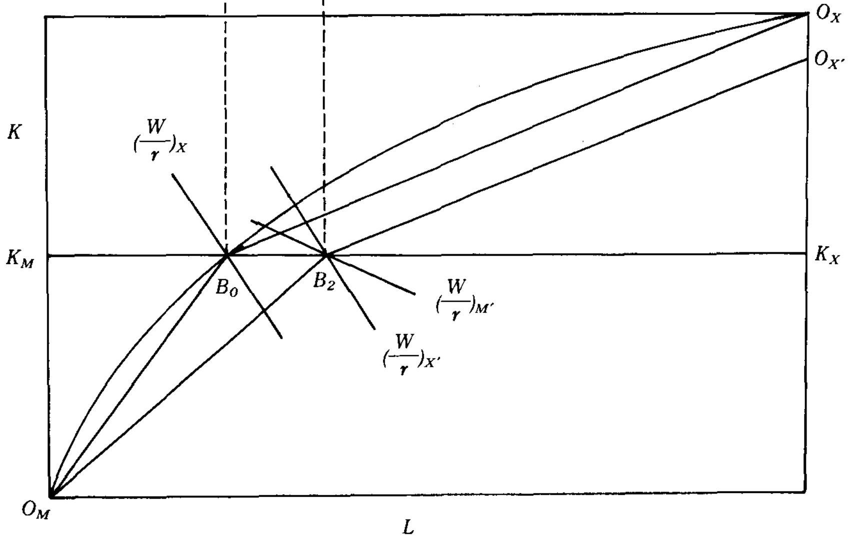


Figure 2

amount. Capital income for sector X is smaller in terms of X as the wage rate is now higher, as indicated by the smaller triangular area between V_X and the new wage line W_1. Since M is now more expensive the capital income also decreases in terms of M. Capital income for sector M is, however, larger than before in terms of the both commodities. It is clear from the figure that this sector's capital income increases in terms of X. It also increases in terms of M since at the initial amount of labor, L_0, the value of this sector's output goes up in proportion with the change in the terms of trade but the cost of labor increases by less. Hence, in terms of X the capital income with the initial amount of labor increases by more than in proportion with the change in the terms of trade and is therefore larger in terms of M than before the change. Since to this we must add the capital income from the additional employment of L_0L_1 in sector M, this sector's total capital income is larger than before the change in the terms of trade.

A deterioration in the terms of trade lowers the Marshallian rent on capital in sector X as its marginal product declines with less labor employed in that sector, and it induces capital to move abroad. Kojima observed this phenomenon--DFI from labor-intensive, declining industries--in Japan in the 1960s and 1970s, and we now observe the same in Korea and Taiwan. What is to be noted, however, is that it is a low Marshallian rent on existing capital and not a low profit rate which induces capital outflow. Why this capital outflow takes place in the form of DFI and not an arm's-length market transaction is, however, the subject matter for section III. For the time being we will simply assume that capital in sector X, although sector-specific, is perfectly mobile between countries. Inflow of foreign capital into sector M is assumed to be prohibited by government policy.

Capital Outflow and Its Effect on Economic Welfare

Capital will move abroad out of sector X until rents are equalized between home and abroad. If the economy was initially in long-run equilibrium, then capital will move until the rent in sector X at home goes up back to the initial level. This situation is reached at point A_2 in Figure 1 and point B_2 off a contract curve in the Edgeworth-Bowley box diagram of Figure 2. In Figure 1 the value of the marginal product curve for sector X shifts down from V_X to $V_{X'}$ with the outflow of capital from this sector. How far it shifts down is determined by the condition that in new equilibrium the rent on capital in sector X is the same as that in the initial equilibrium, the wage rate in terms of X is the same as its initial level, and the capital stock in sector M remains the same. This condition follows from the assumption of perfect international mobility of capital in sector X, which implies that its rental and thus the factor intensity in sector X are determined in the rest of the world. It also implies that this sector's wage rate in terms of X is determined in the rest of the world. Since labor is perfectly mobile between sectors the wage rate also goes down in sector M. Thus, a deterioration in the terms of trade has no effect on the wage rate in terms of X but brings about a decrease in terms of M.

An equilibrium point satisfying the above conditions is reached at point B_2 in Figure 2 where the factor intensity in sector X is the same as that at point B_0 and thus the relative factor price line for sector X, $(w/r)_{X'}$, has the same slope as that in the initial equilibrium, $(w/r)_X$. This short-run equilibrium is reached with an outflow of capital from sector X equal to the distance, $O_XO_{X'}$ in Figure 2, but with the constant amount of capital in sector M (see the appendix). The new relative factor price line for sector M, $(w/r)_{M'}$, has a lower slope, but since the wage rate is the same in terms of X in the both sectors, as shown in Figure 1, the rent in sector M is now higher in terms of X than in the initial equilibrium.

Now we can see the effect of capital outflow on the economy which has undergone a deterioration in its terms of trade. Capital income for sector X is the same as before the deterioration and is therefore larger than that without capital movement. Capital income for sector M is larger than before the deterioration and also larger than that without capital movement as there is now more labor, O_ML_2, employed in that sector. Labor income for the total labor force is the same as before in terms of X but less in terms of M. This contrasts with the case of no capital movement where labor gains in terms of X but loses in terms of M. Thus, in either case labor suffers from a terms of trade deterioration in terms of M but more so in the case of capital mobility because then labor income is smaller in terms of X than in the case of capital immobility.

In terms of GNP the country is better off with capital outflow from sector X than without it. This is because the efficiency of capital allocation improves with capital moving from low marginal productivity at home to high marginal productivity abroad. National income is larger although domestic output is smaller, and thus there can be in principle an income redistribution from capital to labor which could make everbody better off.

This gain in GNP is the triangular area, $A_0A_1A_2$, in Figure 1. Since the wage rate goes back down to W_0 with capital outflow, capital income for sector M is the triangular area between the initial wage line and $V_{M'}$. Capital income for the capital remaining at home in sector X is the triangular area between the initial wage line and $V_{X'}$. The combined capital income from both at home and abroad is the same as before the change in the terms of trade because the rent is the same as before and the total stock of capital in sector X, although divided between home and abroad, remains the same. Since this income is equal to the triangular area between the initial wage line and V_X the income from foreign investment is the area A_0CDA_2. This area is larger, by the triangular area $A_0A_1A_2$, than the area A_1CDA_2, the loss in GDP from capital outflow. Thus, the triangular area is the net gain from foreign investment and is, therefore, the reduction in the cost of structural adjustment brought about by the investment.

III. International Mobility of Sector-Specific Capital

As noted earlier, short-run trade models which assume intersectoral immobility of capital also assume international immobility of capital. In this paper we have relaxed this assumption somewhat by allowing capital in sector X to be perfectly mobile between countries. But, obviously, the underlying implicit assumption that the cost of moving capital is infinitely large in one case but zero in the other is still a polar case and furthermore does not correctly reflect on the economic decision involved in moving capital whether it is to be moved between sectors or countries.

To better understand what is involved in capital movement we should begin with the assumption that even in the short run capital can be made to move between sectors or countries at a cost. This cost may be the explicit resource cost of moving capital, as proposed by Mussa (1982), or it may be the loss in productivity resulting from the use of the capital designed for one sector in another. Since capital will move if a net benefit can be realized from its movement and if there is a larger net benefit from international movement than from intersectoral movement, we will observe the international movement of sector-specific capital.

The point to be noted is that capital movement, whether it is between sectors or between countries, is a combined consequence of economic decisions and technology and not a technological given alone. Once this point is recognized the question we need to ask in answering why sector-specific capital can be internationally mobile and why its movement will take the form of DFI is rather obvious: What are the factors that determine a firm's choice between intersectoral and international movement of such capital?

In the literature on DFI, the cost involved in moving firm-specific intangible capital across national boundaries and thus in maximizing rents on its global use is recognized as the reason why capital movement takes the form of DFI. Because the market for such capital is not well developed its transfer abroad through arm's-length market transaction is costly and is carried out instead as an internal transaction, i. e., DFI.

If, as assumed in section II, sector-specific capital is homogeneous within the sector and everlasting, there is in fact no reason why it cannot be transferred from one country to another as an arm's-length market transaction. But, obviously, the capital employed currently in a declining sector is second-hand capital and is by and large firm- and sector-specific. The market for such capital is, therefore, like that for used cars and deteriorates into a market for "lemons" because of the asymmetry of information (Akerlof 1970). In such a situation the firm would find the market systematically undervaluing its capital and would consider utilizing it internally. When this internal utilization of capital takes place across national boundaries, we observe DFI.

Faced with a declining or low rent on capital, the firm can transfer it either to another country but in the same sector or to another sector within the same country. In the first case the firm can produce and market the same product, utilizing its present sector- and firm-specific tangible and intangible capital. The return on capital may change little although there are additional costs to carrying out business across national boundaries and in an alien country. In the second case the firm will find its capital less productive in the new sector but will not incur the cost of carrying out business in an alien country. These costs and the income that can be generated from the alternative uses of capital thus determine the choice between intersectoral and international movement of capital.

There are reasons to believe that technological developments in communications and transportation in the second half of this century have favored international over intersectoral movement of capital. In fact there is a historical antecedent. In discussing the growth of American business firms from the 1850s until the 1920s Chandler (1977) points out that the firms grew from small enterprises competing in the local and regional market to large enterprises competing in the national market. The reason for this transformation is technological:

> By lowering transportation barriers, the railroads permitted many small enterprises to compete in the national market for the first time. At the same time the telegraph and then telephone helped to make possible centralized supervision of a number of geographically scattered operating units. (Chandler 1977, p. 316)

We can very well see a parallel between the "multi-regionalization" of American business during the early period of its expansion and its multinationalization beginning in the second half of the 20th century. The technological counterparts in the latter period are air transportation and telecommunications. Developments in these have expanded the market globally and made "possible centralized supervision of a number of geographically scattered operating units" but now scattered all over the world. To put it in other words, recent developments in air transportation and telecommunications have decreased the cost of operating a multi-unit business enterprise across national boundaries, thus increasing DFI and the international mobility of sector-specific capital.

IV. Labor-Market Conditions and Capital Mobility

So far the labor market was assumed to be competitive such that workers could be easily hired and laid off. Consequently, the firm's decision either to invest abroad or to invest at home was based only on returns on capital from the alternative investments. In reality, however, the firm may not be free to lay off its workers because of certain union contracts or government regulations, or if it does it may have to incur extra costs. In either way there is a cost to laying off workers, and the firm will take this into account before deciding to invest abroad.

If it invests abroad, the firm will have to lay off at least some of the workers and will thus have to incur the layoff cost. If it moves instead into another sector, it may not have to lay off as many workers as some of them can be carried into the new sector. The cost of this move may be even less if the skills of the currently employed workers are not sector-specific. Even if they are, the firm may find it advantageous to transfer the workers into the new industry. This can happen as, although their marginal product of labor in the new industry is less than the going wage rate, the cost of wage overpayment can be less than the layoff cost it will have to incur if it invests abroad. Thus, if for one reason or another the firm has to bear the layoff cost for its workers, the balance of advantage for the firm may shift toward the intersectoral movement of capital.

According to Kojima, U.S. DFI is carried out by large oligopolistic firms in the industries in which the United States has a comparative advantage whereas Japanese DFI was carried out by firms in the labor-intensive industries in which Japan had comparative disadvantage. If there is a relationship between structural change and returns on capital, as demonstrated in section II, then we will have to ask why we have not observed U.S. DFI out of its declining sectors. Differences in labor-market conditions between the United States and Japan may provide an explanation.

In the case of the Japan of the late 1960s and early 1970s there was a shortage of labor in unskilled labor-intensive industries, and consequently unemployment was not an issue that concerned either labor unions or the government. There was therefore no need to protect the workers in these industries, and labor-market conditions did not become an impediment to investment abroad. In the United States, however, labor unions and government regulations have made labor more protected than in Japan and thus have made it more costly to lay off workers. U.S. firms may have found it more advantageous to move into another industry or even to declare bankruptcy.

Another aspect to consider in the case of Japan is the role that the internal labor market plays when the firm invests abroad or diversifies into another line of product. As Japanese workers tend to be trained as firm-specific generalists they could be more easily transferred from one line of product to another than U. S. workers who tend to be specialists. This characteristic of Japanese workers may make it easier for the Japanese firm to move into another line of product while at the same time it transfers abroad its sector-specific capital. It should be noted, however, that this labor market characteristic holds true only for large firms.

Because U.S. DFI has been carried out in general by large oligopolistic firms it is taken for granted that U.S. DFI is a characteristic of an oligopolistic industry (e. g., Caves 1971, Hymer 1960, and Kindleberger 1969). However, we have just demonstrated that firms even in a competitive industry would have an incentive to invest abroad. Since costs and benefits are compared in making the decision to invest abroad and since non-wage costs such as the layoff cost affect this decision, firms even in a competitive industry may invest abroad if the cost of investing abroad is sufficiently low. Thus, the fact that under the present labor-market condition U.S. DFI is largely by oligopolistic firms should not be taken to mean that under an alternative labor-market condition it would not be carried out, as in the case of Japan, by firms in a more competitive industry.

V. Conclusion

A structural change imposes a cost on the economy because capital--both human and nonhuman--is sector-specific in the short run, and because the change has not been fully anticipated. If fully anticipated, investment decisions would have taken the structural change into account and capital would be fully depreciated by the time when it took place. It is therefore an unanticipated change that imposes a cost to the economy and thus creates the problem of structural adjustment. In the model we have presented here a structural change is not fully anticipated, and a decrease in income on sector-specific capital is thus the cost of the change. What has been demonstrated is that even in such a case the cost can be reduced through direct foreign investment. This reduction in the cost of structural change is shown as the triangular area, $A_0A_1A_2$. The economy, however, still bears some cost because the marginal product of capital is not equal across sectors. With the passage of time capital will move into sectors M from sector X at home and abroad, again equalizing returns on capital between sectors as well as between countries. In the meantime, however, DFI can facilitate structural adjustment in the economy by reducing the cost of structural change.

It should be noted here that the type of DFI discussed in this paper will stop as the economy completes its structural adjustment. Furthermore, multinational enterprises created by this DFI will be sensitive to changes in wage costs, thus becoming so-called foot-loose enterprises. They may even cease to exist as the capital transferred abroad becomes completely depreciated.

In our formal model labor is assumed to be homogeneous. Even then we have seen that labor will suffer from a deterioration in the terms of trade in terms of M and even more when capital is internationally mobile. In reality, labor may be even worse off as it is sector-specific in the short run as well but cannot move between countries. It is obvious that when both capital and labor are sector-specific but only capital is internationally mobile, capital outflow will reduce labor income. Consequently, the response of labor in a declining sector is likely to be different from that of capital. Opposition to outward DFI as a cause for unemployment is exactly a reflection of the frustration of labor which finds itself immobile and suffering from what it perceives to be the effect of capital outflows. What our analysis demonstrates is that a deterioration in the terms of trade is the cause of labor's loss although DFI makes the situation worse. Since DFI is a response on the part of capital to avoid the effect of a deterioration in the terms of trade and since national income is larger as a result, what needs to be done is an income transfer from capital to labor and not the prohibition of outward DFI.

At this point we may ask if there is a case for subsidizing DFI. Since small and medium-sized firms may know less about investment opportunities abroad than at home, they may underinvest abroad and overinvest at home. With respect to proprietary information there is, however, no reason why there would be any difference investing abroad and investing at home. But with respect to general information regarding the economic and political conditions of a foreign country, which takes on the characteristic of a public good, one could argue that it would be socially more efficient for a public agency to collect and disseminate the information freely than for private firms to do it individually. In this regard it is interesting to note that large Japanese trading companies have contributed to DFI by small and medium-sized Japanese firms with assistance in market intelligence, sales, and distribution (World Bank 1988).

If there are distortions in the labor market as in the case of the layoff cost, a second-best policy may be subsidizing foreign investment. The layoff cost increases the cost of the international movement of sector-specific capital, but now subsidies can be used to offset this cost. Workers will be then laid off and receive the layoff payment which the firm pays with subsidies from the government. Now the country's GNP will exceed its GDP provided the subsidies do not introduce distortions in other parts of the economy. Of course, a better policy would be to subsidize directly the workers to move into other industries and eliminate the layoff cost.

Appendix

Following the standard trade models we assume that the sectoral production functions are represented by

$$X = F(K_X, L_X),$$
$$M = G(K_M, L_M),$$

where X and M denote outputs of exportables and importables, K_X and K_M the amounts of capital employed in sectors X and M; and L_X and L_M the amounts of labor employed in sectors X and M, respectively. As these functions are assumed to be linear homogeneous,

$$X = L_X f(k_X),$$
$$M = L_M g(k_M),$$

where k_X and k_M are the capital-labor intensities in sectors X and M, respectively. Functions f and g are twice differentiable with first derivatives, f' and g', being positive and second derivates, f'' and g'', being negative.

Initially, the economy is in long-run equilibrium and perfectly competitive everywhere. Then,

$$r_X = f'(k_X), k_X = K_X/L_X \quad (1)$$
$$r_M = g'(k_M), k_M = K_M/L_M \quad (2)$$
$$w_X = f(k_X) - k_X f'(k_X) \quad (3)$$
$$w_M = g(k_M) - k_M g'(k_M) \quad (4)$$
$$r_X = Pr_M \text{ and } w_X = Pw_M$$
$$L_X + L_M = L \quad (5)$$
$$K_X + K_M = K \quad (6)$$

where r_X and r_M are the rentals in sectors X and M; w_X and w_M the wage rates in sectors X and M; P the terms of trade (price of M in terms of X); and L and K the initial endowments of labor and capital, respectively, in the economy.

Given the assumption that labor cannot move between countries, we obtain from (5) and (6)

$$K = (k_M - k_X)L_M + k_X L. \quad (7)$$

The assumptions of a small open economy and perfect international capital mobility for K_X imply that the rental on K_X, the factor intensity of sector X, and its wage rate are determined in the rest of the world. Then, total differentiation of (7) and the assumption of sector-specific but internationally immobile K_M yield

$$dK_X = L_M dk_M + (k_M - k_X) dL_M. \quad (8)$$

Total differentiation of k_M yields $dL_M = -(L_M/k_M)dk_M$ since K_M is a constant. By substituting this in (8) we obtain

$$dK_X = (k_X L_M / k_M) dk_M. \quad (9)$$

Totally differentiating (4) we obtain

$$dw_M = -k_M g'' dk_M.$$

Substituting the above into (9) we get

$$dK_X = -(k_X L_M / k_M^2 g'') \, dw_M.$$

Since $Pw_M = w_X$, the latter being determined in the rest of the world, $dP/P = -(dw_M / w_M)$. Then,

$$dK_X = (k_X w_M L_M / k_M^2 g'') \, dP/P.$$

Since the term inside the parenthesis is negative, a deterioration in the terms of trade ($dP/P > 0$) leads to a decrease in the amount of capital employed in sector X. Since this capital is not mobile between sectors the decrease is accounted for by the outflow of capital.

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AN APPROACH TO TRANSACTION CONTRACTS WITH ASYMMETRIC INFORMATION*

Kazuhiro IGAWA

This paper discusses an incentive-compatible transaction contract in an environment where information relating to product quality is uncertain and asymmetrically distributed. This contract is shown to improve transactions where the market failure of asymmetric information prevails.

1

Contracts of economic transactions usually become more complicated or some times become more difficult when seller and buyer do not posses the same information than when they do. A negotiation for transaction contracts becomes then complicated as the number of strategies increases. If a contracting method can be found which eliminates this information asymmetry, market efficiency will improve.

The purpose of this paper is to find a contractual arrangement whereby negotiators with informational advantages reveal their advantageous information. This is shown in the context where a seller has perfect knowledge about the quality of a product but a buyer has only a distribution of information relating to its quality. There are many ways of contracts with asymmetric information. For example, the way that an economic agent with informational advantage can make use of it monopolistically, and the way that an agent with informational disadvantage makes use of its subjective distribution (mean, variance, and etc.) for contracts. Here, the contract addressed in this paper is limited to the one in which true information is honestly revealed.

It is well known that a negotiation for one index, about which there exists informational asymmetry between negotiators, may not proceed to final contracts and may produce socially inefficient contracts. For example, if a mean of distribution of the index is used for a contract in the market, economic argents with the index above (or below) the mean value will disappear from the market, if undervaluation (or overvaluation) reduces their gains. This will in turn lower (raise) the mean level of

* I am indebted to professors K. Shimomura, C.H. Lee, H. Ota, M. Tawada and M. Oyama for their helpful comments.

the market and economic agents of reduced gains at the new level will disappear from the market. The market mechanism does not, consequently, work in an efficient way, and the market may disappear. However, if more than one index, say two indices, are used for negotiations in one case of asymmetric information, true information could be revealed.

In a negotiation with one index only, an agent with informational advantage will fully use the advantage for his gains and will want to keep the advantage forever. On the other hand, an agent with informational disadvantage will be sceptical about the strategy of the other player and will believe only his subjective (or market) distribution of the index. However with two indices which have the property that if the informationally advantageous agent tries to be better off by determining one index he must accept the other index making him worse off, it might be possible to find a set of combinations of two indices which will induce the advantagous player to reveal honestly and freely a true index of the asymmetric information. Let us call this choice an incentive-compatible choice. In the next section, conditions for this incentive-compatible choice will be shown.

In the following section, a transaction between a commodity producer and its distributor with asymmetric information will be specified, and an incentive compatibility condition is defined. Section 3 shows the properties of contract with incentive compatibility. In the final section, applications or extensions of the model to real-world economic phenomenan will be discussed.

2

To make the model simple, let us take the following case. Firm X has a product and want to sell it to distributor Y, and X and Y negotiate for transaction contracts. We assume there are a number of firms producing similar products but of different qualities, and there are many competitive distributors. Although firm X knows the quality of his own product, distributor Y has only a subjective distribution function of quality in the market and does not know exactly the quality of firm X. In this situation, Y should be careful about agreeing on a contract, because his sales and profits will depend on the quality of X. Y will get profits if he buys a good quality product at a low price but will make losses with a bad quality product of a high price. To cope with the latter passibility, Y will try to include terms or conditions in the contract for compensating the losses. This makes the negotiation for a contract complicated and difficult.

We are now in a position to set up the mdel. We assume that the quality of product "q" can be indexed between 0 and 1, and the higher q the better the quality.

We also assume for simplicity that index q indicates the probability of successful sale for distributors, that is, the probability of success is q and that of failure $(1 - q)$. Taking a representative firm (X) and a distributor (Y), let us consider a negotiation for two indices: purchasing value (V) and guaranty money (G). V is the value which is paid by Y to X and never to be refunded after transactions. G is a nominal value, which Y gets from X in the case of Y's failure of sale, but G is zero in the case of success. The contracted value of V and G will depend on the quality of product (in this case the quality of firm X). As only X has the information of q, the true value of q is not necessarily revealed in the contract.

The expected profit (Π) of firm X with quality level q is expressed as

(1) $\Pi = V - (1 - q)\ G / r - C,$

where C is the present value of the cost of production and r is a discount rate to get the present value of G. It should be noted that values of V and G depend not on the true level of q but on the quality level which is used in the transaction contract. Firm X will try to choose and pretend to be the quality which maximizes his Π. X will reveal the true value of q if he bears all the risks that come from the difference between the level of true q and the quality level used in the contract, because there is then no incentive to misrepresent his quality. However, if he bears only partial responsibility for the risk, as implied in equation (1), the incentive for misrepresentation exists. Firm X is only responsible for the amount of $(1 - q)\ G/r$ in the case of failure.

As the remainder of the risk will be borne by distributor Y, there is an incentive for Y to find a way to have X reveal the true q in the contract. This incentive compatibility condition can be expressed as

(2) $\Pi(q,\ q) > \Pi(q',\ q),$

where the second element in parenthesis is the true value of quality and the first element is the value reported in the contract. If we can find contract terms satisfying this condition, the reported value of quality in the contracts could be the true one.

Explicitly expressing that value of V and G depend on the quality reported by firm X, equation (2) can be extended as follows:

(3) $$\begin{aligned} \Pi(q',\ q) &= V(q') - (1 - q)\ G(q') / r - C \\ &= \Pi(q',\ q') + (q - q')\ G(q') / r \\ &< \Pi(q,\ q) \end{aligned}$$

where $\Pi(q',\ q')$ is the profit of the firm of quality q' and reporting the truth of q'. A similar condition can be obtained for a firm of quality q' but reporting quality q. That is

(4) $\Pi(q,\ q') = V(q) - (1 - q')\ G(q) / r - C$

$$= \Pi(q, q) + (q' - q)\ G(q)/r$$
$$< \Pi(q', q').$$

From inequalities of (3) and (4), the following relations hold.

(5) $(q - q')\ G(q')/r < \Pi(q, q) - \Pi(q', q') < (q - q')\ G(q)/r,$

and thus

$$\lim_{q' \to q} \frac{\Pi(q', q') - \Pi(q, q)}{q' - q} = G(q)/r.$$

Putting the left hand side of the equation as Π', we get the first derivative of Π with respect to q:

(6) $\Pi' = G\ (q)/r.$

In the case that $q > q'$, using both inequalities of (5) we get:

$G(q')/r = \Pi'(q') < G(q)/r = \Pi'(q)$

This implies the second derivative of Π with respect to q is positive. That is,

(7) $\Pi'' > 0.$

We now find that the local expressions for the incentive compatibility condition are the equations (6) and (7)[1].

A distributor determines V and G, taking into account of relations (6) and (7), and thus using the true value of q. In the above example, an expected profit, M, of the distributor Y can be expressed as

(8) $M = qV + (1 - q)\ G/r - V - K.$

Here, it is assumed that a distributor does not know exactly the quality of firms, but has the distribution function of the quality of firms as a whole in the market.[2] The first term of the right hand side of eqeation (8) is the present value of sales V multiplied by success probability q. Here it is assumed for simplicity that an average rate of profit is equal to the discount rate and the present value of sales is

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1) Conversely, from relations (6), (7), it follows that
$\Pi(q, q) > \Pi(q', q).$
That is, from equation (3),
$\Pi(q, q) - \Pi(q', q)$
$= \Pi(q, q) - \Pi(q', q') - (q - q')\ G(q')/r$
$= \int_{q'}^{q} \Pi'(x)\ dx - (q - q')\ \Pi'(q')$

, and the last relation holds from equation (6).
From equation (7), Π' is an increasing function of q and thus

$\int_{q'}^{q} \Pi'(x)\ dx \geqq (q - q')\ \Pi'(q').$

Therefore,
$\Pi(q, q) > \Pi(q', q)$

2) A distributor might use reported q' instead of true q. However, it is assumed $q' = q$, after the adjustment process of incentive compatible contracts.

equal to the purchasing value. The second term is the discounted value of guaranty money in the case of failure. The third is the purchasing cost and the fourth is the sales cost of the distributor.

To avoid complexities of oligopolistic games between firms and distributors, perfect competition among distributors is assumed. Then, we get the constraint of

(9) $(1-q)(G/r-V)-K=0$

since $M=0$ in equation (8).

Now, there exist many combinations of V and G, which satisfy the zero profit condition (9). For a distributor these combinations might be indifferent, but profits of firms will be different depending on the combinations. A firm will choose a distributor, who shows the combination of V and G which maximizes its profits. Therefore, distributors will compete to make firms better off by showing possible combinations of V and G. That is, the combination of V and G, which maximizes profits of firms, will be set by competition among distributors. This will be refered to in the following section.

3

The model discussed in the previous section is written as follows. That is,

$$II = V(q) - (1-q)G(q)/r - C \quad (1)$$
$$II' = G(q)/r \quad (6)$$
$$II'' > 0 \quad (7)$$
$$(1-q)(G(q)/r - V(q)) - K = 0 \quad (9)$$

To solve these equations, let us reduce the number of variables, by eliminating V and G. From equation (9), it follows that

(10) $V(q)=G(q)/r-K/(1-q)$

and putting this into equation (1), we get

(11) $II(q)=qG(q)/r-C-K/(1-q)$.

Using equation (6), this can be rewritten as

(12) $II'(q)=II(q)/q+C/q+K/(1-q)\,q$.

From this differential equation, the optimum solution of $II(q)$ is solved, if an arbitrary constant is determined. The determination of this is the determination of V and G mentioned in the previous section, but will be discussed in later.Once $II(q)$ is solved, $G(q)$ will be found from equation (11), and $V(q)$ from equation (11), in turn. These solutions of $V(q)$ and $G(q)$ are the schedule of contract terms which are shown by distributor Y to firm X. Y shows the schedule to X which then chooses q, and the value of $V(q)$ and $G(q)$ are determined. The level of q chosen by X is the true level of q, because the V and G schedules satisfy incentive compatibility conditions.

Here, we are in a position to investigate properties of schedules of $V(q)$ and $G(q)$, taking into accont of condition (7). Differentiating equation (6) with respect to q, and using relation (7), we get

(13) $\Pi'' = G'(q) / r > 0.$

This means that the higher quality the larger the guaranty money will be. This is not curious, because the firm with higher quality product has a higher probability of success to sale and he is not very concerned about G, which he will pay in case of failure, as far as V is higher. Next, differentiating equation (11) with respect to q, and using equation (6), we get

(14) $G'(q) / r = K / (1 - q)^2 q$

and, again differentiating this with respect to q, $G''(q)$ becomes as follows.

(15) $G''(q) / r = K(3q - 1) / q^2 (1 - q)^3$

Therefore properties of G schedule are

$$G'(q) \gtreqless 0 \qquad as\ q \gtreqless 1/3.$$

That is, untill $q = 1/3$, the rate of increase of G should become smaller as q increase and it should become larger after $q = 1/3$. This relation is shown in Figure 1. At $q = 1/3$, a positive slope of a tangent line changes from decrease to increase. The properties of V schedule are as follows. Differentiating equation (10) with respect to q, and using equation (14), we get

(16) $V'(q) = K / (1 - q)\ q.$

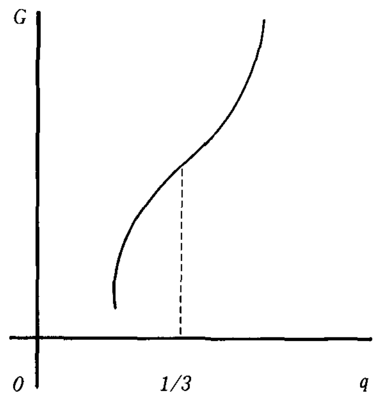

Fig. 1

Therefore $V'(q) > 0$, and this is reasonable because the increasing function of G schedule is balanced by the increasing function of V. If $V'(q) < 0$ for $G'(q) > 0$, every firm has an incentive to tell a low value of q, and this contradicts the incentive compatibility condition. Comparing equations (14) and (16), we find $V'(q)$ is smaller than $G'(q)$. Now differentiating equation (16) with respect to q, we get

(17) $V''(q) = K(2q - 1)/(1 - q)^2 q$

and thus

$$V''(q) \gtreqless 0 \text{ as } q \gtreqless 1/2.$$

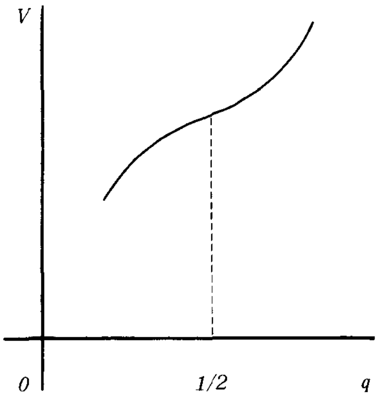

Fig. 2

V schedule is shown as in Figure 2. Comparing equations (15) and (17), we find $V''(q)$ is smaller than $G''(q)$. That is, for higher q the rate of increase of the guaranty money G is higher than the one of the purchasing value V. Therefore a low quality firm has no incentive to tell higher quality, because of relatively higher guaranty money will be asked. Conversely, a high quality firm has no incentive to tell lower q, because of lower V. A high quality firm is not relatively careful for the decrease of G.

With these properties of V and G schedules of the incentive compatibility condition, firms will tell truth in contracts. However, not only the shape of the schedules but the absolute levels should be determined, and this is the determination of the arbitrary constant of differential equation (12).

There are many factors which determine the levels of V and G. In the above model, we focussed only on the shapes of V and G schedules and the model has a property that an equal increase of V and G/r is indifferent for distributor but beneficial for a firm. This is because, for the firm V is certain but G/r is cost only in the case of failure. If nothing is introduced for the model, higher V and G/r are preferable. However this can not be true in the real world. A higher value of V may not be compatible to the demand function which a distributor confronts for sale, and higher value of G may follow higher costs of a financial management. Here, to avoid the complexities of introducing demand functions and costs of management, we assume that the profit of the lowest quality firm is zero. That is, G of the lowest quality (q_0) firm becomes $G = \{C + K/(1 - q_0)\}\ r/q_0$ from equation (11), and $V(q_0)$ is determined by equation (10).

4

So far, transactions under asymmetric information are investigated, and here we briefly compare it with those under symmetric information. The latter is a case where distributors have the same knowledge about the level q as producers have. We can show that the results of both transactions are same, if transaction costs of distributor are same for both cases. For the case of symmetric information in the above model uncertainty is only probability of success q. Therefore the expected profit of a firm, whose products are sold by a distributor at the present value V, is

(18) $\tilde{\Pi} = qV - \tilde{K} - C$

where $\tilde{K}$ is transaction costs of the distributor in the case of symmetric information. This is because the producer pays the cost of $\tilde{K}$ and get qV, taking into account of the success probability and the zero profit of the distributor. On the other hand, the expected profit of the firm in an asymmetric case is, using equations (9) and (1),

(19) $\Pi = qV - K - C.$

Therefore, if transaction costs for making incentive compatible contracts are zero and $\tilde{K}$ is applicable for both symmetric and asymmetric cases, all the results are the same for both cases.

However, it is reasonable that the transaction costs under asymmetric information case are larger than those under symmetric information case, $K > \tilde{K}$. If this is true, the producer's profits are less and thus it is socially less beneficial for larger K. This is the costs of using the incentive compatible contracts.

A long term contract is another way to cope with market deficiency. With a long term contract informational disadvantage might be reduced and risk of cheating between transactors would be reduced. In a long term contract guaranty money might not be necessary and incentive compatible contracts also might not be necessary, but some elements should be put in long term contracts to overcome possible dificiency from asymmetric information.

A long term contract uses market but a trader cannot change a partner in the short run and it is similar as using an organization, at least during the contract period. In the organization, the partners follow their contracts but they are independent in many other economic behaviors. In some sense, a long term contract is a mixture of a market and an organization.

5

With asymmetric information, a market mechanism does not work in an efficient way. There would be many different ways of transaction to cope with the deficiency. One way to cope with asymmetry of information is to find contract terms which reveal the true information, as discussed in this paper. Another way is not to use a market mechanism and to internalize transactions. The former is the way to improve market mechanism and the latter is the way to use organizations instead of markets or internalize the markets. Which one to choose depends on transaction costs. If the cost of finding and using the contract to reveal information is high, an organization which internalize the transaction will be used. A firm, losing his comparative advantage, makes foreign direct investments using his used capital, instead of selling it to foreign firms, is a case in point. If the cost of setting up and maintaining an organization and transaction costs within the organization are high, then the market contract of revealing information will be searched for. If both of these costs are high, many different types of games in the market will determine the ways of transactions. It is interesting to compare transaction costs obtained by different ways of transaction, such as the one of contract terms in this paper, of internalizations by organizations, and of games. This paper showed only one type of transaction of contract term among many of them.

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A MATHEMATICAL NOTE ON THE IMPOSSIBILITY OF GLOBAL ABSOLUTE ADVANTAGE[1)]

Kazuo SHIMOMURA

0. In Kemp and Shimomura (1988) it was asserted that in the standard $2 \times 2 \times 2$ Hecksher-Ohlin model of international trade *one country cannot hold a global absolute advantage over the other.* This 'impossibility theorm' is a direct consequence of the following proposition:

(*) Suppose that one country enjoys a uniform proportinate expansion of its production set. Then the other country is necessarily better-off in the new world equilibrium, if the latter is locally stable.

In the above paper we mentioned that this proposition is valid for any number of commodities. The purpose of this note is to give a formal proof of it.

1. First of all, let us describe a general equilibrium model of international trade which is to be used for our main business here. There is a trading world which consists of two countries, say h and f. Each of the countries can produce $n+1$ tradeable consumption goods, indexed by $i = 0, 1, \ldots, n,$ by using constant-returns-to-scale production technology. The price of the ith good is denoted by p_i and the 0th good serves as numerare; $p_o \equiv 1$. Assuming, furthermore, that the social utility function of each country is also homogeneous of degree one in all consumption goods, the general equilbrium model is described as follows:

(1) $$e_h(p)\, u_h - r_h(p) = 0$$

(2) $$e_f(p)\, u_f - r_f(p) = 0$$

(3) $$e_h^i(p)\, u_h - r_h^i(p) + e_f^i(p)\, u_f - \delta\, r_f^i(p) = 0 \qquad , \quad i = 1, \ldots, n$$

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1) I am grateful to Professor Murray C. kemp for allowing me to publish this note under my own name.

where $e_q(p)$, $q = h, f$, the unit expenditure function of country q, $r_q(p)$, $q = h, f$, the revenue function of country q, p a vector of order $(n+1) \times 1$ such that the ith element of it is p_i, $i = 0, 1, \ldots, n$, $e_h^i \equiv \partial e_h / \partial p_i$, $r_h^i \equiv \partial r_h / \partial p_i$, etc. δ is a parameter whose increase represents the uniform expansion of country f's production set.

2. Now we shall state the proposition to be proved in this note.

PROPOSITION Suppose that the equilibrium solution to the system uniquely exists and locally stable. Then,
(i) a uniform expansion of country f's production set makes country h better-off, that is,

$$\left. \frac{du_h}{d\delta} \right| \delta = 1, \text{ initially} > 0, \tag{4}$$

and
(ii) if at least one of the functions, $r_h(p)$, $r_f(p)$, $-e_h(p)$ and $e_f(p)$, is strictly concave with respect to $p_1, \ldots, p_n$, then (4) is strictly positive.

REMARK : $r_q(p)$ and $-e_q(p)$, $q = h, f$, are homogeneous of degree one in p. Hence, each of them can be strictly convex with respect to $p_1, \ldots, p_n$.

3. Let us start the proof of this proposition. Differentiating (1) — (3) with u_h, u_f, p_1, $i = 1, \ldots, n$, and δ at $\delta = 1$, we have

$$\begin{pmatrix} -e_h, & 0, & r_h^1 - e_h^1 u_h, \ \ldots, & r_h^n - e_h^n u_h, \\ 0, & -e_f, & r_f^1 - e_f^1 u_f, \ \ldots, & r_f^n - e_f^n u_f, \\ -e_h^1, & -e_f^1, & \sum_{q=h,f} (r_q^{11} - e_q^{11} u_q), \ \ldots, & \sum_{q=h,f} (r_q^{1n} - e_q^{1n} u_q) \\ \vdots & \vdots & \vdots & \vdots \\ -e_h^n, & -e_f^n, & \sum_{q=h,f} (r_q^{n1} - e_q^{n1} u_q), \ \ldots, & \sum_{q=h,f} (r_q^{nn} - e_q^{nn} u_q) \end{pmatrix} \begin{pmatrix} du_h \\ du_f \\ dp_1 \\ \vdots \\ dp_n \end{pmatrix} = \begin{pmatrix} 0 \\ -r_f \\ -r_f^1 \\ \vdots \\ -r_f^n \end{pmatrix} d\delta \tag{5}$$

Resorting to Cramer's rule, we have

$$\frac{du_h}{d\delta} = \frac{\det[B]}{\det[A]} \tag{6}$$

where

$$B \equiv \begin{pmatrix} 0, & 0, & r_h^1 - e_h^1 u_h, \; \ldots\ldots, \; r_h^n - e_h^n u_h \\ -r_f, & -e_f, & r_f^1 - e_f^1 u_f, \; \ldots\ldots, \; r_f^n - e_f^n u^f \\ -r_f^1, & -e_f^1, & \\ \vdots & \vdots & D \\ -r_f^n, & -e_f^n, & \end{pmatrix}$$

and

$$A \equiv \begin{pmatrix} -e_h, & 0, & r_h^1 - e_h^1 u_h, \; \ldots\ldots, \; r_h^n - e_h^n u_h \\ 0, & -e_f, & r_f^1 - e_f^1 u_f, \; \ldots\ldots, \; r_f^n - e_f^n u_f \\ \vdots & \vdots & D \\ -e_h^n, & -e_f^n, & \end{pmatrix}$$

where D is a matrix of order $n \times n$ such that its (i, j) element is

$$\sum_{q=h, f} (r_q^{ij} - e_q^{ij} u_q).$$

4. Now let us check the signs of *det [A]* and *det [B]* in turn.

4.1 sign {det [B]} Consider *det [B]*. Subtracting the first colum from the second one, adding the first row to the second one and considering (3), we have

$$(7) \qquad det\ [B] = -\frac{r_f}{u_f} \begin{vmatrix} & 0, & r_f^1 - e_f^1 u_f, \; \ldots\ldots, \; r_f^n - e_f^n u_f \\ r_f^1 - e_f^1 u_f, & & \\ \vdots & & D \\ r_f^n - e_f^n u_f, & & \end{vmatrix}$$

$$\equiv -\frac{r_f}{u_f} det\ [B^*]$$

Since $r_p(p)$ and $-e_q(p)$ are convex functions, D is positive semi-definite, i. e., for any $x \equiv (x_1, \ldots, x_n) \neq 0 \; x'Dx > 0$. Henceforth, we shall assume, without loss, that r_f^1

$-e_f^1u_f \neq 0$. Now partition the matrix B^* defined in (7) as follows:

$$B^* \equiv \begin{pmatrix} 0, & c_1, & C_2' \\ c_1. & d_{11}. & D_2' \\ C_2, & D_2, & D_{22} \end{pmatrix}$$

where $c_1 \equiv r_f^1 - e_f^1u_f$, $d_{11} \equiv \sum_{q=h,f}(r_q^{11} - e_q^{11}u_q)$, C_2 and D_2 are vectors of order $(n-1) \times 1$ and D_{22} is a sub-matrix of order $(n-1) \times (n-1)$ of D. C_2' and D_2' are the transposes of C_2 and D_2, respectively. Denoting x by (x_1, X_2') where X_2 is a sub-vector of order $(n-1) \times 1$ of x, for any x satisfying $x_1c_1 + X_2'C_2 = 1$,

$$x'Dx = X_2' \, [D_{22} - 2D_2C_2'/c_1 + d_{11}C_2C_2'/(c_1)^2] \, X_2 \equiv X_2'D^*X_2$$

, which must be nonnegative for any x because D is positive semi-definite. It follows that $det\ [D^*] > 0$.

Now we see

$$\begin{pmatrix} 1, & 0, & 0_{n-1}' \\ 0, & 1, & 0_{n-1} \\ 0_{n-1}, & -C_2/c_1, & I_{n-1} \end{pmatrix} \begin{pmatrix} 0, & c_1, & C_2' \\ c_1, & d_{11}, & D_2 \\ C_2, & D_2, & D_{22} \end{pmatrix} \begin{pmatrix} 1, & 0, & 0_{n-1} \\ 0, & 1, & C_2'/c_1 \\ 0_{n-1}, & 0, & I_{n-1} \end{pmatrix}$$

(8)

$$= \begin{pmatrix} 0, & c_1, & 0_{n-1}' \\ c_1, & d_{11}, & H' \\ 0_{n-1}, & H, & D^* \end{pmatrix}$$

where 0_{n-1} is a vector of order $(n-1) \times 1$ such that any element of it is zero, I_{n-1} is the identity matrix of order $(n-1) \times (n-1)$ and $H \equiv D_{21} - d_{11}C_2/c_1$. Since

$$\begin{vmatrix} 1, & 0, & 0_{n-1}' \\ 0, & 1, & 0_{n-1}' \\ 0_{n-1}, & C_2/c_1, & I_{n-1} \end{vmatrix} = \begin{vmatrix} 1, & 0, & 0_{n-1}' \\ 0, & 1, & -C_2'/c_1 \\ 0_{n-1}, & 0, & I_{n-1} \end{vmatrix} = 1$$

, (8) implies that $det\ [B^*]$ is equal to

$$\begin{vmatrix} 0, & c_1, & 0_{n-1}' \\ c_1, & D_{11}, & H' \\ 0_{n-1}, & H, & D^* \end{vmatrix} = -c_1 \begin{vmatrix} c_1, & 0'_{n-1} \\ H, & D^* \end{vmatrix}$$

$$= -(c_1)^2 det\ [D^*],$$

which is nonpositive, since $det\ [D^*] > 0$ as was already shown. It follows from the argument to this point that

$$(9) \quad det\ [B] = \frac{r_f (c_1)^2 det\ [D^*]}{u_f} > 0$$

4.2 sign {*det [A]*} To see the sign of $det\ [A]$, consider the following system of differential equations:

$$\dot{p}_i = \alpha_i \times [e_h^i\ (p) r_h(p)/e_h\ (p) - r_h^i(p) + e_f^i(p) r_f(p)/e_f(p) - r_f^i(p)]$$
$$\equiv \alpha_i \times ED_i \quad i = 1, \ldots, n$$

where α_i, $i = 1, \ldots, n$, is positive and constant. For this system to be locally stable in a neighbourhood of the equilibrium point, it is necessary that

$$(10) \qquad -det\ [\partial ED/\partial p] \equiv \begin{vmatrix} -\partial ED_1/\partial p_1, & \ldots\ldots & -\partial ED_1/\partial p_n \\ \vdots & & \vdots \\ -\partial ED_n/\partial p_n, & \ldots\ldots & -\partial ED_n/\partial p_n \end{vmatrix} > 0$$

Each element of this determinant is expressed as the last RHS of the following equation.

$$(11) \qquad -\partial ED_1/\partial p_j = (r_h^{ij} - e_h^{ij}/e_h) + (r_f^{ij} - e_f^{ij}/e_f)$$
$$+ (e_h^j r_h - e_h r_h^j)\ e_h^i/\ (e_h)^2 + (e_f^j r_f - e_f r_f^j)\ e_f^i/\ (e_f)^2$$
$$= (r_h^{ij} - e_h^{ij} u_h) + (r_f^{ij} - e_f^{ij} u_f)$$
$$+ (e_h^j u_h - r_h^j)\ e_h^i/e_h + (e_f^j u_f - r_f)\ e_f^i/e_f$$
$$= \sum_{q=h,f} (r_q^{ij} - e_q^{ij} u_q) + (e_h^j u_h - r_h^j)\ e_h^i/e_h + (e_f^j u_f - r_f^j)\ e_f^i/e_f$$

where the second equality is justified from (1) and (2).

Now concentrnte on $det\ [A]$. Subtracting the first row multiplied by e_h^i/e_h and the second row multiplied by e_f^i/e_f from the $(i + 2)$ th row for $i = 1, \ldots,$ n and taking into account (10)and (11), we see that

$$det\ [A] = \begin{vmatrix} -e_h, & 0, & r_h^1 - e_h^1 u_h, \ldots\ldots\ldots\ldots, & r_h^n - e_h^n u_h \\ 0, & -e_f, & r_f^1 - e_f^1 u_f, \ldots\ldots\ldots\ldots, & r_f^n - e_f^n u_f \\ 0, & 0, & -\partial ED_1/\partial p_1, \ldots\ldots\ldots\ldots, & -\partial ED_1/\partial p_n \\ \vdots & \vdots & \vdots & \vdots \\ 0, & 0, & -\partial ED_n/\partial p_1, \ldots\ldots\ldots\ldots, & \partial ED_n/\partial p_n \end{vmatrix}$$

$$= -e_h e_f det\ [\partial ED/\partial p] > 0,$$

which completes the proof of PROPOSITION.

References

[1] Kemp, M. C. and K. Shimomura "The Impossibility of Global Absolute Advantage in the Heckshen-Ohlin Model of Trade", *Oxford Economic Papers,* 1988, 575–576.

ON REFORM OF THE INTERNATIONAL MONETARY SYSTEM: A SURVEY*

Hideki Izawa

I Introduction

The present floating exchange rate system among the industrial countries after the collapse of the Bretton Woods (adjustable peg) system is characterized by the high volatility in the short-run and the large and persistent misalignment (the deviation from medium-term equilibrium) of real exchange rates over 1980s, as Figure 1 shows. The dollar appreciated by roughly 50% in real effective terms from early 1980s until early 1985 and subsequently depreciated. There is no clearcut consensus about its causes. Some economists argue that misalignment is due to the policy mix in the U. S., and others argue that it is due to bubbles or safe haven. Foreign exchange market is dominated by huge capital transaction rather than commodity trade on a daily or weekly basis. Exchange risk can be hedged in forward market. However, misalignment in real exchange rates has been costly because they distort efficient resource allocation in the trade sector and prompt protectionism. The U. S. economy lost international competition which led to large trade deficit and at the same time large inflow of capital (increase in external debts) due to U. S. fiscal deficit.

In this paper, we review critically the alternative proposals for reform of international monetary system rather than interpreting the behavior of exchange rates.[1)]

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* The author was inspired by the papers presented at the 4th international conference 'The evolution of the International Monetary System: How can Efficiency and Stability be Attained?' organized by Institute for Monetary and Economic Studies, Bank of Japan, and a few sessions of the annual meeting of American Economic Association in Atlanta on December 28–30, 1989.

1) Dornbusch and Frankel (1987) and Frenkel and Goldstein (1989), for example, are recent good survey papers on this topic. See also Frankel and Froot (1990) about the explanation of the exchange rates in 80's. They found that using survey data, the market shifts weight away from fundamentalists (who forcast the exchange rates based on such models as Dornbusch's overshooting model) to technical analyst or chartist (whose information set does not include such fundamantals as long-run equilibrium rates), because the fundamentalists' forecasts of dollar depreciation continued to be proven wrong over the period 1981-85, so that such change is a source of misalignment which takes place with little basis in macroeconomic fundamentals.

(source) IMF, International Financial Statistics

Figure 1 Real effective exchange rate of dollar (1985 = 100) quarterly data

Table 1 classifies international monetary systems (both past and proposed) by the two criteria, flexibility of exchange rates and symmetry of operation. The columns are divided by whether the international monetary system are symmetric or hegemonic. And the rows are divided by whether exchange rates are float, or fixed, or managed. In this paper, we focus on McKinnon's proposal for fixed exchange rates and Williamson's proposal for target zones.

Table 1 International Monetary Systems

	floating	fixed	managed
symmetry	national monetary targets (1973–85)	McKinnon's proposal	Williamson's proposal target zones
hegemony	—	Bretton Woods system	EMS (1979–)

based on Miller and Williamson (1988) p. 1032.

As Frenkel (1987) described, there are some reasons for the diversified views about the desired exchange rate system in spite of the ongoing debate. First, participants in the debate have not shared the presumption concerning the relevant alternative to the system they promote. Second, there are different concepts of the "equilibrium" exchange rate and not all participants in the debate share the same concept. Third, different countries face different shocks. It is apparent that the appropriate exchange rate regime depends on the nature and origin of shocks, which we see below. Fourth, the costs of mistaken policies and the ability to correct errors differs across countries. Fifth, countries differ from each other according to the various criteria (for example, the degree of factor mobility) governing the choice of optimal currency areas. Sixth, views differ about the functions of exchange rates and of market mechanism. There are those who maintain the speculative bubble. On the other hand, there are also those who view exchange rate as an important gauge which provides valuable information about current as well as future policies. Finally, there are also different views about the advisability and effectiveness of foreign exchange intervention. In spite of the evidence that the effectiveness of sterilized exchange intervention is very limited, there are those who still support such intervention, since it can be effective by signalling to the market the intention of policymakers.[2)] The foregoing reasons explain why views about the need for and the desired characteristics of the international monetary system reform differ across countries and may not converge soon.

Any operational international monetary system must solve the so-called n − 1 problem; there are n currencies and only n − 1 independent exchange rates. We thus have one degree of freedom and its disposal must be explicitly specified. The Bretton Woods system allocated the degree of freedom to the United States which could pursue independent monetary policy without external constraint, but was obliged itself to peg the price of gold at $35 an ounce. The other n − 1 countries then committed themselves to peg thier currencies to the U. S. dollar. It should be noted that a design of the international monetary system is not complete unless it provides an explicit resolution to this n − 1 problem.

In section II, first of all, we review the theoretical literature on the exchange intervention in a small open economy model. However, the assumption of a small open country is too limited to cope with the issue of the international monetary system. Thus we use the two-country model to evaluate the relative merits of the flexible and fixed exchange rates, and compare non-cooperative and cooperative regimes. Further, we examine the feasibility of international policy coordination

2) According to Marston (1988), there are three distinct channels through which sterilized intervention can affect exchange rates. The first is the portfolio balance channel. As long as the domestic and foreign securities are imperfect substitutes, sterilized intervention is effective by changing the composition of assets in private portfolios with monetary liabilities unchanged. The other two channels operate through announcement effects which require either market inefficiencies or superior information on the part of the authorities. The intervention provides new information by signalling the private market about the future monetary policies of the authorities. This last channel works even if the market is efficient. See Obstfeld (1988) in detail on the effectiveness of sterilized intervention in the light of recent experience.

which nowadays is widely accepted. In sections III and IV, we focus on the proposals by McKinnon and Williamson and point out their problems. Finally, in section V, concluding remarks are mentioned.

II The Choice of the Optimal Exchange Rate Policy and International Policy Coordination

(i) The optimal exchange market intervention in a small open economy

In this section, first of all, we summarize the debate on flexible versus fixed exchange rate systems and review the literature on optimal foreign exchange intervention in a small open economy. Mundell (1963) analyzed initially on the choice between a completely fixed and a perfectly flexible exchange rate system. It shows that monetary policy in a small open economy under perfect capital mobility is effective in the sense that it affects output under flexible rates, but not under fixed rates, and that fiscal policy is effective under fixed rates, but not under flexible. This results is reinterpreted in the way that countries experiencing large financial disturbances would enjoy more employment stability if exchange rates were fixed, while countries experiencing large goods market disturbances would have more employment stability if exchange rates were flexible. Boyer (1978) concludes that the exchange rate should be pegged if shocks arise in the market of intervention(the money market or the goods market)and should be flexible if they impinge on the other market of non-intervention. Complete fixed or flexible exchange rate is optimal only in these very specific cases. In general, the optimal exchange rate policy is to permit the appropriate degree of exchange rate flexibility. Roper and Turnovsky (1980) also analyze the optimal intervention policy rule in the stochastic open macro model. The conclusion is the same in that the polar cases of perfectly fixed and flexible rates are not generally optimal to the economy which faces domestic and foreign disturbances. Even if the foreign interest rate changes, a flexible rate is not the ideal insulator from this foreign monetary shock for stabilization of domestic income. The sufficient conditions for a perfect flexible rate to be optimal are that there are no disturbances in the money market and the interest elasticity of the demand for money is zero. On the other hand, the sufficient condition to ensure that a fixed rate is optimal is that the disturbances occur only in the domestic money markèt. These analyses are based on the assumption that the price of domestic output is constant in a small open economy, and the objective of exchange intervention is minimizing the variance of output about its target level. Later, Turnovsky (1983a) analyzes the problem in a stochstic rational expectations model of the small open economy in which the domestic price is endogenously determined under the assumption of purchasing power parity. Similarly, fixed or flexible rates are not in general optimal to minimize a weighted average of the asymptotic variances of the domestic output and the domestic price level. The optimal intervention policy may involve either leaning against the wind or leaning with the wind, depending upon the sources of random disturbances impinging on the domestic economy. A fixed rate is optimal in the case that the only disturbance occurs in the domestic monetary market. A flexible rate does not provide perfect insulation from foreign monetary disturbances. The conclusion suggests that the appropriate choice of intervention policy is extremely difficult, being highly sensitive to relevant parameters in the domestic economy as well as the random disturbances impinging on the economy.

More recently, it has been recognized that the choice between fixed and flexible exchange rate systems depends on wage behavior, that is, whether wages are indexed or not. Marston (1982) shows in an extended small country model taking account of wage indexation and flexible prices that first the difference in output variation between fixed and flexible rates depends on wage behavior in the domestic economy. The more highly indexed is the economy, the less difference the choice of exchange rate system makes for output variation. With full indexation, output variation is identical in two systems. Secondly, foreign wage behavior is also to be of key importance, since full wage indexation abroad can insulate the domestic country completely from foreign monetary disturbances regardless of domestic behavior, while for other disturbances it is the relative degree of wage indexation which determines the desirability of flexible rates.

On the other hand, it also has been recognized that the optimal degree of wage indexation depends on the prevailing exchange rate system. Flood and Marion (1982) showed that a small open economy with fixed exchange rates should adopt a complete wage indexation whereas an economy with flexible exchange rates should adopt a partial wage indexation in taking account of foreign disturbances, following an optimal degree of wage indexation in a closed economy developed by Gray (1976). For the small open economy, a fixed exchange rate system provides full insulation from foreign disturbances when indexation is optimal (full), but is unambiguously inferior to a flexible rate system in term of its ability to minimize output variance.

The optimal degree of foreign exchange intervention under an exogenously given degree of wage indexation and the optimal degree of wage indexation under an exogenously given exchange rate system have been analyzed independently. However, they are interrelated and should be simultaneously determined as a joint optimization problem in a stochastic macroeconomic model which incorporates the international transmission of disturbances. Turnovsky (1983b) emphasizes the interdependence between wage indexation and exchange market intervention as policy instruments of macroeconomic stabilization in a small open economy subject to stochastic disturbances. It is shown how the choice of either policy instrument impinges on the effectiveness of the other. If the domestic wage is fully indexed to domestic cost of living, then exchange market intervention becomes ineffective in stabilizing real output. Likewise, under a particular intervention rule wage indexation becomes ineffective. Aizenman and Frenkel (1985) also deal with the design of wage indexation and foreign exchange intervention in a small open economy subject to stochastic shocks. One of the main results is that the adoption of the optimal set of monetary policy rules results in the complete elimination of the welfare loss arising from the existence of nominal wage contracts and the simple indexation rule. It shows that the number of independent indicators which govern a monetary policy aiming at the elimination of a distortion must equal the number of independent sources of information (in their analysis, exchange rate, foreign interest rate shock, and foreign price shock), which influence the determination of the undistorted (or market-clearing) equilibrium, and that with a sufficient number of independent indicators for monetary policy, there may be no need to introduce wage indexation. By the same token, it is also shown that for an economy that is not able to choose freely an exchange rate system (namely, the coefficient of an exchange rate in nominal money supply function), the welfare loss can still be eliminated by the (constrained) monetary policy with an optimal rule for wage indexation.

More recently, Turnovsky (1987) generated the analysis of the interdependence between the optimal degree of wage indexation and optimal monetary policy which adjusts the money supply in accordance with observed movements in the financial and price variables for a small open economy under a variety of assumptions regarding: (i) the relative information available to private agents and the public authority; (ii) the perceived nature of the disturbances impinging on the economy (transitory or permanent). Several conclusions are worth noting. First, if both private agents and monetary authority have same perfect information, then perfect stabilization for replicating the output of the frictionless economy can be achieved either by a wage indexation adjusting to the unanticipated change in price and the unanticipated change in output as well, or by an appropriate but simply specified monetary rule. Next, when disturbances are unanticipated with incomplete information, we should draw the distinction between those perceived as transitory (white noise) and those perceived as permanent. In the former case, the distortion due to the one-period wage contract can be fully eliminated, as long as private agents and the monetary authority have the same imperfect information. However, when private agents can observe transitory shocks and the monetary authority can not, the frictionless economy cannot be replicated because of the inferior information available to the monetary authority. On the other hand, for the perceived permanent shock, perfect stabilization is achieved whether or not private agents and the monetary authority have identical information. Even when private agents are unable to decide whether or not a disturbance which occurs is transitory or permanent, perfect stabilization can be achieved with identical imperfect information between private and public agents.

The small open economy models used often so far have advantage of analytic simplicity and convenience. However, the assumption that a small open economy can choose unilaterally and freely whatever the optimal exchange rate system may be since she does not influence the large economy (or rest of the world), is too restrictive to deal with significantly the issue of the optimal international monetary system among the economically interdependent large (not small) industrial countries. Therefore, we shall extend the choice of optimal foreign exchange intervention in a small open economy into the framework of the two-country model.

(ii) The choice of foreign exchange intervention in the two-country model

Turnovsky and d'Orey (1986) provide the symmetric two-country deterministic macroeconomic model in which each economy specializes in the production of a distinct good and trades a common bond.

$$Y = \alpha_1 Y^* - \alpha_2 (I - \dot{P}) + \alpha_3 (P^* + S - P) \quad (1)$$

$$Y^* = \alpha_1 Y - \alpha_2 (I^* - \dot{P}^*) - \alpha_3 (P^* + S - P) \quad (1')$$

$$0 < \alpha_1 < 1, \quad \alpha_2 > 0, \quad \alpha_3 > 0$$

$$M - P = \beta_1 Y - \beta_2 I \quad (2)$$

$$M^* - P^* = \beta_1 Y^* - \beta_2 I^* \quad (2')$$

$$\beta_1 > 0, \quad \beta_2 > 0$$

$$I = I^* + \dot{S} \quad (3)$$

$$C = \delta P + (1 - \delta)(P^* + S) \quad (4)$$

$$C^* = \delta P^* + (1 - \delta)(P - S) \quad (4')$$

$$1/2 < \delta < 1$$

$$\dot{P} = \gamma Y \quad (5)$$

$$\dot{P}^* = \gamma Y^* \quad (5')$$

$$\gamma > 0$$

notation:

Y = real output, measured as a deviation from its natural rate level

P = price of output

M = nominal money supply

I = nominal interest rate

S = exchange rate, expressed in terms of units of domestic currency per unit of foreign currency

C = consumer price index

Domestic variables are unstarred and foreign variables are denoted with asterisks. All variables except interest rates are expressed in logarithms.

Equations (1) and (1′) represent the goods market equilibrium conditions in each economy. Demand for output depends on the output in the other country, real interest rate, and the relative price (real exchange rate). Equations (2) and (2′) describe the money market equilibrium conditions, respectively. It is assumed that the residents of each country do not hold the currency of the other country. The perfect substitutability between domestic and foreign bonds is specified by the uncovered interest rate parity (3). Equations (4) and (4′) define the consumer price index which is a weighted average of price of domestic output and domestic price of foreign output. Finally, equations (5) and (5′) describe the price adjustment equations without expected rates of inflation.

Soiving for Y, Y^*, and $\dot{S}$,

$$Y = \phi_1 m + \phi_2 m^* + \phi_3 s$$

$$Y^* = \phi_2 m + \phi_1 m^* - \phi_3 s$$

$$\dot{S} = -\eta_1 m + \eta_1 m^* + \eta_2 s$$

where

$s = P^* + S - P$: real exchange rate,

$m = M - P,\quad m^* = M^* - P^*$: real money supply at home and abroad,

$$\phi_1 = \frac{\alpha_2}{2}\left(\frac{1}{D} + \frac{1}{D'}\right),\quad \phi_2 = \frac{\alpha_2}{2}\left(\frac{1}{D} - \frac{1}{D'}\right),\quad \phi_3 = \frac{\beta_2 \alpha_3}{D'},$$

$$\eta_1 = \frac{1 + \alpha_1 - \alpha_2 \gamma}{D'},\quad \eta_2 = \frac{2\beta_1 \alpha_3}{D'},$$

$$D = \beta_2 (1 - \alpha_1 - \alpha_2 \gamma) + \beta_1 \alpha_2,\ D' = \beta_2 (1 + \alpha_1 - \alpha_2 \gamma) + \beta_1 \alpha_2.$$

We assume that $1 - \alpha_1 - \alpha_2 \gamma > 0$. It follows that $D' > D > 0$ and hence $\phi_1 > \phi_2 > 0$.

And the rates of CPI inflation can be expressed in terms of m, m^*, and s,

$$\dot{C} = \xi_1 m + \xi_2 m^* + \xi_3 s,$$

$$\dot{C}^* = \xi_2 m + \xi_1 m^* - \xi_3 s,$$

where

$$\xi_1 = \gamma[\delta\phi_1 + (1-\delta)\phi_2] - \eta_1(1-\delta),$$
$$\xi_2 = \gamma[\delta\phi_2 + (1-\delta)\phi_1] + \eta_1(1-\delta) > 0,$$
$$\xi_3 = \gamma\phi_3(2\delta - 1) + \eta_2(1-\delta) > 0.$$

The policymakers are assumed to choose thier respective money supply to minimize their loss functions defined in terms of deviations in output from equilibrium and the rate of inflation of consumer price.

$$L = aY^2 + (1-a)\dot{C}^2, \quad 0 < a < 1,$$
$$L^* = aY^{*2} + (1-a)\dot{C}^{*2}$$

Given the assumption that prices move gradually at home and abroad, we assume that prices can be observed at each time. Thus the authorities control real money supplies, m and m*. And the nominal exchange rate is also observable instantaneously. Thus the relative price (s) is observable at each time. The optimal monetary policies can be obtained as feedback solution in terms of s.

(1) Under non-cooperative Nash equilibrium, given the symmetry of the economies, the moneatry rules require the equal and opposite adjustment of the real money supply to the real exchange rate.

$$m = -[\rho_1/(\psi_{11} - \psi_{12})]s, \quad m^* = -m$$

where

$$\psi_{11} = a\phi_1^2 + (1-a)\xi^2_1 > 0,$$
$$\psi_{12} = a\phi_1\phi_2 + (1-a)\xi_1\xi_2,$$
$$\rho_1 = a\phi_1\phi_3 + (1-a)\xi_1\xi_3.$$

The coefficient of response may be positive (leaning with the wind) or negative (leaning against the wind). But, this solution is not optimal, since each policymaker does not take account of externalities (or spillover effect).

(2) Under cooperative equilibrium, the two policymakers collude to minimize their aggregate joint loss function;

$$(L + L^*)/2 = [a(Y^2 + Y^{*2}) + (1-a)(\dot{C}^2 + \dot{C}^{*2})]/2$$

The optimal cooperative solution is

$$m = -[(\rho_1 - \rho_2)/(\psi_{11} + \psi_{22} - 2\psi_{12})]s. \quad m^* = -m$$

where

$$\psi_{22} = a\phi_2^2 + (1-a)\xi^2_2 > 0,$$
$$\rho_2 = a\phi_2\phi_3 + (1-a)\xi_2\xi_3 > 0.$$

(3) Under a perfectly flexible exchange rate system, $m = m^* = 0$.

(4) Under a fixed exchange rate system ($\dot{S} = 0$), we use a symmetric monetary policy; $m = (\eta_2 / 2\eta_1)s$, $m^* = -m$.

Their simulation results for a unit positive shock in the relative price (s) under a particular parameter sets show that in general, the purely flexible exchange rate regime performs extremely well, being nearly as satisfactory as the cooperative solution and being substantially superior to the Nash solution and a fixed exchange rate regime.

(iii) International policy coordination

To begin with, we can define the term of international policy coordination; the agreement by countries to a cooperative policies which are better off relative to the non-cooperative Nash equilibrium. And it may be probably possible to define international policy cooperation quite broadly, including the exchange of information among policymakers. However, in this paper, the two terms are used as synonyms.

The proposition that international policy cooperation always improves welfare may not hold when we relax the assumption of full imformation.

Frankel (1988) identify serious obstacles at three stages. At the first stage, each country must decide what specific policy should undertake. At the second stage, the countries must negotiate how the gains from coordination are to be distributed. At the third stage, the agreement must be enforced, including a specification as to what should be done if the agreement is violated. Further, there are difficulties at the first stage;

(1) Where does the initial position of the domestic country lie relative to the optimum values of the target variables?

(2) What are the correct weights to put on the various target variables?

(3) What are the policy multipliers?[3)]

Nevertheless, the most of all literatures on international macroeconomic policy coordination makes the unrealistic assumption that policy-makers know the 'true' model, from which it follows in general that the cooperative solutions are superior to the Nash non-cooperative solutions. However, it is not true once we recognize that policy-makers disagree on the true model.

Frankel and Rockett (1988) provide the pessimistic result when international policymakers do not agree on the true macroeconomic model. Using ten econometric models that could represent U. S. beliefs, non-U. S. beliefs, and the true model, they

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3) Bryant, R., et al., eds., (1988) provides the present level of knowledge of the empirical study on the economic interactions in the interdependent world economy.

find that out of 1,000 combinations, monetary coordination improves U. S. welfare in only 546 cases, and improves the welfare of the other countries in only 539 cases.

As Frankel and Rockett also recognize, it is not sensible to assume that each policymaker acts as if he knows with certainty to which model he considers to be correct or to which model his opponent subscribes. The problem of model uncertainty is analyzed by Ghosh and Masson (1988). They introduce model uncertainty in the sense of parametar uncertainty at the small two-region macro structual model and show that model uncertainty, far from precluding policy coordination, may in fact provide a strong incentive for countries to coordinate thier macroeconomic policies, in contrast to the conclusion by Frankel and Rockett.

Let us consider the effects of model uncertainty on the gains from policy coordination in a very simple model. Policymakers are assumed to minimize the expected welfare loss function defined over price level subject to its linear reduced-form equation;

$$\min_{M} L = E\,(P^2)/2$$

$$\text{s. t.}\quad P = \theta_1 M + \theta_2 M^* + \varepsilon,$$

where P is the price level, ε is a common price shock, M is the money supply in the domestic country, and M^* is the money supply in the foreign country. The coefficient θ_1 represents the effect of the domestic country's money supply on its own price level, whereas θ_2 represents the effect of the foreign policy on the domestic country's price level. A similar loss function and reduced form of foreign price level apply to the symmetric foreign country;

$$\min_{M^*} L^* = E\,(P^{*2})/2$$

$$\text{s. t.}\quad P^* = \theta_1 M^* + \theta_2 M + \varepsilon,$$

Now suppose that the multipliers θ_1 and θ_2 are uncertain, with means μ_1, μ_2, and σ^2_1, σ^2_2, respectively,

The symmetric Nash solutions are given by

$$M = M^* = -\varepsilon / (\mu_1 + \mu_2 + \sigma^2_1 / \mu_1),$$

On the other hand, under a cooperative regime, a single policy-maker minimizes a joint loss function

$$\min_{M,\, M^*} W = (L + L^*)/2$$

And the cooperative equilibrium is given by

$$M = M^* = -\ \varepsilon / [\mu_1 + \mu_2 + (\sigma^2_1 + \sigma^2_2) / (\mu_1 + \mu_2)],$$

Therefore, unless $\mu_1 \sigma^2_2 = \mu_2 \sigma^2_1$ holds, then the Nash equilibria and cooperative equilibria differ, and there would be gains from coordination. The use of policy instrument brings the mean value of target variables closer to their bliss points but also increases their variances around their means. Therefore the policymaker faces a mean-variance trade-off in the use of his instruments. In Nash equilibrium, each government treats the variances from the foreign instrument as exogenous additive uncertainty, so that the Nash equilibrium is inefficient. On the contrary, when there is no parameter uncertainty (that is, $\sigma^2_1 = \sigma^2_2 = 0$), then the equation above holds, and the Nash and cooperative equilibria coincide so that there are no gains from policy coordination. Here each country has one instrument and one target so that the two countries can achieve their the first-best outcomes without coordination.

Consider next a model in which each country has two targets, the price level and the level of output, but only one instrument, the money supply.

It is shown that the incentive to coordinate policies depends crucially on the source of the uncertainty. When transmission effects (μ_2) is unknown, the greater is the uncertainty (σ^2_2), the greater are unambiguously the gains from coordination. However, when the effect of domestic policies on the domestic economy (μ_1) is uncertain, an increase in the uncertainty (σ^2_1) may either increase or decrease the expected value of gains from coordination. In the limiting case of $\sigma^2_1 = \infty$, the optimal policy under both Nash and cooperative solutions, is no active use of instruments; $M = M^* = 0$.

It is shown that in simulations where policymakers explicitly recognize model uncertainty, the expected gains from policy coordination relative to the Nash equilibrium increase considerably.

In addition to model disagreement and model uncertainty mentioned above, there is also the issue of credibility or reputation, as shown in Table 2.

Table 2

		relationship between governments	
		cooperation (C)	non-cooperation (NC)
relationship between governments and private sector	reputation (R)	CR	NCR
	non-reputation (NR)	CNR	NCNR

(source) Currie, Levine, and Vidalis (1987) p. 76

The matrix yields four policy types. First, reputational policies correspond to the full optimal rule. But, such policies are time-inconsistent since governments have an incentive to reoptimize later. Non-reputational policies correspond to the backward dynamic programming optimization solution, which is time-consistent. On the other hand, under cooperation, the two governments jointly adopt a Pareto-efficient policy, which maximizes a weighted average of their respective objective functions. Under non-cooperation, each government maximizes its own objective function, taking as given the policy of the other government. Although the cooperative and reputational policy (CR) is the best, there is the question of sustainability in two aspects. First, there is the issue of whether governments, either jointly or individually, would find it advantageous to renege on the private sector, losing their reputation and switching to a non-reputational policy. This is the issue of time-inconsistency. Second, there is the question of whether either government would find it advantageous to renege on the other government, switching to a non-cooperative policy. They conclude that to obtain the gains from cooperation requires reputation, and to obtain the benefits of reputation requires cooperation.

Rogoff (1985) and Kawai (1989), for example, show analytical argument that in one-shot game, the outcome for both countries under the cooperative non-reputational policy (CNR) may be dominated by one under the non-cooperative non-reputational policy (NCNR).

Rogoff (1985) shows that increased international monetary policy cooperation might be counterproductive, since cooperation between central banks can exacerbate the credibility problem of central banks and vis-à-vis the private sector, and may raise the rate of wage inflation. Kawai (1989) also provides the symmetric deterministic two-country macro model which incorporates explicitly the credibility of the private sector, but for the simplicity, assuming the steady state without uncertainty. When the domestic and foreign countries commit to money supply target and the private sector give it the credibility, the monetary authorities in the two countries can maximize the utilities, regardless international monetary policy coordination or not. However, the optimal policy is time-incosistent, because once the private sector believes in money supply commitment leading to zero inflation and expects zero rate of inflation, the monetary authority has an incentive to deviate from the initial money supply target and cause an unanticipated inflation to raise an output higher than its natural rate so as to maximize its utility. So when the monetary authority loses the credibility, international policy cooperation makes necessarily decrease the utility relative to international non-cooperation (the Nash solution among the two authorities and the private sector).

The following general result in game theory can be applied here. When all players in a game cooperate, their payoffs are improved relative to those in the absence of cooperation. But, when only a subset of players cooperate, the outcome may be worse off than in a case where nobody cooperates.

III The Fixed Exchange Rates

(i) "A International Gold Standard without Gold" by McKinnon

The proposal by McKinnon (1984, 1986, 1988) can be summarized as follows.

1. Rigidly fixed nominal exchange rates (within narrow bands) of the yen-dollar and mark-dollar, officially announced to achieve rough purchasing power parities among the three counties; the United States, Japan, and West Germany (representing EMS).
2. A commitment to adjust domestic monetary policies symmetrically among the three counties to maintain these targets.
3. Rules for symmetrical, unsterilized, direct interventions to correct 'disorderly conditions' in the foreign exchanges.
4. Joint management of aggregate money growth, the sum of domestic credit expansion as an intermediate targets within the triumvirate in order to stabilize their common (wholesale) price level in internationally traded goods in the longer run, as the nominal anchor for the system.

McKinnon argues that it is feasible for monetary cooperation among the three central banks to achieve fixed parities and roughly the same rates of wholesale price inflation, without returning to a gold standard.

(ii) The arguments against McKinnon's proposal

Dornbusch (1987, 1988) criticizes McKinnon.

The exchange rate-oriented monetary policy seems to solve the problem of currency instability by accommodating money demand shifts if the dominant source of disturbances is shifts in money demand from one country's M_1 to another's, i. e. currency substitution. But, carrying the idea by Poole (1970) over to exchange rates as intermediate targets, when international portfolio shifts takes the form of shifts in the demand for bonds denominated in different currencies, the right policy recommendation is not unsterilized intervention à la McKinnon but sterilized intervention. In response to exchange rate appreciation, the authorities should intervene, leaving money supplies unchanged but increasing the supply of domestic bonds and reducing the supply of foreign bonds. Furthermore, the remaining problem is whether it is shifts in international portfolio or shifts in fundamentals that are moving exchange rates. If there are real disturbances, then exchange rate targeting by intervention is altogether inappropriate.[4)]

Purchasing power parity (PPP) is not a good guide to equilibrium exchange rates since goods among the three countries are not perfect substitutes and hence the law of one price or spatial arbitrage are irrelevant. PPP is only appropriate to a world where equilibrium relative prices never change. Further, with fixed exchange rates but different rates of productivity growth in tradable goods, there may be very strong divergences in inflation rates including non-tradable goods and services. When one country experiences productivity growth at a rate higher than the other, they cannot have the same rate of inflation.

In fact, there is little theoretical or empirical basis for McKinnon's proposal. So, we compare in the symmetric two-country stochastic macro model between the flexible and fixed exchange rate systems with optimal degrees of wage indexation. Using the model by Turnovsky and Bianconi (1989), we firstly determine the optimal degrees of wage indexation under both flexible and fixed exchange rate systems and then compare non-cooperative Nash and cooperative Pareto-optimal equilibria under each system. Thus we can evaluate theoretically the McKinnon's proposal, based on the model in which includes the fixed nominal exchange rate, purchasing power parity, and symmetric monetary policy.

The following system is represented in terms of deviation from equilibria.

$$P_t = P^*_t + S_t \tag{6}$$

$$Y_t + Y^*_t = \alpha_1 (Y_t + Y_t^*) - \alpha_2 [I_t - (E_t P_{t+1} - P_t)] - \alpha_2 [I^*_t - (E_t P^*_{t+1} - P^*_t)] + U_t \tag{7}$$

$$0 < \alpha_1 < 1, \quad \alpha_2 > 0$$

$$M_t - P_t = \beta_1 Y_t - \beta_2 I_t \tag{8}$$

$$M^*_t - P^*_t = \beta_1 Y^*_t - \beta_2 I^*_t \tag{8'}$$

$$\beta_1, \quad \beta_2 > 0$$

$$I_t = I^*_t + E_t S_{t+1} - S_t \tag{9}$$

$$Y_t = \gamma \cdot z (P_t - E_{t-1} P_t) + V_t \tag{10}$$

$$Y^*_t = \gamma \cdot z^* (P^*_t - E_{t-1} P^*_t) + V^*_t \tag{10'}$$

$$\gamma > 0,$$

$$0 \leq z, \ z^* \leq 1$$

$$\text{where } z = 1 - \tau, \quad z^* = 1 - \tau^*$$

4) See the theoretical analysis by Fukuda and Hamada (1988) on optimal monetary feedback rules of the additive and difference systems in the symmetric two-country dynamic stochastic macro models.

notation:

Y = real output (measured in deviations from the natural rate level),
P = price of output,
S = exchange rate in terms of units of domestic currency per unit of foreign currency,
M = nominal money supply,
I = nominal interest rate,
E_t = rational expectation conditioned on information at t,
U = stochastic disturbance in world goods market,
V = stochastic disturbance in supply,

All variable except interest rates are expressed in logarithms. Foreign variables are denoted by asterisks (*).

Equation (6) represents the purchasing power parity condition. Equation (7) describes the equilibrium condition of the world goods market. Demand for aggregate output depends on the aggregate income in the world, the expected real interest rates in the two economies, and the world demand shock. Equations (8) and (8′) represent the money market equilibrium conditions. The perfect substitutability between domestic and foreign bonds is described by the uncovered interest rate parity condition (9). Finally, equations (10) and (10′) describe aggregate supply functions derived from the one period wage contract model. The deviation in output from its natural rate level is postulated to be a positive function of unanticipated change in the price level, as well as the stochastic supply (or productivity) shock. The degrees of wage indexation, τ and τ^* which are the policy decision variables, are incorporated in the parameters z and z^*, thereby influencing the slopes of the respective aggregate supply curves. For example, when wage indexations are full, $\tau = \tau^* = 1$ corresponding to $z = z^* = 0$, outputs are affected by only supply shocks.

The stochastic variables U, V, and V^* are assumed to be independently distributed over time with zero means and finite variances. Moreover, while demand and supply shocks are assumed to be uncorrelated, the supply shocks in two countries may or may not be correlated.

Under such assumptions, the rational expectations solution to the model implies that all expectations are zero, so that

$$E_t P_{t+1} = E_t P^*_{t+1} = E_t S_{t+1} = 0. \qquad \text{for any } t$$

The existence of nominal wage contract introduces rigidity into the economy, thereby leading to welfare losses relative to a frictionless economy in which wages are perfectly flexible and labor market clears. The role of wage indexation scheme is to replicate as closely as possible the income in the frictionless economy ($\bar{Y}_t$, $\bar{Y}^*_t$).

$$\bar{Y}_t = \left(\frac{1+n}{1+n+\gamma} \right) V_t,$$

$$\bar{Y}^*_t = \left(\frac{1+n}{1+n+\gamma} \right) V^*_t$$

where n is the elasticity of supply of labor with respect to the real wage.

Under non-cooperative game, the optimal degrees of wage indexation, τ and τ^* (or z, z*) are chosen so as to minimize the variances of output around the respective frictionless levels, taking the behavior of the opponent as given.

$$\underset{z}{\text{Min}}\ L\,(z,\ z^*) = E_t\,[\,Y_t - \bar{Y}_t\,]^2,$$

$$\underset{z^*}{\text{Min}}\ L^*(z,\ z^*) = E_t\,[\,Y^*_t - \bar{Y}^*_t\,]^2$$

Under cooperative game, z and z* are chosen so as to minimize the aggregate of loss functions by single policymaker.

First of all, under the perfectly flexible exchange rate system, $M_t = M^*_t = 0$, solving for Y_t and Y^*_t from (6) – (10′),

$$Y_t = a\,(z,\ z^*)\,V_t + b(z,\ z^*)\,V^*_t + c\,(z,\ z^*)\,U_t,$$
$$Y^*_t = b\,(z^*,\ z)\,V_t + a\,(z^*,\ z)\,V^*_t + c\,(z^*,\ z)\,U_t,$$

where

$$a\,(x,\ y) = \frac{X_2 y + X_3}{X_1 xy + X_2\,(x+y) + X_3} > 0,$$
$$x = z,\ z^*,\ y = z,\ z^*,\ x \neq y,$$

$$b\,(x,\ y) = \frac{\gamma\, x X_4}{X_1 xy + X_2\,(x+y) + X_3} \leq 0,$$

$$c\,(x,\ y) = \frac{\gamma\, x\,(X_5 y + X_6)}{X_1 xy + X_2\,(x+y) + X_3} \geq 0,$$

and

$$X_1 = 2\gamma^2 \left(\frac{\beta_1}{\beta_2} \right) [\,(1-\alpha_1) + \alpha_2 \cdot \frac{\beta_1}{\beta_2}\,] > 0,$$

$$X_2 = \beta_1 \left(\frac{1+\beta_2}{\beta_2} \right) [\,(1-\alpha_1) + 2\alpha_2 \cdot \frac{\beta_1}{\beta_2}\,] > 0,$$

$$X_3 = 2\alpha_2 \left(\frac{1+\beta_2}{\beta_2} \right) > 0,$$

$$X_4 = -(1-\alpha_1)\left(\frac{1+\beta_2}{\beta_2}\right) < 0,$$

$$X_5 = \frac{\gamma\beta_1}{\beta_2} > 0,$$

$$X_6 = \frac{1+\beta_2}{\beta_2} > 0.$$

Solving for S_t under the flexible exchange rate system,

$$S_t = \left\{\frac{1}{\gamma}X_1[zV_t^* - z^*V_t] + 2\beta_1\frac{\alpha_2}{\beta_2}X_6(V^*_t - V_t) + X_5(z^* - z)\cdot U_t\right\} / [X_1zz^* + X_2(z+z^*) + X_3]$$

On the other hand, the solutions for outputs under the fixed exchange rate system ($S = 0$) with $M = -M^*$,

$$Y_t = d(z, z^*)V_t + e(z, z^*)V_t^* + f(z, z^*)U_t,$$
$$Y^*_t = e(z^*, z)V_t + d(z^*, z)V^*_t + f(z^*, z)U_t,$$

where

$$d(x, y) = \frac{\delta_1 + \delta_2 y}{\delta_1 + \delta_2(x+y)} > 0,\ x=z, z^*,\ y=z, z^*,\ x \neq y$$

$$e(x, y) = \frac{-\delta_2 x}{\delta_1 + \delta_2(x+y)} \leq 0,$$

$$f(x, y) = \frac{\gamma\beta_2 x}{\delta_1 + \delta_2(x+y)} \geq 0,$$

and

$$\delta_1 = 2\alpha_2(1+\beta_2)/\beta_2 > 0,$$

$$\delta_2 = \gamma[(1-\alpha_1) + \frac{\alpha_2\beta_1}{\beta_2}] > 0.$$

Under the flexible exchange rate system, in general, non-cooperative Nash equilibrium leads to overindexation of wage relative to the Pareto-optimal cooperative equilibrium. And under the fixed exchange rate system, the non-cooperative and cooperative equilibria coincide. Fixing the exchange rate eliminates any further gains from cooperating on wage policy, since the externality caused by foreign wage policy is eliminated.

Because the optimal solutions for indexations and the values of loss functions are complex functions of the underlying parameters of the model and variances of stochastic shocks, Turnovsky and Bianconi resort to numerical analysis to get further insights into the general welfare implication of the different strategic equilibria under the different exchange rate systems. The set of parameter values for simulation is as follows.

$$\alpha_1 = 0.65,\ \alpha_2 = 0.25,\ \beta_1 = 1.00,\ \beta_2 = 0.5,\ \gamma = 1.5,$$
$$n = 0.15.$$

In comparison between flexible and fixed exchange rate systems, the flexible rate system with optimal indexation, in general, is superior to the fixed rate system. It has an implication of a case against McKinnon's proposal. Moreover, their numerical calculation indicates that the gains from cooperation under the flexible exchange rate are extremely small while they are zero under the fixed rate.

IV Target Zones[5)]

(i) A 'blueprint' by Williamson and Miller

Williamson advocates that countries should agree on target zones for exchange rates in order to limit misalignment. Williamson and Miller (1987) state the following;

The participating countries agree that they will conduct their macroeconomic policies with a view to pursuing the following two intermediate targets:

(1) A rate of growth of domestic demand in each country calculated according to a formula designed to promote the fastest growth of output consistent with gradual reduction of inflation to an acceptable level and agreed adjustment of the current account of the balance of payments.

(2) A real effective exchange rate that will not deviate by more than 10 percent from an internationally agreed estimate of 'fundamental equilibrium exchange rate', the rate estimated to be consistent with simultaneous internal and external balance in the medium term.

To that end, the participants agree that they will modify their monetary and fiscal policies according to the following principles:

(A) The average level of world (real) short-term interest rates should be revised up (down) if aggregate growth of nominal income is threatening to exceed (fall short of) the sum of the target growth of nominal demand for the participating countries.

(B) Differences in short-term interest rates among countries should be revised when necessary to supplement intervention in the exchange market to prevent the

5) See Frenkel and Goldstein (1986) in detail on target zones.

deviation of currencies from their target ranges.

(C) National fiscal policies should be revised with a view to achieving national target rates of growth of domestic demand.

The rules (A) to (C) should be constrained by the midium-term objectives of maintaining the real interest rate in its historically normal range and of avoiding an increasing or excessive ratio of public debt to GNP.

Rule (A) deals with the (n−1) problem in a McKinnonesque way (termd "McKinnon without the monetarism"), assuming that aggregate monetary policy should be guided by the collective need of the participating countries. Rule (B) embodies the essence of the target zone system. Rule (C) endorses Keynesian fiscal policy.

A technical difficulty in the scheme is the ambiguous notion of 'fundamental equilibrium exchange rate (FEER)'. It is difficult to estimate and internationally agree on it since its definition involves appropriate equilibrium current balance or equivalently, the underlying capital flow. And, in reality, fiscal policy is not flexible and there is need for correcting U. S. budget deficit.

The key point made by proponents of target zones is that such a system encompasses the best of the both systems; the flexibility of the flexible exchange rate system as well as the stability of the fixed exchange rate system. Monetary policy can pursue internal objectives within a wide band. However, the same logic can be used to argue that this hybrid system encompasses the worst of both systems; the instability of flexible rates and the unsustainability of fixed rates.

In contrast to fixed rates, the FEER is changeable as well as crawing peg in the future so that the target zone loses credibility in the absence of an anchor and would remain vulnerable to speculative attack.

(ii) Exchange rate dynamics in target zones

Krugman (1988) analyzes theoretically how the exchange rate behaves within a band under the credible target zone when 'fundamentals' follow a random walk. The remarkable result is that the expectation which the monetary authority will defend the band by intervening at the upper or lower edge exerts a more stabilizing effect on the exchange rate behavior inside the band than under the freely floating system, even when the authority is not actively intervening.

We summarize his stochastic process model briefly.

The log of the spot exchange rate (s) is assumed to be determined by two factors: 'fundamentals' (x) which evolve exogenously over time as explained below, and the expected rate of exchange rate, E (ds/dt).

$$s(t) = x(t) + \gamma \cdot E[ds(t)/dt \mid I_t] \tag{11}$$

The fundamentals (x) is assumed to follow a diffusion process without a drift over time. The increment of the diffusion process is represented by

$$dx(t) = \sigma \cdot dz(t) \tag{12}$$

where dz is an increment of a standard Brownian motion or Wiener motion or white noise, $z(t) \sim N(0, t)$. Hence, dx is independent and normally distributed with mean zero and variance over the interval dt, $\sigma^2 \cdot dt$, where σ is a constant. Equation (12) is the continuous type version of a random walk without drift (or time trend). The monetary authority can control x (for example, money supply) through intervention at edges, so that x need not follow (12) under the target zone.

The way to solve for the exchange rate dynamics inside the target zone is to look for an equilibrium function, $s = g(x)$ such that satisfies (11). The general solution is

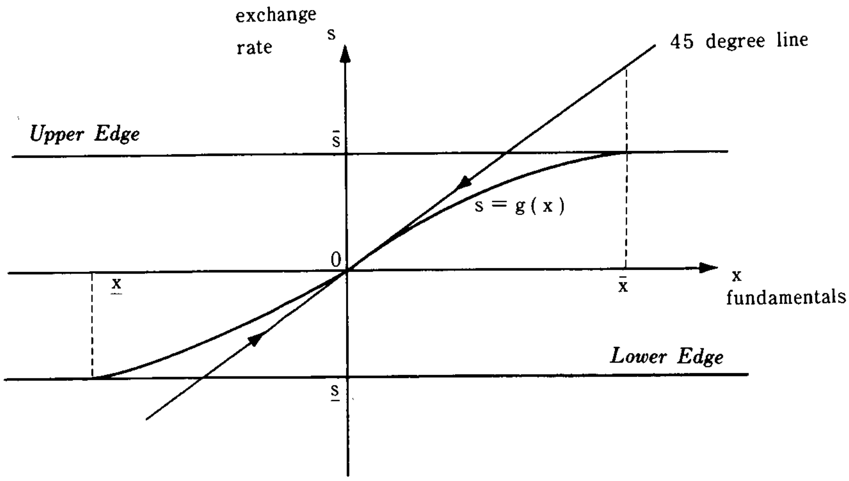
$$s = g(x) = x + Ae^{\lambda x} + Be^{-\lambda x}$$
$$\text{where } \lambda = \sqrt{2/\gamma\sigma^2} > 0$$

If $A = -B$ holds, then $g(0) = 0$, and the target zone is symmetically centered around zero.

$$s = x + A[e^{\lambda x} - e^{-\lambda x}], \; A < 0$$

The expected change in the exchange rate, $E(ds/dt) = \sigma^2 \cdot g''(x)/2$ is negative in the upper part of the target zone, where g (x) is concave. This drags the exchange rate below the fundamentals. Conversely, the expected change in the exchange rate is positive in the lower part of the target zone, where g (x) is convex. This drags the exchange rate above fundamentals. Figure 2 shows the relationship between the exchange rate and fundamentals as S-shaped curve flatter than 45-degree line $s(t) = x(t)$, which is the no-boundary saddlepath solution (the case of $A = B = 0$)under a permanent free floating system, ruling out bubble solutions. The curve g (x) is tangent to the top and the bottom of the band.

Because the market has a regressive expectation that the authority will defend the zone in the future, the target zone has a stabilizing effect on the exchange rate within the band, depending on parameters, γ (the sensitivity of the spot exchange rate to the expected rate of depreciation) and σ^2 (the volatility of fundamentals). But, when the exchange rate reaches the upper edge of the zone $\bar{s}$, if the authorities do not defend the band, the exchange rate will jump to the 45-degree line at $\bar{x}$[6].



(source) Krugman, P. (1988)

Figure 2

V Concluding Remarks

As Frenkel and Goldstein (1989, p. 24) point out, one of the problems in open economy macroeconomics is that it is impossible to simultaneously achieve (1) independent monetary policy, (2) fixed exchange rates, and (3) free international capital markets: the best one can do is to achieve any *two* of the three. The reform of international monetary system is basically about which two to pick, From the lessons of the Bretton Woods system, fixed exchange rates cannot be maintained without extensive capital controls. For the industrial countries after 1973, fixed exchange rates were dropped and flexible exchange rates were chosen to obtain autonomy of monetary policy (national monetarism) and to admit international capital movements. However, because of volatility and misalignment of exchange rates, and the lack of international policy coordination in the economically interdependent world economy, several proposals have been discussed to improve the function of the international monetary system. First, even if the present international monetary system is not wrong, international macroeconomic policy coordination instead of independent monetary policy is needed in the increasingly interdependent world economy.

6) Furthermore, Miller, Weller, and Williamson (1989) have examined the stabilizing property of target zones even when the foreign exchange market suffers from two stylized forms of market inefficiency, that is, Blanchard's 'rational bubbles' and autoregreessive 'fads' attributable to noise traders (or chartists).

Similarly, whether to reestablish fixed exchange rates according to McKinnon's proposal, or to set target zone according to Williamson, independent monetary policy must be changed to multilateral and coordinated monetary policy. Second, although we did not discuss in the text, Tobin (1978) recommends worldwide uniform tax on all spot foreign exchange transactions to deter excessive international hot money round-trip. The cost from 'throwing some sand in the wheels of excessively efficient international money markets' should be weighed against the benefits from the efficient international capital markets or trend of international financial liberalization. Third, from the experiences of some developing countries, the radical proposal of a dual exchange rate system also draws from the problem of volatile short-term capital flows. Governments would establish a fixed (or rigid crawing peg with trend) exchange rate for commercial trade transaction. But for all capital account transactions the exchange rate would be flexible. A separate exchange rate would detach the capital account and deprive it from distorting influences on trade and inflation. Fourth, as to the EC monetary integration in 1992, fixed exchange rate within the EMS (but float outside the area) and open capital markets are paired with the abandonment of monetary policy independence.

Needless to say, optimum currency area—the creation of a common currency for all of the industrial countries, with a common monetary policy and a joint Bank of Issue, as Cooper (1984) suggests—is the best way to solve $n - 1$ problem and is the ideal vision. But, it is too radical and there seems no practical feasibility in the near future due to national sovereignty.

As to an empirical study, McKibbin and Sachs (1988) compare the performance of the seven alternative international monetary arrangements using a large simulation model of the world economy consisting of the USA, Japan, the rest of the OECD, OPEC, and the developing countries. Each government chooses its control variables (or money supply rule) to minimize an intertemporal loss function, which is a weighted average of GDP gap, consumer price inflation, current balance, and budget deficit. Among pure float, non-cooperation, cooperation, nominal GDP targeting, McKinnon rule for fixed exchange rates, global nominal GDP targeting,[7)] and leaning with or against the wind, generally speaking, for the country-specific shocks, the cooperative and non-cooperative regimes under a floating exchange rate perform better than the fixed exchange regimes. However, for an unobserved negatively

7) See Frankel (1989) about international nominal targeting (INT). He argues that INT is the best choice for nominal anchor, as well as the best choice for the performance criterion by which compliance with international agreements can be monitored. Nominal GNP or nominal demand is superior to other candidates such as M1 as a candidate for the nominal variable on which policy-makers should focus, because it is far more robust to velocity shifts and other uncertainties.

correlated monetary shock, the fixed exchange rate regime proposed by McKinnon performs well. While cooperative regime is superior to the others, a gain from cooperation relative to non-cooperation is empirically small. They conclude that the performance of each regime depends crucially on the nature and observability of the shocks hitting the world economy. However, the results are model specific.

International monetary system is, by Kindleberger's term, one of international public goods, but there exists no world government. We need further theoretical and empirical investigation how the international monetary system can be reformed, especially among the three major currency blocs; the U. S., Japan, and EMS.

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In 1919, a research organization named the Institute for Commerce was founded in Kobe Higher Commercial School, one of the chief predecessors of Kobe University, with a gift made by F. Kanematsu & Company, a leading mercantile firm in Kobe. The organization was designed to carry on and facilitate integrated research on business and commerce and to formulate and publish the results of these studies and investigations in such form as to make them available to the business community.

With the founding of Kobe University of Commerce, successor of Kobe Higher Commercial School, in 1929, the Institute extended its research activities by adding several divisions. One was the famous Latin-American Library, which soon became the center of research in this field in Japan. A room for statistics equipped with various computing machines was established and began publication of Jūyo Keizai Tōkei and Sekai Bōeki Tōkei annually. A filing room was prepared to deposit press clipping files systematically arranged by topics and dates. Another room was designed to become the center of all possible original records and data having to do with the beginning and progress of Japanese business.

On the campus of Kobe University of Commerce, another organization named the Institute for Business Mechanization was founded in 1941 utilizing business machines donated by the IBM Corporation and others. With Professor Yasutaro Hirai as its head a broad and forward-looking plan for business mechanization in Japan was developed.

In 1944, Kobe University of Commerce changed its name to Kobe University of Economics. After the War, however, the University was consolidated with three other colleges in Hyogo Prefecture to become Kobe University. With this development, the two Institutes were also amalgamated into the Research Institute for Economics and Business Administration, Kobe University. At present, the Institute, with its twenty-two full-time professional staff members, carries on studies and investigations in international economics, international environment, international comparative economics, internaitonal business, management information systems and international cooperation.

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