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ON THE CHOICE OF THE EXCHANGE-RATE REGIMES

by Chien Nan Wang

Chien Nan Wang is an economist at the Federal Reserve Bank of Cleveland. The author would like to thank Anthony Koo, Timothy Lane, Ronald McKinnon, Lawrence Officer, Peter Quirk, Peter Schmidt, Mark Sniderman, and Thomas Willett for helpful suggestions.

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ABSTRACT

This paper utilizes recent research developments in portfolio balance theory and in real exchange-rate instability to synthesize, update, and test the optimum currency area (OCA) theory. Four hypotheses, capturing the central features of the OCA theory, are advanced and tested in a multinomial-logit setup. The empirical results establish the linkage between a fixed rate and financial integration, trade integration, plus inflation convergence. The Mundell-Fleming ranking of regime is refuted in a fundamental way. These findings are applied to a discussion of European monetary integration, in relation to both its final objective and its intermediate procedure.

I. INTRODUCTION

The Single European Act, amending the Treaty of Rome, became effective in July 1987. This act envisages the ending of all remaining restrictions on the intracommunity flow of goods, capital, and labor in Europe by 1992. However, the recommendation of the Delors Report for the intermediate procedures and the final goal of European monetary union is facing objections from Britain and raising concerns among other members of the European Economic Community. In an area of increasing financial and trade integration, what is the appropriate choice of an exchange-rate regime? This question can be addressed in the context of the optimum currency area (OCA) theory, which provides criteria for different types of countries to choose between floating and fixed exchange-rate regimes. (Useful reviews of the OCA theory can be found in Ishiyama [1975], Tower and Willett [1976], and Obstfeld [1985].)

The OCA theory, however, has not incorporated more recent development of the portfolio-balance theory and recent research on real exchange-rate instability under a nominal floating exchange-rate regime. Moreover, existing empirical studies of the OCA theory have generally confirmed the linkage between trade integration and a fixed rate, but have found the linkage between financial integration and exchange-rate regimes to be blurred (see Dreyer [1977], Heller [1978], Holden, Holden, and Suss [1979], and Weil [1984]). In an environment of rapid, advanced telecommunication and liberalization of capital control, financial markets are increasingly linked worldwide.[1] It is important to investigate the linkage between financial integration and exchange-rate regimes more closely.

This paper reviews and updates the OCA theory and then provides an empirical study in light of more recent research developments. These developments help strengthen the linkage between the fixed rate and financial integration. The empirical evidence from this paper supports this theoretical linkage, resulting in the refutation of the Mundell-Fleming ranking of exchange-rate regimes. Three characteristics--financial integration, trade integration, and inflation convergence--are identified empirically as important criteria for a country to consider in choosing its own exchange-rate regime. These findings are used in this paper to analyze European monetary integration. The multinomial-logit analysis in this study highlights the complicated nature of multiple-regime selections.

II. THE (EXTENDED) OPTIMUM CURRENCY AREA THEORY

This section reviews, synthesizes, and updates OCA theory. Four hypotheses and their antitheses, which capture the central features of the OCA theory, are developed. These hypotheses are related to financial integration, trade integration, inflation convergence, and labor mobility.

Mundell (1963, 1964) and Fleming (1962) examined the effect of the exchange-rate arrangement on stabilization policies. The Mundell-Fleming (M-F) proposition established in their work has proved its sustaining power for the last 25 years. According to Dornbusch (1988):

> The Mundell-Fleming model ... continues virtually unchallenged today. Of course, the models we use today have gone further in separating short run and long run, in allowing a role for expectations, and in taking into account the consequences of trade imbalances for asset accumulation. Even the stock market has now become a part of the wider model. But the conclusions remain close to those of the Mundell-Fleming model.

The M-F proposition is based on the assumption that prices adjust slowly relative to exchange rates, and that capital mobility is a central factor in the transmission of business cycles. Their proposition is:

(1) In a small, open economy with perfect capital mobility (perfect asset substitution and instantaneous portfolio adjustment), monetary policy is ineffective in changing output under a fixed exchange rate because monetary expansion or contraction causes incipient interest-rate changes and the offsetting capital flows;
(2) In a small, open economy with perfect capital mobility, fiscal policy is ineffective in changing output under a floating exchange rate, because the induced exchange-rate change causes trade-balance adjustment that offsets the fiscal policy; and
(3) If the country is large or capital mobility is imperfect, each policy retains some effectiveness due to the wedge between domestic and world interest rates, although the qualitative content of (1) and (2) remains important.[2]

While the M-F proposition on relative policy effectiveness remains valid, it is always generalized according to the ranking of exchange-rate regimes. The effectiveness of monetary policy is often the central criterion for choosing a nominal exchange-rate regime, resulting both from the relative flexibility of monetary policy and from the monetary authority's ability to determine the exchange-rate regime. We can thus form our first maintained hypothesis:

H_1: Under increasing financial integration (or capital mobility), a floating-rate regime (or more exchange-rate flexibility) is preferred for the sake of monetary autonomy.

On the other hand, as financial integration increases, monetary and asset shocks in one economy transmit rapidly and widely to other economies. This diffusion of disturbances causes exchange-rate instability and volatile expectations that, in turn, render monetary autonomy less viable and spill over to real sectors. Therefore, a fixed exchange-rate regime would be preferred.

To illustrate, we can consider different theories under the rubric of the portfolio-balance models. In these models, the nominal exchange rate is an

asset price that is predominantly determined in the asset market. The empirical basis of this assertion is that marketable world wealth can be counted in trillions of dollars; even a small shift in asset preference can lead to a capital transfer that is much larger than what can be effected through the current account. Also, asset price adjusts much faster than goods price. Therefore, the nominal exchange rate is sensitive to changes in the supply and demand of monies and securities.

Moreover, international portfolio preferences themselves become more volatile with a floating exchange rate. Market participants form their exchange-rate expectations based on speculations of future monetary, fiscal, and exchange-rate policies according to news and guesses. This forward-looking expectation can be highly unstable if the authorities do not commit themselves to maintaining the exchange rate along a predetermined path.

Besides the auction-market nature of the foreign-exchange market, some other theoretical arguments contribute to exchange-rate instability under a floating-rate regime: (1) overshooting due to instantaneous exchange-rate adjustment to restore asset-market equilibrium when output and price adjust slowly over time; (2) expectation errors due to wrong beliefs or insufficient use of market information; (3) a bandwagon effect (jump-in of more speculators) without sufficient economic rationale; (4) rational bubbles due to persistent shocks in one direction; and (5) irrational bubbles due to insufficient speculation.

The autonomy of monetary policy is weakened under these unstable circumstances, which are exacerbated by increasing financial integration. McKinnon (1982) argued that volatile exchange-rate expectation can cause domestic (real) money-demand instability either through direct M1 currency

substitution, because of the gap between the interest-rate differential and anticipated exchange-rate change, or (more importantly) through indirect impact on domestic- and foreign-bond yields that, in turn, will induce international capital flow because of bond arbitrage in a highly mobile international bond market.[3] Assuming money-market equilibrium, the domestic inflation rate is the difference between the growth rate of nominal money supply and real money demand. Thus, domestic price stability cannot be achieved through independent monetary policy (without accommodating money demand changes) provided by a floating rate. Therefore, direct or indirect currency substitution will constrain monetary policy autonomy even if monetary policy independence is granted.[4]

Also, under high financial integration, the government's control of credit has already been undermined due to the huge inflow and outflow of capital. The unregulated Eurocurrency market, or any comparatively unregulated financial intermediaries, would contribute to this effect. Considering the monetary interdependence under a floating-rate regime and the leverage of monetary policy that exists under a fixed-rate regime (for large countries and in the case of imperfect capital mobility), the benefit of a floating rate and the corresponding monetary independence should not be overstated.

Moreover, Stockman (1983) and Mussa (1986) found that a nominal floating-rate regime is associated with greater real-exchange-rate variability as compared to a nominal fixed-rate regime. Mussa attributes this phenomenon to differential speeds of adjustment in asset and goods markets, while Stockman points out the possible importance of real shocks in an equilibrium model.

In an equilibrium model, exchange-rate change is an optimal response to exogenous shocks, and thus may well maximize national welfare. If there is some price rigidity, however, a floating exchange rate may not be optimal. A major reason is that real exchange-rate instability would incur costs in international trade and finance. The instability can be distinguished in terms of volatility and misalignment. Volatility is the short-term fluctuation of nominal or real exchange rates about their long-term trends. Misalignment refers to a sustained deviation from the fundamental equilibrium real exchange rate (FER). FER has been defined as the purchasing power parity rate or as the rate that generates a current account surplus or deficit equal to the underlying capital flow over a cycle (Williamson [1985]).

Volatility increases the uncertainty associated with international trade and finance and may discourage these transactions. If the forward market can be used to hedge the exchange risk, a hedging cost will be incurred. Moreover, hedging cannot be perfect because the timing and magnitude of a firm's foreign-exchange needs may not be predictable. Some empirical works (especially those using earlier data) showed little evidence of trade interruption (see International Monetary Fund staff [1984] and the survey therein). Bailey and Tavlas (1988) find that effective exchange-rate volatility is insignificant in affecting aggregate real exports. However, what matters in the short run is the impact of bilateral exchange-rate volatility on bilateral trade. On that account, most recent studies based on bilateral trade and bilateral exchange-rate data find significant effects (see, for example, Thursby and Thursby [1987] and Cushman [1988]).

So far as the author can tell, there are only two published studies of exchange-rate volatility on international finance (Cushman [1985] and Bailey

and Tavlas [1988]), and they find either a positive significant effect or an insignificant effect of exchange-rate risk on direct investment. These results are consistent with the model that states, in response to risk, that multinational firms concentrate more on the home market, but offset this somewhat by increasing foreign capital input and production. However, direct investment is only one form of international financial flow. Others, such as bank credit and deposit, bond finance, and portfolio investment, should also be investigated. These forms of finance do not possess the special characteristics of direct investment as stated above.

Misalignment may incur significant costs in finance and trade. Long-term foreign lending cannot be well-hedged because short-term hedging on a noncontingent basis covers only a small portion of the potential long-term risk, and the transaction costs and the moral hazard associated with contract enforcement of long-term contingent futures would be prohibitive (McKinnon [1988]). Therefore, long-term lending and investment may be severely affected by misalignment.

Misalignment may also cause serious deindustrialization effects. Production facilities may be mothballed or scrapped, and the reentry fee may be prohibitive. The resulting unemployment is also costly. Moreover, resources will shift back to the original sector when the exchange-rate change reverses its direction, thus incurring more costs. Protectionist legislation, which often occurs during the process of deindustrialization, imposes costs on consumers throughout the economy. Marston (1988) provides a case study for the sterling misalignment (1979-82) and the dollar misalignment (1981-85), finding significant disruptive effects on the tradeable sector.

Therefore, increasing financial integration exacerbates exchange-rate instability, which may well incur costs on international trade and finance. Also, the link between financial integration and a fixed rate is further strengthened for domestic economic stability.

With regard to domestic stabilization, macroeconomic performance can be evaluated in terms of variation of output and general price level relative to their trends. Assuming the authorities cannot directly observe the source of the disturbances, or if the macropolicy measures are uncertain in effect or costly to use, then the optimal nominal exchange-rate regime functions as an automatic stabilizer for the economy, yielding the best macroeconomic performance on average.

More financial integration increases the need for stabilizing financial shocks. Domestic money-supply shock will be ineffective to change domestic output under a fixed rate (M-F proposition). The same stability can be reached by a foreign country if it adopts a fixed-rate regime. Changes in money or asset demand will lead to changes in interest rates and exchange rates that, in turn, will affect domestic and foreign output. A fixed rate can prevent the spillover from financial sectors to real sectors. The risk-sharing consideration suggests that the two regions would prefer a fixed rate, together with appropriate international settlement arrangements (Obstfeld [1985]).[5]

Therefore, although the M-F proposition on policy effectiveness may remain valid (but weakened), it is relatively less important in determining an exchange-rate regime. We can summarize the above discussions as our alternative hypothesis:

H_1^A: Under increasing financial integration, a fixed-rate regime (or lower exchange-rate flexibility) is preferred both because monetary autonomy is constrained and because the impact of stochastic disturbances on international trade, international finance, and domestic output can be stabilized.

The second hypothesis is the existence of a link between trade integration and a fixed exchange-rate regime. Under the rubric of trade integration, we can incorporate a country's economic size, the relative importance of its foreign-trade sector (openness), and its trade pattern (commodity and geographic concentration). These are associated concepts because a small country usually has limited resources. Therefore, it must specialize in order to exploit economy of scale, and it requires openness in order to diversify its consumption bundle and to earn sufficient foreign exchange to pay for it.

In a small, open economy, the exchange-rate adjustment mechanism tends to be less effective. To restore balance-of-payment (BOP) equilibrium, exchange-rate adjustment needs to change the relative prices between domestic and foreign goods (terms of trade [TOT]) and between tradeable and nontradeable goods. A small country has little market power to influence its TOT, however. An open economy needs more price adjustment between sectors, which is often difficult to achieve because of more effective pass-through from a nominal exchange-rate change to domestic price (McKinnon [1963]).

A small country often does not have a well-developed financial market. Monetary policy independence does not assure its effectiveness, because open market operation is less viable. Also, a small country may face more exchange-rate fluctuations because its foreign-exchange market is thin.

Because the tradeable sector is relatively important for an open economy, the economy will incur more costs from exchange-rate volatility and misalignment. Also, a relatively open economy is easier to adjust to external

imbalance through absorption changes because less income adjustment is needed. Furthermore, the lack of money illusion in an open economy and the downward rigidity of wage rates will cause depreciations to raise labor costs more than equivalent appreciations will lower them. Also, monetary and fiscal expansion is more likely to occur in a more open economy where the deindustrialization effect of appreciation is more serious. Therefore, in a regime of fluctuating exchange rates, world inflation would be ratcheted up.

A more undiversified economy (in terms of commodity variety) will experience more exchange-rate changes because microshocks (supply-demand changes of individual goods) to the export sector do not cancel each other out. As discussed earlier, exchange-rate change is more costly in a small, open (undiversified) economy. Constant exchange-rate change will be even more costly. Therefore, a fixed rate is preferred.

Another type of diversification is related to geographical factors. When a country finds that a large share of its exports are sold to only one or to very few countries, a case can be made for maintaining its exchange rate pegged to a single country's currency (or to relatively few countries' currencies) in order to promote trade.

We can summarize the effect of increasing trade integration as the second maintained hypothesis:

H_2: Under increasing trade integration, a fixed-rate regime is preferred for the sake of less inflation and lower costs in trade and in BOP adjustment.

However, there are alternative cases based on stabilizing real shocks. In a small, open economy, the real disturbances originating in external sectors are likely to dominate real disturbances of domestic origin. External real demand disturbances tend to move the BOP and the domestic economy in the same

direction. Therefore, expenditure-changing policy cannot restore internal and external equilibrium simultaneously. This dilemma makes a case for a flexible-rate regime (Whitman [1967]). (A floating rate also tends to better stabilize domestic real demand disturbances, parallel to the M-F proposition on fiscal-policy ineffectiveness.) For the real external supply shocks, such as productivity or technology shocks in the tradeable sector, differential wage and price trends would be developed. A small, open economy will face more international commodity arbitrage and more pressure for either an exchange-rate or a wage-price adjustment. Then exchange-rate change provides the least costly route that prevents wealth or relative-price effects from taking place (see Friedman [1953] and Kravis and Lipsey [1983]). Thus, we have the alternative hypothesis:

H_2^A: Under increasing trade integration, a floating-rate regime is preferred for the sake of stabilizing real shocks in the least costly way.

Aside from the impact of financial integration, the insulation from external (especially inflationary) shocks allows the authority to pursue domestic macroeconomic targets. In the long run, a floating exchange rate provides more policy independence than a fixed rate. Even though the historical records attribute more variable and generally higher inflation to the floating-rate regime, it is likely to be caused by multiple policy goals or policy imprudence and does not negate the ability of independent monetary policy to pursue a domestic inflation target (see evidence provided by Darby and Lothian [1989].) However, concern about reduced monetary independence under a fixed-rate regime is most pronounced in countries with either relatively high or relatively low inflation rates.

High-inflation countries often suffer from a weak fiscal system with relatively heavy reliance on an inflation tax. Lower inflation rates will reduce the government's seigniorage revenue and complicate its already difficult fiscal problems. Therefore, a flexible exchange rate is preferred.

Low-inflation countries generally are concerned that under a fixed, disequilibrium exchange rate, heavy exchange-market intervention and massive capital flows would prevent effective control of their money supply. Therefore, these countries would lose both their price-stability objective and their hard-won anti-inflationary reputations. They would suffer rather than gain from monetary linkage to foreigners (see Frenkel and Goldstein [1988]).

Thus, we have our third maintained hypothesis:

H_3: With divergent inflation rates, a floating-rate regime is preferred for the sake of seigniorage and for the ability to maintain national price stability.

Alternatively, a fixed-rate regime provides valuable anti-inflationary discipline. Under a fixed-rate regime, the government will be more prudent in macro-policy management for fear of losing political support as a result of lost reserves and huge exchange-rate changes. Also, government officials may spur labor union leaders and businessmen to join the fight against inflation by citing the danger of the BOP crisis. This is especially true when coordination can help rectify the externality caused by the spillover when one country's policies affect other countries' targets and when price-stability objectives are convergent among regions. An interpretation of the EMS is that high-inflation France and Italy borrow the anti-inflation reputation from low-inflation Germany. Therefore:

H_3^A: With divergent inflation rates and convergent low inflation-rate consensus, a fixed rate is preferred in order to provide external discipline on inflation.

Mundell (1961) defines a currency area as an area with high resource (capital and labor) mobility. Capital mobility has been discussed earlier. In regard to labor mobility, without prompt and complete pass-through, nominal depreciation causes real depreciation and may cause factors to move from nontradeable-goods production to tradeable-goods production. Labor mobility within a country directly influences the efficiency with which resources can be transferred between sectors. The accompanying adjustment costs under a floating-rate regime will be lower for a country with higher internal resource mobility. On the other hand, BOP adjustment under a fixed-rate regime often adopts the mechanism of overall deflation or inflation. Some factors simply will not be used. Labor movement between sectors will not change the situation (see McKinnon [1963]). Therefore, we have the fourth maintained hypothesis:

H_4: Under high labor mobility, a floating rate is preferred for the sake of relatively low cost of adjustment within a region (country).

However, in a currency area, interregional labor movement helps the adjustment of a depressed region by changing its pattern of production and resource allocation. Costly areawide price inflation is not needed to inflate away pockets of unemployment. Therefore, high labor mobility among countries promotes the formation of a currency area (see Mundell [1961] and Tower and Willett [1976]). Interregional labor mobility and labor mobility within a region are often correlated. The maintained hypothesis emphasizes the latter mobility. If we, in turn, emphasize the former mobility, we have:

H_4^A: Under high labor mobility, a fixed rate is preferred for the lower interregional adjustment cost.

Some argue that, due to cultural and sociological differences, labor mobility within a country is already difficult, which is even more true concerning mobility across borders. Moreover, mobility due to homogeneity of occupation (for example, movement within the automobile industry) may not be useful because the whole industry may face the same drop in demand. On the other hand, mobility compatible with diversity of occupation would be rather unlikely (Ishiyama [1975], Yeager [1976]). Therefore, labor mobility would be an insignificant factor in determining exchange-rate-regime choice. However, in the Mundell tradition, we still incorporate it and test its significance.

III. THE EMPIRICAL MODEL

A. The Logit Model

To test the (extended) OCA theory, a logit model is built that uses country characteristics to explain the exchange-rate-regime choice. An independent-shock term is not incorporated. A reason is that exchange-rate-regime choice is a medium-term (at least for several years) choice based on anticipated shock patterns. The correct way to separate and specify the shock terms is unclear. More important, trade integration (which is more susceptible to transmission of real shocks) and financial integration (which is more susceptible to transmission of financial shocks) themselves have already implied a circumstance with specific sources of shocks anticipated to occur more frequently. These implied circumstances have been embodied in the hypotheses to be tested, based on country characteristics.

Melvin (1985) provides an empirical study of exchange-rate-regime choice based on two types of disturbances: domestic money shocks and foreign price shocks. Disturbance terms are created as the standard errors of second-order

autoregressive equations on the percentage change in foreign price and money supply from 1976 to 1978. Melvin finds that these shock terms have a significant impact on exchange-rate-regime choice. It is not clear, however, how the current-period unexpected shocks can be used to explain the exchange-rate-regime choice that is based on anticipated shocks for several future periods. Moreover, his shock terms may be correlated with country characteristics.[6]

The actual regime choice (the dependent variable) can be classified into several major categories, while the explanatory variables are continuous measures of country characteristics. For logit models, the relative odds of choosing a discrete regime can be represented by a linear combination of explanatory variables, where the coefficients are the maximum likelihood estimates (MLE).

B. The Exchange-Rate Regime (Dependent Variable)

A discrete qualitative measure for exchange-rate flexibility is used for the dependent variable. The measure is defined according to International Monetary Fund (IMF) classification of the exchange-rate practices of member countries contained in the IMF's 1977 and 1980 annual reports. Data from 1977 are employed so that we can compare our results with those of several major studies that use 1977 data; data from 91 countries are represented. Data from 1980 are employed so that we can compare a country's exchange-rate-regime choice behavior over time; data from 88 countries are represented. While using data from the 1980s would better reveal the current trend, one should note that many developing countries fell into arrears in the 1980s. Those countries adopted flexible exchange rates simply because they ran out of

international reserves. Those exchange-rate arrangements are thus more of a practical nature rather than a reflection of the choice based on country characteristics (see Quirk [1989]).

The dependent variables in terms of ascending order of flexibility are:

(a)	Narrow Margin Peg	(NMP)	:	Maintains the exchange rate within a margin of less than 2.25% of the central rates, for a single currency or for a basket of currencies.
(b)	Wider Margin Peg	(WMP)	:	Maintains a margin greater than 2.25% of the central rates.
(c)	Crawler	(C)	:	Changes rates discretely according to a set of predetermined indicators.
(d)	Group Float	(GF)	:	EMS (snake) countries, which maintain within-group rates up to a 2.25% margin and between-group rates without a margin.
(e)	Independent Float	(IF)	:	Does not maintain exchange rates within a specific margin.

Here (a) and (b) can be subsumed under "peg," while (c), (d), and (e) can be subsumed under "float."

The dependent variable can be viewed as the revealed preference of the authorities regarding the exchange-rate flexibility adopted. It should reflect the underlying cost-benefit calculations.

The second amendment of the IMF's Articles of Agreement came into effect on April 1, 1978. It granted each member the right to choose its own form of exchange-rate arrangement. Intending not to categorize exchange-rate arrangements according to the previous adjustable-peg system, the IMF has not classified member countries in terms of narrow/wider margin peg practices since 1978. Therefore, 1980 data are used in distinguishing between countries that peg and countries that float.

C. The Country Characteristics (Explanatory Variables)

The explanatory variables represent the factors thought to be important in determining the size of the benefits and costs of adopting any of the alternative regimes. They are crucial country characteristics suggested by the (extended) OCA theory. Data from 1977 and 1980 are used.

X_1 (FI): The measure of financial integration is proxied by the ratio of commercial bank holdings of foreign assets to central bank holdings of foreign assets. An increase in this ratio is presumed to indicate increasing depth in the foreign-exchange market. Central bank holdings of foreign assets is a scale factor to standardize the FI measure. The data are from International Financial Statistics (IFS), June 1981 and June 1984.

X_2 (SIZE): Under the rubric of trade integration, four variables (SIZE, OPEN, CC, and GCl) are created. The dollar value of each country's GNP is used as a measure of size. The data are from World Bank Atlas, 1979 and 1982.

X_3 (OPEN): Concern about openness relates to foreign trade. The ratio of (Export + Import) over GNP is used as the measure. GNP data are from the World Bank Atlas, 1979 and 1982. Export and import data are from IMF Direction of Trade, 1982.

X_4 (CC): The measure of commodity concentration (CC), the inverse measure of diversification, is the ratio of the largest trade category to total trade from Standard International Trade Category (SITC) one-digit data. It is derived from the U.N. Yearbook of International Trade Statistics, 1979, 1983, vol. I: Trade by Nation.

X_5 (GC1): The geographic concentration 1 (GC1) is the portion in total exports to the largest trading partner. The data are derived from U.N. Yearbook of International Trade Statistics, 1979, 1983, vol. I: Trade by Nation.

X_6 (RIR): The relative inflation rate (RIR) is calculated as the square deviation of a nation's CPI inflation rate from the world weighted-average CPI inflation rate. The world rate is a proxy for the inflation rate of the nation's trading partners. The data are from IFS, June 1979, June 1982.

X_7 (LM): The presence of domestic output originating in manufacturing can serve as a proxy for the degree of labor mobility (LM). A higher value for this ratio is presumed to be associated with more developed markets and more labor mobility. The data are from the U.N. Yearbook of National Accounts Statistics, 1980 and 1983.

IV. EMPIRICAL RESULTS

A. 1977 Data

The econometric results are reported here in two parts, using 1977 data. The first part examines the exchange-rate regime selection problem with three alternatives: narrow margin peg (NMP), wider margin peg (WMP), and float. The second part reclassifies the countries involved into two categories: peg and float.

(1) The Choice Among Narrow Margin Peg, Wider Margin Peg, and Float

The maximum likelihood estimates (MLE) of the coefficients are reported in equations (1), (2), and (3). Here the relative odds of regime 1 with respect to regime 2 are defined as the log value of Prob(regime 1)/Prob(regime 2).

Note: here we take the log values of the original independent variables as the independent variables in estimation. Therefore, the estimated coefficients can be interpreted as the elasticities of the relative odds with respect to the country characteristics.

$$\log \frac{P(Y=Float)}{P(Y=NMP)} = \underset{(-1.712)^{*}}{-0.3598}\log(FI) + \underset{(3.601)^{***}}{0.8126}\log(SIZE) + \underset{(0.4661)}{0.1287}\log(OPEN) \underset{(-0.9346)}{-0.3925}\log(CC) + \underset{(0.7946)}{0.3263}\log(GC1) + \underset{(2.698)^{***}}{0.2941}\log(RIR) \underset{(-0.4713)}{-0.3296}\log(LM) \underset{(-1.184)}{-6.929}\ Constant \quad (1)$$

$$\log \frac{P(Y=WMP)}{P(Y=NMP)} = \underset{(1.582)^{*@}}{0.2557}\log(FI) \underset{(-1.22)}{-0.1987}\log(SIZE) \underset{(-1.727)^{*}}{-0.3647}\log(OPEN) + \underset{(0.095)}{0.0349}\log(CC) \underset{(-2.867)^{***}}{-0.9184}\log(GC1) \underset{(-2.055)^{**}}{-0.1736}\log(RIR) \underset{(-1.04)}{-0.54}\log(LM) + \underset{(1.575)}{7.12}\ Constant \quad (2)$$

Since $\log(P_1/P_2) = \log(P_1/P_3) - \log(P_2/P_3)$
where P_1=probability of choosing float,
P_2=probability of choosing wider margin peg, and
P_3=probability of choosing narrow margin peg.

We can derive equation (1.3) from equation (1.1) and (1.2):

$$\log \frac{P(Y=Float)}{P(Y=WMP)} = -0.6155\log(FI) + 1.0113\log(SIZE) + 0.4934\log(OPEN) - 0.4274\log(CC) + 1.2447\log(GC1) + 0.4677\log(RIR) + 0.2104\log(LM) - 14.049\ Constant \quad (3)$$

*@ Significant at 12% level
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level
Overall, likelihood ratio index = 0.4293,
likelihood ratio statistics = 85.84.

From equation (1), the significant independent variables affecting the relative odds of selecting a float regime, as compared to a NMP regime, are FI, SIZE, and RIR. Their signs show that an economy more integrated with the

international goods and capital markets is more likely to choose a fixed-rate regime, and that an economy with a larger differential inflation rate from its major trading partners is more likely to choose a floating-rate regime. We label this as the conventional view of the OCA theory.

From equation (3), the conventional view on financial integration (FI) and inflation convergence (RIR) is significantly confirmed. Also, the impact of trade integration is confirmed by the significant coefficient of SIZE. However, the significant GC1 coefficient gives a different result (float is preferred to WMP). A probable reason is that a country with geographically concentrated trade is susceptible to both microshocks and macroshocks from its main trading partner(s). For microshocks, exchange-rate adjustment may be costly. However, for macroshocks, such as marketwide price changes (inflation shocks), exchange-rate adjustment is least costly. Therefore, when a floating rate (which provides sufficient flexibility) is a viable choice, it is preferred. Thus, an intermediate regime sometimes is less preferred to both extreme regimes and vice versa.

From equation (2), the significant variables affecting the relative odds of selecting the WMP, as compared to the NMP, are FI, OPEN, GC1, and RIR. The conventional views on trade integration (OPEN and GC1) are confirmed here. However, FI and RIR have perverse signs that differ from the conventional view.

The reason for the perverse sign of FI may be that WMP provides more short-run flexibility, which can better contain the exchange rate that maintains the asset-market equilibrium. (An asset-market-clearing exchange rate exhibits significant short-run volatility because of the various reasons given in the section on the OCA theory). Moreover, a wide band provides scope

for anticyclical monetary policy. When the money supply is increased to combat a depression, for example, exchange-rate depreciation should be allowed to create an expectation for subsequent rebound that will compensate investors for temporarily low interest rates. On the other hand, WMP's longer-run stability provides an anchor for expectations of a longer-term exchange rate, thereby promoting stabilizing speculation and greater stability of the exchange rate. NMP enjoys stability similar to that of WMP in the longer run. In the short run, however, NMP is likely to be subject to much heavier speculative pressure and greater difficulty in accommodating anticyclical policies.

The perverse sign of RIR can also be explained by the nature of WMP. Both WMP and NMP do not provide sufficient flexibility in the long run for a country to choose its trend inflation rate. In the short run, however, WMP does not provide as much anti-inflationary discipline as NMP does. Therefore, if a country chooses to peg its exchange rate, NMP is preferred to WMP. The empirical results show that the domestic inflation target is more important than the anti-inflationary discipline (because float is preferred to peg) and that there are some (relatively weak) grounds for the discipline argument (because NMP is preferred to WMP).

Though the intermediate regime (WMP) involves more complicated trade-offs, taking equation (1), (2), and (3) together, a floating-rate regime is preferred to a pegging-rate regime (which can be either NMP or WMP) for high RIR, and a pegging regime is preferred to a floating regime for high FI, both of which are compatible with the conventional view. Overall, this evidence provides support for hypotheses H_1^A, H_2, and H_3:

(H_1^A dominates H_1) The Mundell-Fleming ranking of exchange-rate regimes is overridden by the unstable nature of a floating rate under increasing financial integration. We shall elaborate on this result later.

(H_2 dominates H_2^A) An economy facing more real shocks because of increasing trade integration still prefers a fixed rate because, in an economy open to trade, a floating rate causes higher inflation and incurs more costs in BOP adjustment and trade.

(H_3 dominates H_3^A) A country with an inflation rate vastly different from its major trading partners tends to adopt a floating rate to preserve its domestic inflation target, while the anti-inflationary discipline from a fixed rate may provide fewer benefits.

This three-alternative, multinomial-logit model simulates real-world choice among more than two alternative exchange-rate regimes. More important, the economic content of multiple-regime selection is analyzed. Overall, the likelihood ratio index (analogous to the multiple correlation coefficient, R^2) is 0.4293, which is high among cross-sectional data results. The likelihood ratio statistic, which tests the joint significance of all coefficients, is asymptotically distributed as a chi-square with 16 degrees of freedom (number of parameters to be estimated). It is 85.84, and is significant at 1 percent level. The within-sample prediction of regime choice has a success rate of 72.53 percent.

We can elaborate on a major finding of this study now: "H_1^A dominates H_1." That is, high financial integration is shown to be associated with fixed-rate regimes (WMP and NMP). However, previous works by Heller (1977, 1978) and Holden, Holden, and Suss (1979) show a positive effect of CM (FI) on choosing a flexible exchange-rate regime. Nonetheless, Heller employs discriminant analysis, which does not provide a meaningful interpretation of the coefficients for hypothesis testing (t-test); Holden, Holden, and Suss

drop the SIZE variable, and the coefficient of FI is insignificant. By employing a more complete set of explanatory variables, and by using a multinomial-logit method, this paper reaches quite different conclusions about FI.

According to the predominant Mundell-Fleming proposition, only two of the three conditions can hold simultaneously: (1) monetary policy independence, (2) a fixed exchange rate, and (3) free capital mobility. This proposition is often used as an argument that floating exchange-rate regimes should be adopted in a financially integrated world. However, the empirical results of this paper show that, under high financial integration, a fixed rate is preferred to a floating rate. Thus, the Mundell-Fleming regime ranking is refuted.

There are two major explanations, as discussed in the section on the OCA theory. First, national monetary autonomy has already been eroded by high financial integration. High capital mobility makes control of the money supply and credit difficult (with the possible exception of a reserve-currency country) and makes the demand for money unstable. Even the independent monetary policy itself can be viewed as a monetary disturbance if neither a commitment nor a rule is attached. Second, under high financial integration, a fixed rate would be quite beneficial. It can smooth the adjustment mechanism, lower the costs in international trade and finance, and promote domestic stabilization.

(2) The Choice Between Float and Peg

In order to provide a comparison with the above multiple-regime-choice model and to provide a comparison with the model employing 1980 data (where no

WMP category is available), a binomial-logit model is used to study the choice between floating and pegging regimes. The binomial results (using 1977 data) are:

$$\log \frac{P(Y=Float)}{P(Y=Peg)} = \underset{(-0.857)}{-\ 0.2736\ \log(FI)} + \underset{(3.694)^{***}}{1.425\ \log(SIZE)} + \underset{(0.8376)}{0.3892\ \log(OPEN)} - \underset{(-1.389)^{@}}{0.7905\ \log(CC)} + \underset{(1.185)}{0.6177\ \log(GCl)} + \underset{(2.247)^{**}}{0.2982\ \log(RIR)} + \underset{(0.2237)}{0.2084\ \log(LM)} - \underset{(-2.817)^{***}}{15.58\ Constant} \qquad (4)$$

@ Significant at 18% level
** Significant at 5% level
*** Significant at 1% level
where the numbers in parentheses are the t-statistics.
The likelihood ratio index = 0.5960, which is relatively high.
The likelihood ratio statistic = 75.19, which is significant at the 1 percent level.

The significant coefficients, SIZE and RIR, both have signs compatible with conventional theory. (CC is significant at the 18 percent level.) Compared with the three-alternative model in the last section, the hypothesis testing in this two-alternative model does not incur any perverse sign (from the conventional OCA view) on significant coefficients. This result is not surprising, because the OCA theory was originally designed to distinguish the choice between floating and pegging regimes. Also, there appear to be fewer significant coefficients in the two-alternative model, probably because there is a less-realistic choice between only two regimes.

The overall prediction rate is 89.01 percent, which is higher than that in the three-alternative model (72.53 percent). The reason may be that, with a finer and more detailed classification, it is more difficult to make a clear-cut choice. The likelihood ratio index and statistic also are favorable. We can summarize the overall performance in the above (three- and

two-alternative) models as satisfactory (better or much better than average). This indicates that the OCA country characteristics as a group can reasonably explain the behavior of the exchange-rate-regime choice.

We can also summarize the significance-test results in the models above. Most of the significant coefficients match the conventional view of the OCA theory. (The three occasions of perverse signs have reasonable explanations.) Only the coefficient of LM has never been significant (CC is significant only at the 18 percent level. However, it is significant at the 10 percent level by using 1980 data). The insignificant LM seems to indicate that the effects of internal labor mobility (pro-floating rate) and external labor mobility (pro-fixed rate) cancel each other out; or that labor mobility simply does not play a role in exchange-rate-regime selection. That is, H_4 and H_4^A are not meaningful distinctions. Moreover, RIR is significant in four out of four occasions. FI and SIZE are significant in three out of four occasions, while OPEN and GC1 are significant less frequently. Although there are some insignificant coefficients, significant coefficients do reveal the validity of the conventional OCA theory. That is, a country with the following characteristics is likely to join a currency area: (1) high financial integration, (2) high trade integration, and (3) inflation convergence with the area.

B. 1980 Data

The current monetary system emerged only after the breakdown of the Bretton Woods System. As time passes and experiences accumulate, countries are supposed to become more capable of selecting their regimes according to

cost-benefit considerations. Thus, we expect that more recent data will better reveal the validity of the OCA theory.

Therefore, we also employ 1980 data to reestimate the above models. After selection and collection, the 1980 data include 88 countries. Our report will focus only on the choice between float and peg due to the lack of finer IMF classifications.

The Choice Between Float and Peg

Following the previous classification of countries into two cells, one for float and one for peg, we obtain the following binomial-logit-model results:

$$\log \frac{P(Y=Float)}{P(Y=Peg)} = \underset{(-1.36)^{@}}{-0.3829 \log(FI)} + \underset{(3.355)^{***}}{0.9653 \log(SIZE)} \underset{(-1.246)}{- 0.8161 \log(OPEN)} \underset{(-1.827)^{*}}{- 2.084 \log(CC)} \underset{(0.1068)}{+ 0.0780 \log(GC1)} + \underset{(1.316)^{@}}{0.2439 \log(RIR)} \underset{(0.6095)}{+ 0.4633 \log(LM)} + \underset{(0.008)}{0.0564 \text{ Constant}} \quad (5)$$

@ Significant at 18% level
* Significant at 10% level
*** Significant at 1% level
Where the numbers in parentheses are the t-statistics.
The likelihood ratio index = 0.5221.
The likelihood ratio statistics = 63.69, significant at 1 percent levels.

The significant coefficients are those of SIZE and CC; both have signs compatible with the conventional theory. Adding to the 1977 data results, the significant CC shows that a country with an undiversified composition of tradeable goods is likely to join a currency area. FI and RIR are significant only at the 18 percent level, with signs compatible with the conventional view.

We get a lower prediction rate from 1980 data (82.95 percent) than from 1977 data (89.01 percent), which appears to contradict the statement discussed in the beginning of this section. A probable explanation lies in the disillusionment with the floating exchange-rate system. By comparing the two-alternative model (float versus peg), we note that the significance levels of individual coefficients change as we move from 1977 data to 1980 data. While the significance level of RIR deteriorated from 5 percent to 18 percent, the significance level of FI improved from lower significance to significance at an 18 percent level, and the level of significance of CC improved from 18 percent to 10 percent. This evidence seems to indicate that (1) RIR becomes less relevant, probably due to incomplete insulation under a floating-rate regime; and (2) FI and CC become more relevant, probably due to a perception change about the costs of exchange-rate fluctuation on finance and trade.

However, the OCA effect of individual country characteristics is still significant (with correct signs) by using 1980 data. Furthermore, the international economic environment is changing. For example, in 1980, the United States adopted new monetary operating procedures, and a second oil shock had just occurred. Both the disillusionment and the environmental change make the comparative costs of different exchange-rate regimes less certain. The country characteristic effect and model performance thus become blurred accordingly.

V. CONCLUSION AND POLICY IMPLICATIONS

In this paper, we ask the same question that Heller (1977) did:

> Is the current international monetary system really a system, or is it a haphazard collection of ad hoc arrangements resulting from decisions by individual countries?

The empirical study in this paper shows some inherent order in exchange-rate-regime selection, and the OCA theory provides acceptable criteria for that choice. The empirical support comes from supportive significance-test results and from reasonable model performance.

In agreement with previous empirical results, this study confirms the relatively tight linkage between trade integration and a fixed rate, and between inflation convergence and a fixed rate. However, labor mobility does not exhibit a significant impact on exchange-rate-regime choice. In contrast to previous (fuzzy) results, this study confirms the linkage between financial integration and a fixed rate. A direct implication is to refute the relative importance of the Mundell-Fleming proposition on the exchange-rate-regime choice. Therefore, the result indicates a research direction that emphasizes the potential importance of (direct and indirect) currency substitution and of the costs of exchange-rate instability.

The findings of this study can readily be applied to policy decisions. For western European countries attempting to form a currency area, for example, the important consideration lies in the degree of intracommunity trade and financial integration and on whether there is a near-consensus on a common inflation rate. Prospective economic developments in western Europe seem to be favorable. The 1992 economic goals promise an increasingly integrated Europe in trade and finance, and all 12 European Community central-bank governors endorse a low inflation policy. Therefore, the conditions in western Europe justify the formation of a currency area.

As for the intermediate procedure, the gradual approach as adopted in the Delors plan seeks to narrow the band successively and to reach full monetary integration gradually. However, our empirical evidence shows that, in an

increasingly financially integrated world, if countries prefer pegging with a band, they should choose a wider band. The gradualism suggested in the Delors plan is not compatible with the revealed preference of economic cost-benefit considerations. Also, the speculative attack in the foreign exchange market would force misalignment and hinder the gradual approach.

Our empirical evidence also shows that the inflation-rate convergence favors a WMP. On the other hand, increasing trade integration favors a NMP. However, in a time horizon of two to three years (1990-1992), trade volume and prices may be sticky.[7] Thus, increasing financial integration would be the dominant factor because of the fast pace of adjustment in the asset market, the huge volumes of financial transactions, and the earlier removal of investment barriers (by 1990) in the European Community. However, occasional parity adjustments may be needed to accommodate real shocks and policy differences. The EMS tradition of striking a balance between rules and discretion thus is worth preserving.

Therefore, in the transitional period, EMS countries can adopt a hard-margin wider band with adjustable parities. The EMS can then jump to an irrevocably fixed rate, or to a single currency, if substantial trade integration, financial integration, and monetary policy coordination have been achieved. Alternatively, EMS countries can fix their exchange rates irrevocably in the very early stage. Eclecticism (gradualism) may only weaken the system.

FOOTNOTES

1. The United States liberalized its capital control in 1974; Great Britain in 1979; Japan in 1980; and western Europe in 1990.

2. The Mundell-Fleming ranking of the exchange-rate regimes has been reversed by Fischer (1976) and by Frenkel and Aizenman (1983). However, these studies mainly assume a financially closed economy, which misses the central role of capital mobility. Marston (1985) illustrates the importance of wage indexation. Domestic full-indexation will make fixed-rate and floating-rate regimes indistinguishable. Foreign full-indexation will make foreign disturbances purely monetary. However, assuming there is a contractual lag of wage adjustment and a certain degree of capital mobility, thus preserving the assumptions in the M-F proposition, the M-F ranking of the exchange regimes can still be reversed. This is a main theme of this paper, which refutes the M-F ranking in a fundamental way.

3. Kareken and Wallace (1981) offer a rationale for unlimited M1 currency substitution. Because fiat money is intrinsically useless, unbacked, and costless to produce, the exchange rate, as the relative price between two fiat monies, can be virtually anything. This is also the case for corresponding world currency supply and currency composition.

4. National autonomy is often confused with national sovereignty. The latter concerns the formal ability of a nation to act independently, free from another nation's will, such as monetary policy independence. National autonomy, in contrast, is the ability of a nation to attain its objectives through unilateral action. That is constrained in an interdependent world.

5. Henderson (1984) uses a small general-equilibrium model to analyze exchange-market-intervention policy. He finds that for a single open economy, with disturbances to the home goods market, an aggregate (money supply) constant policy incurs less variation in output; for disturbances to financial markets, a rate (exchange-rate and interest-rate) constant policy also incurs less variation in output. In a two-country world economy, Henderson finds that a fixed rate minimizes output variation for a preference shift between domestic and foreign assets. On the other hand, a floating rate minimizes output variation for a demand shift between domestic goods and foreign goods.

6. In general, it is difficult to assess the relative insulating properties of a floating rate versus a fixed rate without specifying the nature and origin of the disturbances and what variable and which sector are to be insulated. These properties are often model-specific, and there is a lack of theoretical consensus in this area (see Bordo and Schwartz [1988]).

7. Besides the J-curve effect, the lack of sensitivity of trade volume and price to exchange-rate variation can be the result of sunk costs. Under exchange-rate uncertainty, a firm will wait and see before it changes trade volumes and prices because of the significant irrevocable fixed costs involved (see Krugman [1989]). A practical reason for the insensitivity is the difficulty in meeting the requirement for common technical product standards.

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