

IS-LM-BP: an inquest

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Introduction

Open economy macroeconomics is not a new field of theoretical enquiry. Its origins can be traced back to mercantilist and classical notions of the impact of the trade balance, gold flows and exchange rate mechanisms (e.g. Hume, 1752). But *formal mathematical* models of trade and capital flows and exchange rate movements are a much more recent development, emerging only over the past 60 years. In the same year as the publication of Keynes' *General Theory*, Harrod and Meade also published significant works, *The Trade Cycle* and *Economic Analysis and Policy* respectively, parts of which dealt with floating exchange rates and "free capital movements". This and subsequent work of Meade and Metzler, among others, stimulated a generation of theorists to develop what Mundell calls the "international macroeconomic model" (Mundell, 2002).

In our previous work, we examined the development of the early mathematical models of IS-LM closed economy vintage (Darity and Young, 1995). In this paper, we attempt to do the same for the open economy version of IS-LM. Now, there are a number of the general accounts of the evolution of the open economy macroeconomic model, including those of Kenen (1985), Flanders (1989), and Isard (1995), and specific accounts of the evolution of the "Mundell-Fleming model" by Blejer et.al (1995), Boyer (2002), Boughton (2003), and Mundell himself (1999, 2001, 2002). But up to now, the *specific* development of IS-LM-BP, as distinct from the "Mundell-Fleming" story as told by Mundell, among others, has not been dealt with. Indeed, as will be shown, IS-LM-BP has a history *parallel* to the story of Mundell's *models* and Fleming's *model* as told by Mundell, Boyer and Boughton. In this context we must

distinguish between the “Mundell-Fleming” model *synthesized* by Dornbusch, that is, with flexible exchange rates and perfect capital mobility *only* (Dornbusch, 1980, 193-194) and the more *general* IS-LM-BP framework, which encompasses both fixed and flexible exchange rates and all degrees of capital mobility.

The paper is divided into four sections. Section 1 deals with the early *mathematical* models of the open economy, including Metzler’s pioneering 1942 model and the Laursen-Metzler model (1950); Metzler’s 1951 *JPE* model is also briefly discussed as it influenced Mundell, on Mundell’s own account. This section also deals with the impact of Meade’s 1951 model and Metzler’s models on Mundell’s work. In this context, we will integrate the relevant parts of Mundell’s accounts of the development of his models (1999,2001,2002). Section 2 surveys the early 1960s—the years of “high theory”— and deals with the *characteristics* of Mundell’s *models* from 1960 to 1964, and compares them to Fleming’s 1962 *model*. Section 3 deals with the *diagrammatic* development of IS-LM-BP as it emanated from the important *generalized* model of Krueger (1965); the “overlooked” linkage of Krueger’s model to the “Hicksian IS-LL construct” made by Michaely (1968); Takayama’s 1969 “general equilibrium model” based upon the open economy extension, that is “straightforward use”, of IS-LM; the somewhat forgotten “IS-LM-EE” approach of Wrightsman (1970); to the appearance, in Branson’s widely-used 1972 textbook, of IS-LM-BP with fixed exchange rates; all this *before* Dornbusch’s *synthesis* of Mundell’s models and Fleming’s model into what he called the “Mundell-Fleming” model (1976-1980). This section also deals with Dornbusch’s contribution to the IS-LM-BP story, that is, his “Mundell-Fleming” *synthesis* and its extensions.

Early mathematical models

Meade, Metzler, and Samuelsonian Methods

Metzler and Laursen-Metzler, 1942-1951

Metzler's 1942 *Econometrica* paper, "Underemployment Equilibrium in International Trade", is a pioneer amongst the early mathematical models of the open economy after the publication of Keynes's *General Theory* (1936), and Harrod's *Trade Cycle* (1936). Now, in the initial footnote to his 1942 paper, Metzler wrote that he had "confined" his "analysis" to the "real income approach" to the balance of trade (1942, 97 note 1), as set out by Harrod (1933, 1936). Metzler's "static scheme" [his emphasis] (1942, 99) is based upon national accounts equations for an open economy, albeit extended to the two-country case (1942, 99). But the object of Metzler's model was not simply to analyze investment-consumption relations. For, as he wrote, "if certain stability conditions ... are satisfied, this fundamental system determines the equilibrium of investment and consumption in each country, and hence total incomes and the balance of trade" (1942, 99), or in other words, the general equilibrium of the two country system.

Metzler then turned his "static scheme" into a "dynamic system" by dating the variables and analyzing the stability and equilibrium of the system he proposed (1942, 100). By doing this, he departed from Harrod's methodological approach and adopted that of Hicks's *Value and Capital* and Samuelson's *Foundations* (see Young, 1989, 1991). But more is involved here, for Metzler was among the first to utilize the Samuelsonian "Correspondence Principle" (Samuelson, 1941; 1947; 258, 262); and this, based upon Samuelson's as yet unpublished book, which Metzler cited as "The Foundations of Analytical Economics" (1942, 100 note 6). This is readily seen in Metzler's summary of Samuelson's view that "stability depends not only upon the

characteristics of the static equations ... but also upon the nature of the assumed dynamic system" (1942, 100).

Metzler's 1942 model is a two-country model, with domestic prices, interest rate, and exchange rate fixed and no capital movements. His dynamic system consists of "linear difference equations with constant coefficients" (1942, 98,101). Using Samuelson's methods, Metzler is able to analyze "four types" of parametric variation as they affect total consumption, investment, and income, in the respective countries, and the trade balance, dependent on whether one or both of the countries are stable or unstable "in isolation". For example, as he writes "domestic expansion will lead to a drain on foreign balances only if the country with which the expanding country deals is stable in isolation". Thus, Metzler continues, "one should always specify which of the countries is assumed to be unstable in isolation and which stable. Many economists will probably prefer to assume that all countries are stable in isolation ... With stability conditions specified, directions of change may be determined for all variables except investment in one of the two countries. This remaining ambiguity is attributable to the dual nature of such investment. That is, whenever the balance of trade of a country declines while domestic investment rises (or conversely), the direction of change of total investment cannot be determined without further information ... the final outcome under these circumstances depends ... upon such nonstability conditions as the relation between marginal propensity to invest and marginal propensity to import" (1942, 110-112). What should be recalled is that Metzler's paper antedates Modigliani's *Econometrica* paper by two years, but while latter is recognized as the apex of the closed economy "neoclassical synthesis" (Fischer, 1987), the former is not recognized as one of the starting points of the

general equilibrium approach to the open economy. For example, Isard (1995) does not mention Metzler's 1942 paper, nor does Blejer et.al (1995).

In their 1950 *Review of Economics and Statistics* paper, Laursen and Metzler extended the analysis of Metzler's 1942 paper to the case of flexible exchange rates. Indeed, as they indicated in their mathematical appendix (which greatly influenced Mundell among others, as will be seen below), similar questions had been addressed in Metzler's 1942 paper (1950, 297-298; 298 note 6). The 1950 model is a two-country model with fixed interest rate and no capital movements but with the *possibility* of price flexibility (1950, 292) under a flexible exchange rate regime. As they wrote, if " the exchange rate is flexible rate ... it accordingly takes on a value at which the international payments and receipts between the two countries are equalized. If capital movements are prohibited, the equilibrium exchange rate will be that rate at which each country's exports are equal to its imports" (1950,293). Based upon this, they then presented an equation system which " with given expenditure functions and price levels in both countries" indicated " the equilibrium levels of income as well as the equilibrium exchange rate" (1950, 293). The Samuelsonian "Correspondence Principle" method was also used by Laursen and Metzler; that is they examined the conditions of stability and dynamic behavior of their proposed equation system before evaluating their " static equations" (1950, 295). But the main thing to remember here is that the Laursen-Metzler model *does not flow* from "Keynesian headwaters". Rather, "the fundamental problem" the paper tries to address, that is " the degree of economic insulation that can be achieved by a system of flexible exchange rates" (1950, 291) emanated from issues earlier raised a decade earlier by Haberler in the "revised edition" of *Prosperity and Depression* (1950, 284, note 10).

Metzler's 1951 *JPE* paper "Wealth, Saving and Rate of Interest"--while a closed economy model--also emanated from what Metzler called "the remodeled classical theory", or *general equilibrium* approach of Haberler (1941) among others (1951, 93 note 3,98). The formal model, as presented in the Mathematical Appendix to the paper, consists of two markets: goods and services, and securities, and a system of equations determining the equilibrium values of variables. Metzler first presents a static system (1951, 113) and then goes on to present two "dynamic" postulates, that is to say "equations of adjustment" (1951, 115), which "are the dynamic counterpart" of two of his static equations. He then presents his "complete dynamic system" by utilizing the "definitional equations" of the static system (1951, 115). He goes on to analyze the stability of system and its "approach toward equilibrium", in addition to the possibility of cyclical fluctuations, by means of Samuelsonian methods--that is, analysis of the roots of his dynamical equations--in a manner similar to the 1950 Laursen-Metzler paper (1951, 115-116; also see 1950, 295-297). And, as will be seen below, it is this paper that stimulated Mundell into extending Metzler's approach to the open economy, according to Mundell himself.

Meade, Metzler, and Mundell

From 1999 onwards, Mundell has given a number of accounts of the development of his own work (1999, 2001, 2002). It is to these accounts, therefore, that we now turn. As his 1999 account, in a letter to one of the authors, was the original basis for his subsequent accounts, and contains his *frank* views on the subject, we will be referring to it at length here.

Meade's *Mathematical Supplement* (1951)

According to Mundell's accounts, there were three major influences upon his work: Meade, Metzler, and Samuelson. After completing his doctoral exams at MIT, where he was "especially influenced by Samuelson and Kindleberger" (2001, 216), Mundell chose to visit LSE from mid-1955 for a year and work on completing his thesis under the supervision of Meade (1999,1; 2001, 216; 2002,1-2), as he "was fascinated" with, as he put it, Meade's "Geometry of International Trade"[1952] (1999, 1). While at LSE, Mundell met Meade on a weekly basis, but he focused upon trade theory and not macroeconomics (1999, 2001, 2002).

In his 1999 letter to one of the authors--that became the basis for his 2001 *IMF Staff Papers* article and his subsequent "Notes on the Development of the International Macroeconomic Model" (2002, 15-16, note 1)--Mundell gave a frank assessment of the "*Mathematical Supplement*" [MS] to Meade's 1951 volume *The Balance of Payments*, which he did not include in his published accounts (2001, 2002). In his letter, Mundell talks about his "own methods" of solving mathematical problems involving equational systems. And, as he writes, "it is almost true to say that I didn't get any of my international macroeconomics from Meade's MS" (1999, 2). Moreover, Mundell points out an error in Meade's MS, and also mentions a conclusion which "would never fit into any of my models" (1999, 2-3). Mundell goes on to say "my interest in macroeconomics was very much below the surface that year 1955-56 in London, which was taken up with a thesis that had an entirely classical flavor" (1999, 3). He repeated this more or less verbatim in his subsequent accounts. With regard to Meade's indirect influence upon his work, however, Mundell said "I

was able to develop his work in some new areas, develop some of the dynamics, and generalize the model, following up on Mosak, in a multi- country framework" (2001, 217; Mosak, 1944).

Now, according to Mundell, Meade's MS does contain "the equations of an international macroeconomic model" (2001, 217; 2002, 3). Mundell goes on to say "but when I was doing my work on this subject a few years later, I never made any connections to it, although it must have influenced me at least subconsciously. The reason, I think, is that my approach came through a Walrasian-like general equilibrium theory, which was at best only implicit in Meade's analysis" (2002, 3). Mundell then distinguishes his approach from that of Meade by citing Meade's effort to bring about, in his model, "a marriage of the Keynesian and Hicksian type of analysis" for "balance of payments theory" (Meade 1951 b, 2-3); something which as Mundell states "was **not**, however what I was trying to do in my international macroeconomic model [Mundell's emphasis]" (1999,4; 2001, 217; 2002, 3). And indeed, Mundell's own treatment of balance of payments problems may have been catalyzed by Meade's footnote to the passage in MS in which he proposed "a marriage" of Keynesian and Hicksian analytical approaches. For as Meade noted "the Hicksian type of analysis has been applied to international trade problems in J.L. Mosak's *General Equilibrium Theory in International Trade* ... But that work does not deal at all directly with problems of disequilibrium in the balance of payments" (Meade 1951 b, 3, note 1). What was still missing, however, in Mundell's thought, was a systematic way to enable him to approach the international economy within a general equilibrium framework; and it is this Metzler supplied, according to Mundell himself.

Metzler's "architectonic paradigm"

One of the most important questions regarding Mundell's accounts of the development of his models relates to the influence of Metzler's models. This is because in one of his key papers, "Flexible Exchange Rates and Employment Policy" (1961b), Mundell based his model "on the work of Laursen and Metzler" (Mundell, 1961b, 510, note 3; Laursen and Metzler, 1950). This model became the basis for his subsequent analysis in perhaps his best known paper "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates", in which he assumed "perfect capital mobility" (1963, 481-482, note 5).

But Metzler influenced Mundell some five years before he even published his 1961 *Canadian Journal of Economics* paper (1961b). This is seen in his in his 1961 *Kyklos* paper "The International Disequilibrium System", where Mundell writes "at this point I should like to record my indebtedness to Professor Lloyd Metzler for stimulating discussion at Chicago in 1956 on the subject of the conditions of general equilibrium in an open economy" (1961a, 155, note 5). Indeed, as Mundell recalled, he spent the year 1956-57 as a postdoctoral fellow in political economy at the University of Chicago and as he put it "became especially interested in the work of Lloyd Metzler in theory and Milton Friedman in policy. Metzler's (1951) architectonic "Wealth, Saving, and the Rate of Interest" started me thinking about that model as a more suitable paradigm for macroeconomics than the Keynesian model and worth developing in an international framework. By 1955[1956], Patinkin's work had appeared and the Metzler-Patinkin general equilibrium approach to the closed macroeconomy provided a more classical full-employment counterpart to the standard IS-LM Framework" (2001, 218; 2003,4). In his 1999 letter, Mundell also wrote that

reading "his [Metzler's] 'Wealth, Saving, and the Rate of Interest' started me thinking about it in international context ... This general equilibrium approach to the closed macroeconomy got me thinking about the way to write down the general equilibrium equations for the international economy. In retrospect I'm surprised I didn't think about it earlier! ... I remember conversations I had with Metzler in that year [1956-57] and, even though after his brain operation, he was only 50%, I'm sure that wonderful man helped me getting my thinking straight. My personal view is that if Metzler had stayed healthy after 1951 he would have done the work I did, in some ways better. As an architect of original economic systems, he was peerless in his generation" (1999, 3). Mundell subsequently repeated his opinion regarding Metzler's potential contribution by writing that "had he remained healthy, he would surely have pioneered the international macroeconomic model. His 1950 article with Svend Laursen was an important step along the way" (2002,4).

The influence of Metzler's work of the early 1950's upon Mundell is clear. The question that must be asked, however, is: why did Mundell overlook the model presented in Metzler's 1942 paper "Underemployment Equilibrium in International Trade" in his various accounts of the development of his own models? . At this point, suffice it to say that Mundell does not refer to it at all, and in view of the fact that it is mentioned in the appendix to the Laursen- Metzler paper--the model of which is the basis for Mundell's 1961 *Canadian Journal* paper (1961 b)-- that Mundell would overlook it *deliberately* is surprising indeed. The most plausible explanation would be that since Metzler's 1942 model is characterized by fixed prices, interest rates, and exchange rates (1942,98), Mundell did not consider it to be as *general* as either the 1950 Laursen-Metzler model or Metzler's 1951 model, *both* of which he subsequently utilized. Mundell himself has recently offered another explanation (Mundell, 2003a)

when he replied to one of the authors "...I fixed upon the Laursen-Metzler article because it integrated the early Metzler-Machlup works with an adjustment system (the exchange rate) to correct the balance of trade. Of course there were no monetary equations in the system so the exchange rate had to be the real exchange rate (or the terms of trade). For me to give credits to those earlier articles [Metzler, 1942] would be like hand-waving to the General Theory of Hicks' IS-LM paper".

Samuelsonian Methods and Economic Policy Alternatives

Mundell's approach, that is to say, the *conflation* of Meade's complex three market model, its *combination* with Metzler's mechanism for general equilibrium, and Mundell's special emphasis on the importance of capital movements, enabled him to create, as Dornbusch noted, simple albeit powerful models which served as analytical frameworks, not only for thought and policy but for posing new questions (1980,5). In other words, Mundell "did a Hicks" (Young, 1987).

Mundell's work is crucial in the following way. While certain ideas and elements in his models already existed in the literature, and he was aware of and influenced by them, his contribution was not only the synthesis of elements of previous complex albeit incomplete approaches, but also the addition of elements not included or stressed in previous models and their combination into complete simplified geometrical-equational systems.

The "methods" that Mundell refers to in his 1999 account (1999,2) relate to what can be called "Stability Analysis and the Correspondence Principle" (Samuelson, 1947;1958), which enabled Mundell to "reduce" the "Central Message" of a Meade-type [static] model to 5 equations and then to 3 equations [markets] by focusing upon the dynamics involved in the adjustment process (Mundell, 1968, pp. 219-221). For, as Samuelson noted (1958, pp. 262, 350)

The equations of comparative statics are...a special case of the general dynamic analysis. They can indeed be discussed abstracting completely from dynamical analysis...But the problem of stability of equilibrium cannot be discussed except with reference to dynamical considerations...in order for the comparative-statics analysis to yield fruitful results, we must first develop a theory of dynamics...

He goes on to say

Indeed, the correspondence principle, enunciating the relationship between the stability conditions of dynamics and the evaluation of displacements in comparative statics, provides the second great weapon in the arsenal of the economist interested in deriving definite, meaningful theorems.

And, on Samuelson's criterion, it was Mundell, using the methodology of the correspondence principle, and not Meade, who developed the "meaningful" models that yielded "fruitful results".

In his accounts (1999,2001,2002), Mundell describes how he started to work on his own open economy macromodels. As he recalled in his 1999 account (1999,3) in these early papers, he was not trying to emulate Meade's proposed "marriage of the Keynesian and Hicksian type of analysis". Rather, as he wrote (1999,4)

The stimuli to my work were quite different. To understand this, first it is necessary to distinguish between two strains of my models. What is called the "Mundell-Fleming model" is usually taken to refer to that group of articles that includes my *Kyklos* 1961, *Can. Jour.* 1961, *IMF Staff Papers* 1962, and *Can. Jour.* 1963, papers, i.e. chapters 15, 17, 16, and 18 of my

International Economics, including the appendix to 18, which was published in the Canadian Journal in 1964 as “Reply to McCleod...”

Mundell went on to say (1999,4)

These articles, usually thought about as the Mundell “half” of the Mundell-Fleming model, are more or less in the tradition of the internationalized IS-LM model. It is hard to argue that this model is the same as Meade’s model, although there are obvious connections. In retrospect, it can be thought of as a international multiplier model pioneered by Machlup, Metzler, Chipman et.al., but with the securities and money markets added.

Mundell then continued on to give his account of how his dynamic approach developed. As he put it (1999,4-5)

However, the first and in some respects my most important international macroeconomic model was not the Hicks-Keynes IS-LM internationalized, but the QJE 1960 model “The Monetary Dynamics of International Adjustment Under Fixed and Flexible Exchange Rates”...The purpose of this article was not to introduce a new model but to find a way to analyze the difference between fixed exchange rates with flexible prices, and flexible exchange rates with fixed prices. I needed a coherent and plausible international macroeconomic model that was at least consistent with a full-employment economy or at least one in which full employment policy was being pursued by the government. There did not as yet exist such a model the literature. The macroeconomic model I used employed an internal

balance and a foreign balance schedule (for the first time in the literature) and the variables were the interest rate (representing monetary policy) and the real exchange rate (or the relative prices of home and foreign goods). These defined four zones of disequilibrium and made possible an examination of the different dynamics relevant to a fixed exchange rate system (such as the gold standard) compared to a flexible system in which monetary policy is directed at price-level stabilization.

Mundell went on to say (1999,5)

I personally have always liked this model better than the internationalized Keynes-Hicks version, but at the IMF and elsewhere, economists only seemed to understand or pay attention to Keynesian formulations. To me this formulation—the diagram with the FF and XX curves in a plane depicting the rate of interest on one axis and the real exchange rate (or some other relative price) on the other—fits the world of today better than the variable output versions. Of course it has to be brought up to date with a distinction between nominal and real interest rates and growth curves along the lines depicted in my *Monetary Theory* (1971).

Mundell then went into detail regarding how he had developed his dynamic approach, linking it, as noted above, with the analytical methodology of Samuelsonian dynamic stability analysis. As he wrote (1999, 5)

It could be argued that it [Mundell's 1960 QJE model] introduced a new form of analysis. Meade, who was at heart a Marshallian, had not been concerned at all with dynamics. Samuelson of course had pioneered the

economic dynamics of the Walrasian system, and a number of writers, including Lange, Metzler and Arrow, had developed theorems on its dynamic stability. Metzler and Laursen (1950) had analyzed flexible exchange rates, including a dynamic appendix, in the context of a multiplier model. Metzler (1951) had written his brilliant article on Wealth, Saving and the Rate of Interest with an appendix on the dynamics. Patinkin had followed in Metzler's footsteps with a very thorough treatment under similar assumptions (with P instead of M/P on the abscissa). But none of the writers on dynamics had used theorems about dynamic stability to settle the choice between economic policy alternatives.

He went on to say (1999,5)

When I started writing the paper [Mundell's 1960 QJE paper], I had no idea what the conclusions would be. I didn't make the model to elucidate or make appealing to the reader conclusions I had already reached by other means. I used the model as an engine of discovery. At first I thought that the different dynamics of the two systems (fixed and flexible rates) didn't really matter much. After all, who cares if the business cycle sequence is inverted? Why should it matter?

Mundell then recalled how he discovered that the dynamic stability conditions of variant exchange rate regimes differed (1999,5-6)

Nevertheless, as a good student of Samuelson, I routinely derived the stability conditions of the two systems. It turned out, under the assumptions about the signs of coefficients, that both systems would

normally be stable. But it was with great excitement—and I remember the very moment in my Menlo Park apartment on that Sunday afternoon in November 1958—that I noticed that the stability conditions were different. In particular, the terms under the discriminant could be positive or negative, giving rise to asymptoticity or cyclicity in the path to equilibrium. There spread before me now a whole new world of implications including of course the “principle of effective market classification.” I was so taken with the idea—elated might be a better word—that I put pencil and paper down, to prolong the enjoyment of the suspense about what would, with a few more equations, unfold!

Mundell then concluded his description of the development of his 1960 QJE paper (1999,6)

I believe I am right in saying that this was the first time monetary conditions had been explicitly incorporated into an international trade model, and I had a nice letter from Harry Johnson complimenting me on it, saying something to the effect that it carried the subject to a different level. One implication of the model was that a domestic boom (shift up and right of the XX curve) would raise interest rates, attract capital inflows, appreciate the real exchange rate, and worsen the balance of trade, a conclusion that would hold under either fixed or flexible exchange rates. This was very relevant to an understanding of the Canadian economy, which was the only major country with a flexible exchange rate, in the 1950s, and of course later very relevant for understanding the Reagan boom in the early 1980s, the ERM crisis in the early 1990s, and the

Clinton boom in the 1990s. Under the old Keynesian model, which typically assumed capital immobility, it was generally assumed that domestic expansion would weaken the currency.

Before proceeding, one issue remains, that is, the reason for Mundell's emphasis on capital mobility in his best-known paper, and the one most often cited, that is, his 1963 *Canadian Journal* paper. Now, in this paper, Mundell stressed the importance of capital movements and capital mobility. As he put it (1963, pp. 475,484)

My paper concerns the theoretical and practical implications of the increased mobility of capital. In order to present my conclusions in the simplest possible way... I assume the extreme degree of mobility that prevails when a country cannot maintain an interest rate different from the general level prevailing abroad. This assumption will overstate the case but it has the merit of posing a stereotype towards which international financial relations seem to be heading. At the same time it might be argued that the assumption is not far from the truth... I have demonstrated that perfect capital mobility implies different concepts of stabilization policy from those to which we have become accustomed in the post - war period.

At first glance, Mundell's approach *could* be attributed to the influence of Meade, who over a decade earlier wrote (1951b, 3)

Our model also allows for movements of capital in the balance of payments and not only for current payments for visible and invisible trade. Recent analysis has interested itself too little in this aspect of the balance-of-payments problem, perhaps because it is

nowadays too easily assumed that as a result of direct controls capital movements are always necessarily zero or, at least, unaffected by any disturbances. But this is not only unrealistic (since even today some important countries do not control capital movements); but it is unfortunate also because there are many good arguments for allowing greater freedom of capital movements. And in order to argue for and against the control of capital movements we must first analyze the balance-of-payments aspects of free capital movements.

However, while capital movements had already appeared in Meade's 1951 model, their role in his model was minimal, in comparison to the role they attained in Mundell's models. Indeed, as Kenen noted (1985, p.636) "Meade was careful to include them, but they could be deleted without altering his argument". The central role played by capital movements in Mundell's approach emanated from the passage of a decade between Meade (1951a,b) and Mundell, who was working in the early 1960s, when international capital movements had grown to such a significant extent that they were seen by economists as an important factor in influencing economic activity.

But there was also a "hidden agenda" in Mundell's stress on capital mobility. This emanated from his defense of his 1962 *IMF Staff Papers* article against critics at the Federal Reserve, on the one hand, and what Mundell called the "Samuelson-Tobin 'neo-classical synthesis'" view that he took strong issue with, on the other hand. As Mundell recalled " I decided to reply to my critics by writing an even more extreme piece, assuming complete capital mobility, which made the Samuelson-Tobin view even more absurd, because it showed that under fixed rates and perfect capital

mobility, monetary policy was completely impotent. Open market operations to buy Treasuries would result in equivalent gold losses or build-up of dollar balances. This led to the...1963 paper that has been so frequently reproduced...[and] that is usually cited as the locus classicus of my half of the Mundell-Fleming model" (1999,7; 2001,222; 2002, 9).

At this point, then, let us sum up the main points made by Mundell regarding the development of his models and their relationship with those of Meade and Metzler. Firstly, Mundell's approach was developed according to the Samuelsonian "Correspondence Principle", that is, first setting out dynamic [general] models, deriving their stability conditions, and then looking at static [special case] models and analysis that can be derived from the more general set of models (Samuelson, 1958[1947], 258). Mundell's approach encompasses both static and dynamic analysis, whereas that of Meade's *MS* only dealt with static analysis, as Meade's model was static and not dynamic. Therefore, while there is a relationship between Meade's model and that of Mundell, it is a tenuous one, and only applies to Mundell's static model in any event, as Mundell notes.

Secondly, Metzler's general equilibrium approach to the closed economy influenced Mundell regarding the development of his own general equilibrium approach to the open economy as he recalled; but so did Patinkin(1956), Machlup(1943) and Chipman (1951), among others, once again, according to Mundell himself. Thus, to say, for example, that Metzler was the sole influence on this aspect of the development of his models, as Flanders asserts (Flanders1989, 329-330) is not the full story, according to Mundell's own account.

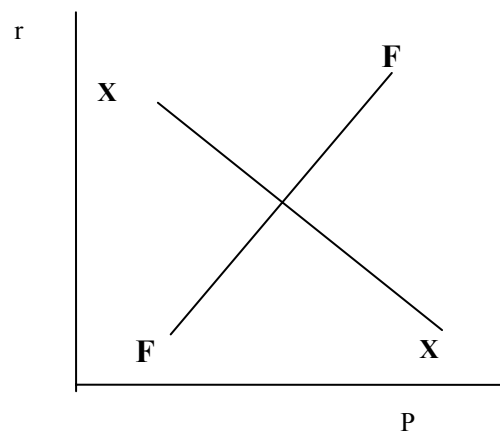
Mundell's *Models* and Fleming's *Model* in Comparative Perspective

Mundell's 1960 *QJE* Model

The importance of Mundell's 1960 *QJE* model (Mundell, 1960b) cannot be overstated. Despite this, Flanders (1989) does not deal at all with Mundell's 1960 *QJE* paper, preferring to focus upon Mundell's 1961 *Kyklos* paper, which she asserted "flows naturally...out of the Metzler headwaters, and it is an elegant statement of what the other models are about" (Flanders, 1989, 329). It should be recalled at this point that Mundell himself placed his 1961 *Kyklos* paper (1961a) in the "group of articles" of "Mundell-Fleming", that is "Hicks-Keynes IS-LM internationalized" vintage (1999,4). Moreover, as he put it (1999,4) "the first and in some respects my most important international macroeconomic model was not the [static] Hicks-Keynes IS-LM internationalized, but the [macrodynamic] 1960 *QJE* model". In light of this, specific treatment of Mundell's 1960 *QJE* model is, in our view, warranted here.

The first thing to recognize is that in his 1960 *QJE* paper, Mundell separated his analysis into two: an analysis of what he called "the static system" (229-232) and "the dynamic systems" (232-236) in order to deal with both fixed and flexible exchange rate regimes according to Samuelsonian methodology. His model consists of two markets—domestic goods and services and foreign exchange. These markets are influenced by two factors, the domestic interest rate—determined by the Central Bank's monetary policy—and what Mundell calls the "terms of trade", that is to say, the ratio of domestic to foreign prices. He assumes flexible domestic prices and also assumes foreign prices, incomes and interest rates constant, meaning that changes in the ratio of domestic to foreign prices emanates only from changes in the rate of exchange or in the domestic price level (1960b, 229-30).

Mundell then presents a “simple geometric interpretation of the forces governing the rate of interest [r] and the terms of trade [P]” by constructing what he calls the “foreign-balance schedule” for the foreign exchange market [FF] and the “internal balance schedule” for the goods and services market [XX] accordingly (1960b, 230-32). It is clear from the text of his paper that FF is what we now call the BP schedule with imperfect capital mobility, whereas XX is the IS schedule. This is illustrated in Mundell’s diagram below (1960b, 231)



But Mundell proceeded in a different manner to that of the conventional approach, i.e. rather than developing the comparative statics of the model, he proceeded according to Samuelsonian methodology to develop its comparative macrodynamics, which consisted of the adjustment processes and paths of adjustment, and not only an analysis of the equilibrium states after the processes were completed. And this, so as to answer some of the key questions he posed at the beginning of the paper (1960b, p.228), which related to stability conditions of fixed as against flexible exchange rate systems and the nature of the paths to equilibrium and their relation to the extent of capital mobility, among other issues.

Mundell’s 1961 vintage models

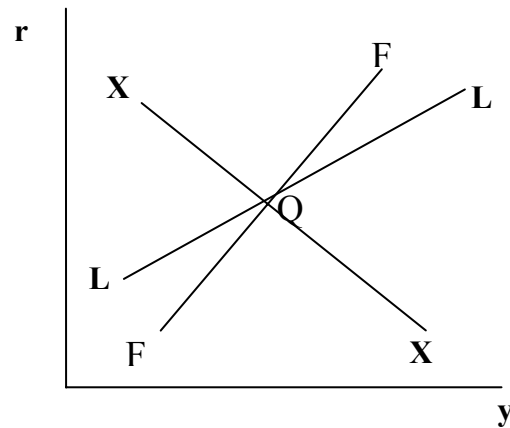
The 1961 *Kyklos* model: the IS-LM-BP prototype

According to Flanders this one-country model flows “naturally” from Metzlerian “headwaters” (1989,329)., Mundell, on the other hand, saw the model as what he called an “internationalized” version of “Hicks-Keynes IS-LM” (1999,4). In any event, Mundell assumes general equilibrium in three markets, goods, money, and foreign exchange, and develops two systems of "excess demand" equations: a static system and a generalized system. In the static system, the excess demand for goods and services, and the balance of payments surplus, are functions of money income and rate of interest; while the excess demand for money is a function of money income, the rate of interest and the quantity of money. In the in the generalized system, all 3 equations include money income, the rate of interest and the quantity of money (1961 a, 155 note 5). Mundell goes on to " assume also that the conditions of balance in each of the ... markets depend only on the level of money, the rate of interest and the quantity of money". He goes on to say that " for simplicity, however, and also to show that the results are not dependent on the Quantity Theory of Money, I assume that a change in the money supply affects the level of effective demand the balance of payments only insofar as it first affects the rate of interest" (1961 a, 155).

Mundell defines “F”, the balance of payments surplus, as the “trade balance + net capital imports”. He also has included a money market in his model, and has excluded the quantity theory of money (1961a, 155). These are *crucial distinguishing features* between Mundell’s “prototype” IS-LM-BP model as it appears in his 1961 *Kyklos* paper, and Fleming’s 1962 model, as will be seen below

The diagrammatic representation Mundell uses in this paper is in interest rate and *money income* space (r - y), with three markets: goods (XX), foreign exchange (FF), and money market (LL). As Mundell puts it (1961a, 155-156) " The curve XX traces the locus of interest rates and money incomes along which there is equilibrium in the goods market ... The curve FF traces the locus of interest rates and money incomes along which there is equilibrium in the balance of payments; this *foreign balance* schedule has a positive slope because an increase in the rate of interest improves the balance of payments (by attracting capital) while an increase in money income worsens the balance of payments (by worsening the trade balance). The LL curve, on the other hand, requires a slightly different interpretation: it gives the pairs of interest rates and money comes at which there is equilibrium in the money market *for any given quantity of money*, and it occupies a different position as a quantity of money varies, moving downward and to the right as the supply of money increases, and upward and to the left as the supply of money decreases. General equilibrium of the system is determined at the point Q common to both the XX and FF schedules, with a supply of money such to make the LL curve pass through Q [Mundell's emphases]".

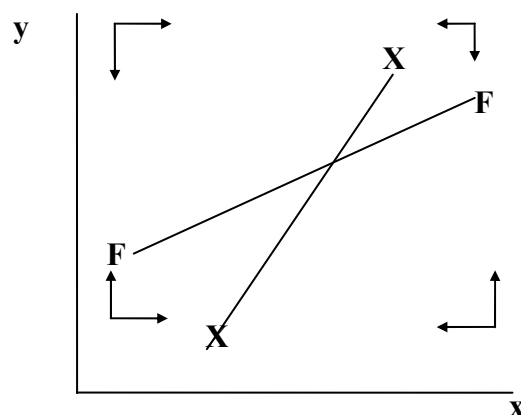
The IS-LM-BP model with imperfect capital mobility, therefore, flows directly out of Mundell's 1961 *Kyklos* paper. In this model, general equilibrium is based upon equilibrium in three markets: the foreign exchange and balance of payments (FF schedule), the goods and services market (XX schedule), and the money market (LL schedule), all in income-interest rate space. Below the LL schedule there is excess demand for money, above it, excess supply. The equilibrium point is at Q, as illustrated below:

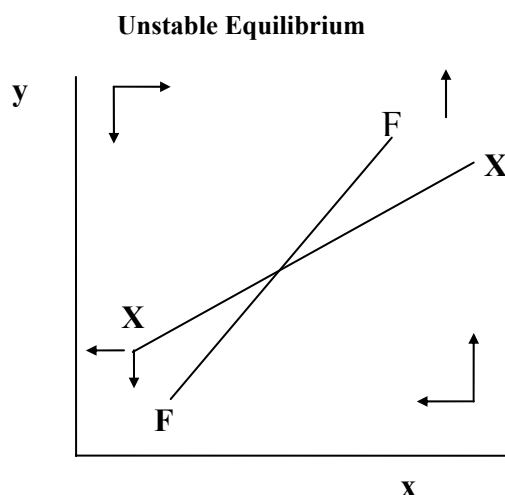


Mundell's 1961 *Canadian Journal* model

Mundell develops his 1961 *Canadian Journal* (1961b) model in exchange rate (y) and output space (x). The model consists of two markets, domestic goods and services, and foreign exchange and balance of payments, represented by the XX-FF schedules of 1960 QJE vintage. In (x - y) space, the slope of the XX schedule must be larger than that of FF in order to ensure systemic equilibrium, as illustrated in the diagrams below.

Stable Equilibrium





On the basis of his 1961 *Canadian Journal* model, Mundell developed the comparative statics regarding fiscal and monetary policy under alternate exchange rate regimes. According to this model, expansionary fiscal policy would shift the XX schedule down and to the right (1961b, 512). The intermediate increment is that which results from the simple multiplier. The final increment is that which results from the fiscal policy itself and from the increment to domestic product that results from the devaluation it brings about. According to Mundell, it follows from this that fiscal policy is more effective in increasing domestic product and employment under a flexible exchange regime than under a fixed rate regime (1961b, 512-513).

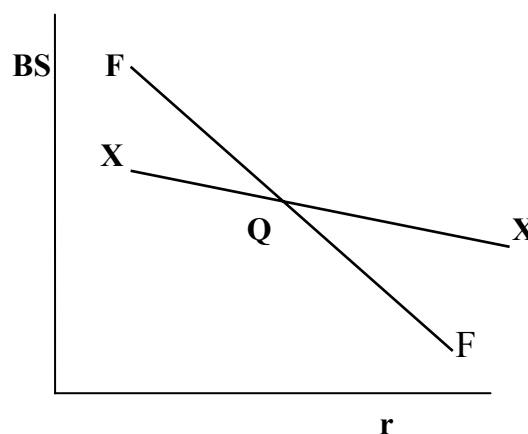
According to the model, expansionary monetary policy increases the money supply and decreases the interest rate and thus increases investment shifting the XX curve to the right. In addition, capital inflow will decrease and thus a deficit in the Balance of Payments will result, that is, the FF curve will shift up and to the left accordingly, reaching a new equilibrium (1961b, 513). From this, Mundell concluded that monetary policy under a flexible exchange rate regime is more effective than one under a fixed rate regime, under which the deficit in the Balance of Payments would bring about a loss of Foreign Exchange Reserves, and not a change in the exchange rate (1961b, 513-514).

Mundell also analyzed import restrictions and export incentives that did not have direct effects on saving or investment. Import restrictions or export incentives would shift the XX schedule downwards and to the right, and the FF schedule to the right and downwards, that is, both shift in the same direction (1961b, 514). In this case, what exactly would happen to the domestic product could not be ascertained, as the outcome of such policies would depend on the relative movement of each schedule in relation to the other. However, it is clear that FF would have to move rightwards more than XX, as the initial outcome of the simple multiplier on the level of domestic product would not be enough to eliminate the surplus in the Balance of Payments. For, there may still be a surplus in the Balance of Payments, which can be eliminated only by an increase in the domestic product, and thus the exchange rate must fall. In order to ascertain if the domestic product has declined or increased, it is necessary to ascertain whether XX has moved vertically more than FF (1961b, 514-515).

The conclusions that Mundell draws are as follows. Firstly, if capital mobility is imperfect, then Fiscal Policy is more effective under a flexible exchange rate regime than a fixed rate regime, but is not effective under a flexible rate regime when capital mobility is perfect. Secondly, monetary policy is more effective under a flexible rate than fixed rate regime. Thirdly, trade policies such as import restrictions or export incentives are less effective under flexible than fixed rate regimes, and may even bring about deflationary results and have a negative impact on domestic product (1961b, 515-516).

Mundell's 1962 *IMF Staff Papers* model

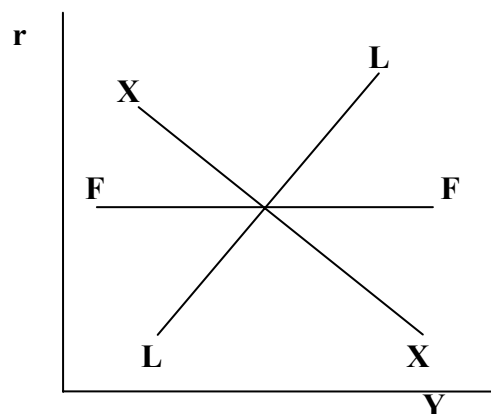
In this model, there are two markets--in budget surplus (BS) and interest rate (r) space, the goods and services market and the foreign exchange market. Once again, Mundell utilizes his FF and XX schedules, but this time both slope downwards from left to right as illustrated in the diagram below (1962,72)



In his 1962 approach, Mundell also developed the notion of “the proper policy mix” or “the assignment problem”. Mundell showed that every policy instrument should be assigned to a policy objective upon which it had the greatest impact. According to his approach, this meant that monetary policy should be directed towards external targets, while fiscal policy directed towards internal targets (1962,76-77). Interestingly enough, Meade had made the same points a decade earlier (Meade 1951a, 108-114).

Mundell's 1963 *Canadian Journal* model

The IS-LM-BP model with perfect capital mobility flows directly out of Mundell's 1963 *Canadian Journal* paper. In this model, general equilibrium is based upon equilibrium in three markets: the foreign exchange and balance of payments (FF schedule), the goods and services market (XX schedule), and the money market (LL schedule), with all schedules in income-interest rate space. In this paper, Mundell returns to the diagrammatic exposition of *both* his 1961 *Kyklos* paper (1961a), and his 1961 *Canadian Journal* paper (1961b), by presenting a *combination* of diagrams: one in income-interest rate space, and a *mapping* of the results of the comparative statics of monetary and fiscal policy under fixed and flexible exchange, that is, he also gives the results by plotting the *internal* (XX) and *external* (FF) *balance lines* in exchange rate and income space. However, despite its importance, the *combined* diagram is not the one that “caught on”; rather, the one illustrated below came to “rule the roost”, due to the influence of one of its main expositors, that is Dornbusch, as we will show.



Mundell's 1964 *Canadian Journal* model

As Mundell noted (1999,7; 2001, 223; 2002,10), it was a critical comment on his 1963 *Canadian Journal* model that “provoked” him “into extending the model to the two-country global context”. This model is perhaps the most sophisticated of his early models, and indeed, due to “complicating features”, Mundell presented the model “in the form of an explicit mathematical system” only (1964,424), and did not use diagrammatic exposition, which limited its utilization; and this, in contrast to his previous models that, for the most part, used *both* equations and diagrams. The main results of his analysis, however, were subsequently *co-opted* into the Mundell-Dornbusch-Krugman two-country model *with* diagrammatic exposition (Dornbusch and Krugman, 1976, 543-548; Dornbusch, 1980, 199-202).

Fleming's 1962 *IMF Staff Papers* Model versus Mundell's 1961 *Kyklos* Model

Fleming assumes “a simple Keynesian model” with fixed prices (1962, 369). He presents “a mathematical formulation” of the model in his appendix (1962, 377). These equations include one relating income velocity to the ratio of national income to the stock of money. The rate of interest in Fleming's model is a function of the velocity of money, but there is no demand for money function. In other words, in Fleming's model money demand is set equal to supply and he uses a modified quantity theory equation to determine the interest-rate (1962, 377). This is in direct contradiction to Mundell's 1961 *Kyklos* model (1961a).

More importantly however, Fleming has no balance of payments function per-se. Rather, he deals with the balance of trade and net capital imports in *separate equations, with the result that the adjustment in the balance of payments cannot be determined*. This can be seen in the example of the impact of a change in “budgetary

policy” given by Fleming, with divergent outcomes regarding the trade balance and net capital imports, and *indeterminacy* regarding the balance of payments as a whole (1962, 370-371).

In addition, under *fixed rates*, as Mundell has asserted, the money supply must be endogenous, so as to enable adjustment, and not constant, as Fleming would have it (1962, 370). Under Fleming's assumption, there would be no adjustment of LM, that is to say "accommodating monetary policy", in the case of the "budgetary expansion" he is talking about. The money stock cannot be " held constant" if adjustment is to take place. Thus, under fixed rates, according to Fleming's model, not only would "budgetary expansion" be ineffective, it would have *no* effect on the outcome at all. In other words, Fleming's 1962 model generates an outcome *contrary* to the conventional "Mundell-Fleming" result.

Briefly put, an attempt to *analytically* link Mundell's 1961 *Kyklos* paper-- with its IS-LM-BP prototype model and sophisticated general equilibrium equational-diagrammatic system and market adjustment processes-- with Fleming's 1962 "simple Keynesian model", is problematic, to say the least.

Fleming's 1962 *Staff Papers* Model vs. Mundell's 1961 and 1963 *CJEPS* Models

To reiterate, in his 1962 paper, Fleming deals with a small country under both a fixed and flexible exchange rate regime, and tried to assess the relative efficacy of fiscal as against monetary policy. In his analysis of an increase in government expenditure under a fixed rate regime, he held the stock of money constant and then assessed under what conditions the balance of payments would improve. But, as Kuska noted in his *AER* critique of "Keynesian Balance of Payments Theory" (1978,665-666), Fleming seemed to be "unaware that his money market assumption

requires the balance of payments to be zero”. Moreover, as Kuska went on to say, in Fleming’s “consideration of the effects of an increase in the supply of money under fixed exchange rates, he continues to require equilibrium in the money market, and then deduces that the equilibrium balance of payments decreases, which is another contradiction”. Mundell later called the *indeterminacy* described above, and the results Kuska criticized, Fleming’s “fatal error” (1999,7).

There is a problem, however, in that in his 1961 *CJE* paper, Mundell also obtained an *indeterminate* result, while in his 1963 *CJE* paper he made a similar assumption to that of Fleming regarding fiscal policy. For example, in the former paper (1961b, 512-513), the magnitude of the increase in output resulting from expansionary fiscal policy under fixed rates is a function of the magnitude of devaluation due to the resultant balance of payments deficit, that is, if devaluation is adopted as a policy option under the “constant exchange rate” Mundell initially assumed. Moreover, in his figure illustrating “the effect of fiscal policy on employment” (1961b,p.513, figure 3), Mundell is essentially comparing a point of flexible rate equilibrium with a situation of fixed rates, where the balance of payments is *not* in equilibrium (Boyer, 2003); and this, without advising the reader that he has “conflated” his diagrammatic analysis, to use Hicks’s methodological terminology (Young, 1987).

In his 1963 paper, Mundell made an identical assumption to that of Fleming, when he wrote (1963,481 note 5) “I have defined fiscal policy as an increase in government spending financed by government bond issues with *no* change in the money supply [emphasis in original]”. What saves Mundell’s 1963 model, however, is his more significant assumption of *perfect capital mobility*, and the *change* in his definitions of *both* fiscal and monetary policy, so as to get around the “apparent

conflict” with the results in his previous papers (1963,481-482, note 5). But, once again, to link Mundell’s 1961 and 1963 results with those of Fleming’s 1962 is *simply not acceptable*. For as Mundell himself has recently written to one of the authors (Mundell, 2003b) “It seems to me mildly astonishing that no one has noticed the mistake in the Fleming model in the forty years since it appeared. His mistake lies in not connecting the balance of payments with the money supply, and in defining monetary policy as a change in the money supply when the exchange rate is fixed. What Fleming didn’t understand was the relation between domestic and foreign assets, the money supply and the balance of payments”.

Mundell’s *Models* versus Fleming’s *Model*, 1960-1964

Up to now, it has been customary to refer to the open economy equilibrium macromodel as the “Mundell-Fleming model”. We have dealt with Mundell’s own view of Fleming’s work above. It should be stressed that Mundell’s interests were different than those of Fleming. Mundell put much emphasis on the theory of the equilibrium open market model and the “policy-mix”, while Fleming emphasized what he took to be the concerns of the Central Bank. Their respective methods of economic analysis and presentation differed greatly. Mundell preferred an integration of static and dynamic analysis, based upon Samuelsonian *Foundations* methodology, and, for the most part, both equational and diagrammatic representations of his models. Fleming preferred the comparative statics of “a simple Keynesian model” with fixed prices (1962,369), and without any dynamic analysis or diagrammatic exposition.

Moreover, in his 1960 *QJE* paper, both Mundell's static and dynamic model are based upon *flexible* prices (1960, 232-233). His 1961 *Kyklos* static and dynamic model are based upon *money* income, and his stated purpose "is to show the *existence* of an adjustment process under both classical and Keynesian assumptions [Mundell's emphasis]" (1961a, 158). It is only in his 1963 *Canadian Journal* paper that he makes the explicit assumption of fixed prices (1963, 476), enabling his model to be linked by later observers, such as Dornbusch, as will be seen below, to that of Fleming. Mundell's 1964 extension of his analysis to the two-country case also distinguishes his approach from that of Fleming. In addition, there were a number of important points on which Mundell and Fleming disagreed. In a 1963 *IMF Staff papers* article (Fleming, 1963), Fleming actually took issue with one of the cornerstones of the "Mundell-Fleming model", that is the principle of the "policy-mix", which was also a basic element in Mundell's 1962 vintage model. Mundell had asserted that Monetary Policy should be directed towards attaining external balance and Fiscal Policy internal balance respectively. But Fleming maintained that in most nations the State Budget was too "rigid" and thus it was impossible to rely on it as the "sole means" for attaining internal stability. Fleming suggested an alternative based upon the following logic. If all nations set their interest rate with respect to their Balance of Payments position, without reference to saving and investment considerations, a situation would arise where the interest rates would be too high and the countries would be forced to adopt expansionary deficit fiscal policies to maintain full employment. Fleming proposed a solution to the problem which differed from that of the "Mundell-Fleming model" when he suggested "cooperative" action on the part of the countries involved to regulate the interest rate structure.

Moreover, Fleming had always been in favor of flexible exchange rates (Polak in Fleming, 1978, xxiii); and this, in contrast to Mundell. Fleming's justification for his support for flexible exchange rates was twofold (Fleming, 1978, 138-39). Firstly, fixed exchange rates caused speculative capital movements in periods of disequilibrium in the foreign exchange markets without bringing about actual adjustments in the exchange rates in order to attain stable equilibrium. Secondly, countries with Balance of Payments deficits chose the option of import restrictions and not devaluation in order to regain equilibrium.

To sum up, Fleming's 1962 model was based upon "a simple Keynesian representation" of the open economy, without any dynamics or diagrams. Mundell's critique of his "fatal error" has been presented above, based upon the fact that, in Mundell's view, Fleming examined "a system that has no mechanism of adjustment" (1999,8). But this was only to be expected, as Fleming's 1962 model did not "flow most naturally", out of the Mundell "headwaters" of 1960 *QJE* or 1961 *Kyklos* vintages. Rather, it only marginally added to Mundell's 1960-64 models, and problematically at that, as Mundell himself has asserted.

The "Mundell-Fleming" Synthesis: Dornbusch "did a Hansen"

As Mundell attributes the coining of the term "Mundell-Fleming model" to Dornbusch (Mundell 2002, 6, 11), we must turn to Dornbusch's contributions to ascertain what he actually meant when he referred to the "Mundell-Fleming model" in his writings, and how his exposition of what he called "the Mundell-Fleming approach" developed. In addition, some possible influences on Dornbusch's linking of Mundell and Fleming, such as the approaches of Krueger (1965), Michaley (1968), and Niehans (1975) must be taken into account.

Dornbusch *without* “Mundell-Fleming”: 1971-1975

The members of Dornbusch’s 1971 University of Chicago Ph.D. thesis committee were Harry Johnson, Stanley Fischer and Robert Mundell. The title of his dissertation was " Aspects of a monetary theory of currency depreciation", and it was the basis for his two major 1973 papers in the *JPE* and *AER* respectively (1973a, 893; 1973b, 871), both of which made no mention of Fleming's work, although the former did refer to Mundell’s 1968 volume *International Economics*, which contained his early papers (1973a, 915). Dornbusch’s early interest in Mundell’s approach can readily be seen in his short 1971 *CJE* “Notes on growth and the balance of payments”—which he based upon Chapter 9 of Mundell’s 1968 volume (1971, 389), but no mention of Fleming’s 1962 paper appears there either. In addition, in his 1974 paper " Real and Monetary Aspects of the Effects of Exchange Rate Changes", there is no mention of Fleming's 1962 paper, although Mundell’s 1971 volume *Monetary Policy* is cited. Neither Dornbusch’s Sept. 1975 *Manchester School* paper “Exchange Rates and Stabilization Rules”, nor his Dec. 1975 *AER* paper “Exchange Rates and Fiscal Policy in a Popular Model of International Trade” mentions Fleming’s work. Briefly put, then, up to the end of 1975 at least, Fleming’s model had no influence upon Dornbusch’s ideas.

From Krueger to Niehans, 1965-75

Krueger’s 1965 Model and Michaely’s 1968 “IS-LL-BP” adaptation

In her May 1965 *QJE* paper " The Impact of Alternative Government Policies under varying Exchange Rates", Krueger set out a "general" model to deal with the “special cases" and " apparently conflicting results" of Mundell (1961 b, 1963), Fleming (1962), and Rhomberg (1964). As she put it, her object was to specify a model that "provides a satisfactory framework for analysis of all the cases" considered

by Mundell, Fleming and Rhomberg (1965, 195-196, 198). Krueger was, therefore, the *first* to provide a *generalized* equational system *linking* Mundell's "analysis" with that of Fleming and Rhomberg.

Krueger initially dealt with the special case of "fiscal policy" under fixed rates as analyzed by Fleming and Rhomberg. As she wrote (1965, 203) "the Rhomberg-Fleming result hinges on the assumption that government expenditures are not accompanied by any issuance of money. This in turn results in an increase in the interest rate. If capital flows are sufficiently responsive to interest-rate changes, and if the government did not issue any money as the level of income rose, this particular form of "fiscal policy" could generate a balance-of-payments improvement, but it is attributable to the rising interest rate, and not to government expenditures per se."

She went on to say (1965, 203) "by contrast, Mundell's analysis of fiscal policy assumes no change in the interest rate ... in the limiting case pointed out by Mundell, if capital flows were perfectly elastic with respect to the interest-rate, it would be impossible for the monetary authority to raise the interest rate, since foreign purchasers would be willing to purchase all bonds offered at the prevailing price".

Krueger then proceeded to the case of flexible exchange rates, and focused on "the special case considered by Fleming and Rhomberg" under a flexible rate regime, which concerned "the utilization of fiscal policy with no money creation" (1965, 205). She wrote (1965, 205) "indeed, any interest rate-expenditure policy that would lead to an improved payments position and rising incomes under fixed rates would lead to a currency appreciation under flexible rates ... The "ineffectiveness" of fiscal policy results from a rising interest rate, rather than from government expenditures themselves".

Now, this is not the place for detailed consideration of Krueger's significant contribution and the conclusions that she draws from her "general" model. Suffice it to say, however, that her *QJE* paper has, until now, been overlooked by most observers--including Dornbusch--who did not cite it in his papers, or in his 1980 text *Open Economy Macroeconomics*. Moreover, the paper is not even cited by Isard (1995) in his ostensibly comprehensive review of the literature.

In his comment on Krueger, Michaely (1968, 508-510) was perhaps the first to make the transition from the original diagrammatic framework of earlier analyses--such as those that appeared in Mundell's works between 1961-1963--to one based on what he called "the Hicksian IS-LL construct"; and this in order to analyze both Krueger's "general" model and "the analysis advanced by Fleming and Rhomberg". As he wrote (1968, 508), the Hicksian construct "may easily be adapted to deal with an open economy". His IS-LL-BP diagram (1968, 509) illustrates the case of imperfect capital mobility (an upward sloping BP cutting LL from below at the equilibrium rate of interest). Michaely utilized his IS-LL-BP framework "to provide a convenient and graphic demonstration of the analyses advanced by Fleming and Rhomberg" regarding "expansionary budgetary policy" under fixed rates (1965, 510). It is not surprising that Michaely associated the "Hicksian IS-LL construct" with Fleming's result, as Fleming's 1962 model was based only upon *comparative statics*, as we have already shown above. When Krueger's 1965 *QJE* generalized model of the Mundell and Rhomberg-Fleming results are combined with Michaely's IS-LL-BP diagram, however, we obtain *exactly the same* Mundell-Fleming analytical framework put forward by Dornbusch a decade later.

Takayama, Wrightsman, and Branson: general equilibrium, four-quadrant analysis and textbook IS-LM-BP, 1969-1972

In his 1969 *CJE* paper “The Effects of Fiscal and Monetary Policies under Flexible and Fixed Exchange Rates”, Takayama first surveyed the “state of play” of the models extant that dealt with the question of the relative efficacy of alternative policies under alternative exchange rate regimes. He placed special emphasis on what he called the “Mundellian assumption” of perfect capital mobility and its related “model” and “conclusion”, as against that of Johnson (what he called the “Johnson effect”, and Johnson’s assumption of imperfect mobility), utilizing, at the beginning of his paper, a standard IS-LM diagram *without* BP for the purpose of his analyses (1969,192-193, Figures 1 and 2). Indeed, when referring to Mundell’s 1963 diagrammatic analysis, he wrote (1969,190 note 1) “I believe that we do not need diagrams as complicated as the ones he used, rather straightforward use of the IS and LM diagram appears to be sufficient”. Takayama goes on to say that the purpose of his " paper is to construct a general equilibrium model which will include both of the” approaches of Mundell and Johnson "as special cases and point out their special assumptions", going on to say " we shall focus on Mundell and Johnson, but shall always be aware of other works on the topic" (1969, 194). And, interestingly enough, in his 1969 paper, Takayama only mentions Fleming's 1962 paper in a footnote (1969, 191 note 1). But this is not surprising, in light of the fact that in the influential AEA *Readings in International Economics* volume edited by Caves and Johnson, and published a year before, Fleming's 1962 paper *was not mentioned at all*.

Wrightsmann's 1970 AEA article "IS, LM, and External Equilibrium: a Graphical Analysis" has been overlooked until now. He provided the following rationale for his approach (1970, 203): "The IS-LM exposition of general equilibrium in the domestic money and goods markets excludes the problem of balance of payments equilibrium when the economy engages in foreign trade under the conditions of fixed foreign exchange rates. This expositional shortcoming is easily rectified by superimposing an external equilibrium condition onto the IS-LM framework". He proposed "a new external equilibrium curve, called the EE curve" which he "derived geometrically" in a "four-section diagram" where the "EE curve shows" interest rate-income "combinations which generate external equilibrium" (1970, 203-204 Figure 1). Wrightsmann then combined his construct with IS-LM and added a full employment line (F) to his analysis (1970, 206 Figure 2). He then went on to illustrate various combinations of fiscal and monetary policy that enabled the economy to converge "at full employment with external equilibrium" (1970, 207). Wrightsmann's 1970 "IS-LM-EE" framework, however, did not "catch on" with either the profession or pedagogically. Rather, it was Branson's 1972 textbook version of IS-LM-BP that came to "rule the roost".

As Wrightsmann before him, Branson constructed the "BP line" in four-quadrant space (1972, 305 Figure 15-2). He said that "to determine whether any given internal equilibrium ... point determined by the intersection of the IS and LM curves will yield a balance-of-payments surplus or deficit, we can simply superimpose the BP line on the ISLM diagram..." (1972, 305-306). Branson then went on to analyze the price effect on balance of payments equilibrium, again using a four-quadrant diagram ((1972,307 Figure 15-4). What is important to recall here is that, again, as Wrightsmann, Branson's 1972 IS-LM-BP diagrammatic analysis *is for fixed exchange*

rates only. While he analyzed the case of exchange-rate flexibility in equational terms, he did not deal with the case of perfect capital mobility *at all*. It is not surprising, therefore, that while he cited Mundell's 1960 *QJE* paper and 1962 *IMF Staff Papers* article, he does not mention Fleming's 1962 model nor Mundell's 1963 *CJE* paper in his textbook.

Niehans's 1975 Critique and the Niehans-Dornbusch Nexus

In his note in the 1975 issue of the *Journal of International Economics*, Niehans challenged the results of Mundell, Krueger (1965) and Sohmen (1967) regarding the "efficacy of monetary policy in stabilizing domestic output" under flexible rates (1975, 275). Interestingly enough, in his note, Niehans did not mention Fleming's 1962 model. Rather, he utilized "a Keynesian model for an open economy similar to that used by Sohmen" (1975, 277), and went on to analyze the implications of the dynamic assumptions of his proposed model. His primary result was "the paradox of a possible contractive effect of monetary expansion" in the case of flexible rates (1975, 279). As he put it, under *certain* conditions this model predicted that "monetary policy loses all of its effect on output under flexible rates, and there is even an extreme range in which its effect is perverse" (1975, 280). Niehans concluded that "the principal benefit of flexibility should not be looked for in the short-run effects of monetary policy and stabilizing output and employment, but rather in its long-term effects on price trends" (1975, 281).

The fact of the matter is that the differential efficacy of monetary as against fiscal policy under flexible rates had appeared as early as Sohmen's MIT Ph.D thesis (1958, 74-82) and his 1961 book (1961, 83-90, 123-24). Sohmen's approach to the relative efficacy of fiscal and monetary policies under alternate exchange rate regimes, that is, his assertion regarding, as he put it, the "automatic mechanism" and

“forceful booster to domestic national income” emanating from expansionary monetary policy under flexible rates (1958, 75), and the “different leverage of monetary policy under fixed and flexible exchange rates”, was the result of his discovery of this “independently” of Mundell (1967,521,note 1). This was a clear case of *independent multiple discovery* rather than “cross-fertilization”(Patinkin, 1983; Young, 1987), as there was *minimal* contact between Sohmen and Mundell during the early stages of their respective careers, according to Mundell, who also could not recall noticing Sohmen’s early result (1999,8-9; 2002,13-14).

A year later, in his paper " The Theory of flexible exchange rate regimes and Macroeconomic Policy", Dornbusch took up the question raised by Niehans regarding " the effectiveness of monetary policy under flexible rates" (Dornbusch, 1976a, 255). In this paper, Dornbusch presented a model *in exchange rate-price space*, but *did not link* the works of Mundell he cited (Mundell 1964, 1968) to Fleming’s paper (1962). In other words, Dornbusch’s proposed " Mundell-Fleming model" does not appear in *this* paper at all.

Dornbusch’s next paper, published in the *Journal of the International Economics*, and entitled " Exchange-rate expectations and monetary policy" (1976 b), was a direct outcome of Niehans (1975). As Dornbusch wrote (1976 b, 231) " the purpose of this paper is to reassess the effects of monetary policy under flexible exchange rates and to give attention to the details of the short-run adjustment process. The paper is stimulated by a recent study of Niehans (1975) ... the Niehans conclusions are of importance because they run counter to the established Mundell-Fleming view that monetary policy is most effective under flexible rates with capital mobility, and that a monetary expansion under these conditions will lead to an expansion in output and employment, and that it will cause a trade surplus and capital

outflow". This is the *first* time that Dornbusch puts Mundell's analysis and Fleming's 1962 model together, *albeit in exchange rate-income space*, " following", as he put it " Mundell (1968)" (1976 b, 233). He then proceeds to " consider ... the modification to the Mundell-Fleming model that arises from exchange rate expectations, or the endogeneity, in the short run of the domestic interest rate" (1976 b, 235). In *this* paper, the *first* in which Dornbusch uses the term " Mundell-Fleming", he not only presents his version of what he calls the " Mundell-Fleming model", but presents his notion of "Mundell-Fleming equilibrium" as convergence, over time, to the point "where actual and expected exchange rates are equal" (1976 b, 232, 236). In this context, Dornbusch also talks about "the Mundell-Fleming treatment of the goods market", the "Mundell-Fleming prediction", the " Mundell-Fleming long-run position", and the " long-run Mundell-Fleming equilibrium" (1976 b, 239,241-243). As in his *Scandinavian Journal of Economics* paper (1976 a), Dornbusch cites Niehans. But strangely, neither Kruger's model (1965), nor Sohmen's model (1967)--which formed the basis for Niehans's analysis, according to his own account (1975, 277), *both* of which Niehans cites--*are cited by Dornbusch in either paper*.

Dornbusch on Mundell and Fleming and "Mundell-Fleming": 1976-1980

In two subsequent papers published in 1976, Dornbusch further refined his proposed "Mundell-Fleming model" emphasizing its connection with flexible rates and the efficacy of monetary policy. For example, in his *JPE* paper (1976c), entitled "Expectations and Exchange Rate Dynamics" Dornbusch not only talked about the "Mundell-Fleming model" and " Mundell-Fleming results", but also coined the term "Mundell-Fleming world" (1976 c, 1170 note 13, 1173). In Dornbusch's next article, with Krugman, entitled "Flexible Exchange Rates in the Short Run", published in *Brookings Papers* (1976d), they define the Mundell-Fleming model as a *flexible rate*

model. As they put it (1976d, 548) "the Mundell-Fleming approach to macroeconomics under flexible rates emphasizes interdependence and capital mobility". This definition antedates an identical one in Dornbusch's later textbook, *Open Economy Macroeconomics* (1980). In their paper Dornbusch and Krugman formally develop a two-country "Mundell-Fleming model". Interestingly enough, their model is very similar to that proposed by Metzler (1942), albeit with flexible rates, but they only refer to the 1950 Laursen-Metzler paper (1976d, 542-543).

In his survey article "Exchange Rate Economics: where do we stand", published in *Brookings Papers*, Dornbusch described what he called "the traditional Mundell-Fleming model", which, as he put it "remains, with some adaptations, the backbone of macroeconomic models of the exchange rate"(1980a, 152). In this context, he referred to his "forthcoming" textbook, *Open Economy Macroeconomics*, "for an exposition" (1980a, 152). He then went on to outline the characteristics of what he called "an extended Mundell-Fleming model" that included "rational expectations...and full employment"(1980a, 152-152).

In Chapter 10 of *Open Economy Macroeconomics* (1980b), Dornbusch presented an open economy version of IS-LM with fixed exchange rates and perfect capital mobility, *but did not call this the "Mundell-Fleming model"*, choosing instead to refer to Fleming's 1962 paper and Mundell's book *International Economics* (1968) as being the "seminal work" upon which the "literature ... developed during the '60s" (1980b, 176). He then went on to "examine", at the beginning of the next chapter--entitled "Flexible Exchange Rates and Capital Mobility"--what called "the *Mundell-Fleming model* [italics in original]-the flexible rate version of the standard IS-LM model with output demand determined and prices taken as given" (1980b, 193). He then presented the differential effects of monetary as

against fiscal expansion in *this* model, where the latter “leads to full crowding out through a deterioration in the trade balance” and then said “these conclusions oppose those reached for the fixed exchange rate model in Chapter 10” (1980b, 193). Dornbusch then went on to “develop the basic macroeconomic model of flexible exchange rates under conditions of perfect capital mobility. The model is a direct extension of the IS-LM model”. And it is *this* model, and *this model alone*, that Dornbusch called “the Mundell-Fleming model” (1980 b, 194).

To sum up, the following may be said. The generalized IS-LM-BP framework, which encompasses the flexible rate “Mundell-Fleming model” with perfect capital mobility, exhibits similar “*plasticity*” to its closed economy counterpart. This has enabled it to also undergo a similar metamorphosis into *augmented* forms (Darity and Young, 1995; Young and Zilberfarb, 2000). The *generality* of the IS-LM-BP framework enabled it not only to encompass the opposite conclusions, as Dornbusch put it, of the fixed and flexible rate models with imperfect and perfect capital mobility, but enabled the development of two-country models (e.g. Mundell, 1964; Dornbusch, 1980b, 199-202), and “extended Mundell-Fleming” models that include rational expectations, long-run neo-classical features and exchange rate dynamics of *Mundell-Dornbusch* vintage (Dornbusch 1980a, 152-157; 1980b, 202-213) But the development of *these* models is *another* story.

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