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**Reading material 3:
Effectiveness of Monetary Policy**

The Effectiveness of Monetary Policy Reconsidered¹

Abstract

This paper inspects the standard policy rule that under a flexible exchange rate regime with perfectly elastic capital flows monetary policy is effective and fiscal policy is not. The logical validity of the statement requires that one ignore the domestic price level effect of devaluation. The price level effect is noted in some textbooks, but not analyzed. When it is subjected to a rigorous analysis, the interaction between exchange rate changes and domestic price level changes render the standard statement false.

The logically correct statement would be, under a flexible exchange rate regime with perfectly elastic capital flows the effectiveness of monetary policy depends on the values of the import share and the sum of the trade elasticities. If the effectiveness of monetary policy on real output in a closed economy is defined as unity, in an open economy with perfect capital flows effectiveness can never exceed one minus the import share. Statistics on developing countries indicates that this basic relationship implies a low effectiveness of monetary policy under flexible exchange rates for most countries.

In the more general case of less than perfectly elastic capital flows the conditions for monetary policy to be more effective than fiscal policy are very restrictive. Empirical evidence on trade shares and interest rate differentials suggest that for most countries fiscal policy would prove more effective than monetary policy under a flexible exchange rate regime. Thus, the general theoretical assertion that monetary policy is more effective than fiscal policy under fixed exchange rates is incorrect. The algebra in this paper sustains the general Keynesian view that fiscal policy is more effective, whether the exchange rate is fixed or flexible.

I. Background

The keystone of open economy macroeconomics is the Mundell-Fleming model (MF model), now approaching its fiftieth birthday.² The model provided a simple and apparently consistent method of integrating the exchange rate into a multi-market equilibrium analysis, which could be presented as an extension of the IS-LM model developed a generation earlier by Hicks and others as part of the so-called neoclassical synthesis of Keynesian and pre-Keynesian macroeconomics.³ The Mundell and Fleming contribution seemed to transform the neoclassical synthesis of the Keynesian framework from a closed to an open economy model that generated powerful policy rules that can be found in textbooks a half century later.⁴

While synthesis Keynesian in structure with its use of IS and LM schedules, the Mundell-Fleming model carried a non-Keynesian lesson for a flexible exchange rate regime, that monetary policy is effective and fiscal policy is not.⁵ The reasoning goes as follows: with perfectly elastic capital flows, beginning from balanced trade and a position of less than full employment, an increase in the money supply increases output which generates a trade deficit; the trade deficit is instantaneously eliminated by depreciation of the exchange rate, which via exports and imports generates the effective demand to bring an equilibrium in product and money markets. In contrast, an increase in government expenditure instantaneously places upward pressure on the domestic interest rate, which results in an appreciation of the currency to cancel the fiscal expansion.⁶ While these two conclusions are based on the extreme assumption of perfect capital flows, it is typical to present them as the general lesson: fiscal policy is effective with a fixed exchange rate and ineffective with a flexible rate, and the opposite holds for monetary policy.⁷

With the collapse of the IMF-monitored system of fixed exchange rates in the early 1970s, the conclusion that monetary policy is effective and fiscal policy impotent passed from theoretical curiosity to practical importance. It seemed to counsel that active fiscal policy, like fixed exchange rates, was an anachronism.⁸ However, the Mundell-Fleming analysis of a flexible exchange rate regime would appear to ignore an obvious, simple and fundamental economic relationship, the impact of nominal exchange rate changes on the domestic price level.⁹ A logically complete story of a monetary expansion would be: an increase in the money supply results in a trade deficit; with perfect capital flow this deficit is instantaneously eliminated by depreciation of the currency; the depreciation of the currency raises the price level via its impact on imported goods;¹⁰ and this price increase lowers the real money supply; therefore, the outward shift of the LM curve is less than what would be implied by the increase in the nominal money supply. It follows that monetary policy would not be completely effective because the real money supply increases less than the nominal money supply.

Some might argue that Mundell-Fleming is a “fixed price” model,¹¹ and to raise the exchange rate effect on domestic prices is not obeying the rules of the model. This argument is not correct. The comparative statics of the MF model require a change in a price, the exchange rate; so by its own formulation it cannot be fixed price in character. Further, the model has no mechanism by which the price effect of a change in the exchange rate would be exactly compensated by a change in non-import prices in the opposite direction. Further still, the trade adjustment required for equilibrium requires a change in relative prices to make tradables more profitable. The initial level of income would be the only possible equilibrium if the model were fixed-price because no relative price change would occur.

As a second defense an empirical argument could be made that domestic prices in practice adjust slowly, so that the price level effect of changes in the exchange rate can be ignored in the short run. Accepting this argument would be a refutation of the conclusions of the model, because in the absence of immediate relative price changes the necessary adjustment in exports and imports would not occur.

Third, it might be asserted that Mundell-Fleming refers to a chronological “long run”, not to short run adjustment. Like the first two, this argument cannot eliminate the need to consider price effects; it makes that need all the greater. The first implication of the “long run” argument is that the model has little policy importance, because an unsustainable balance of payments must be resolved in the short run. The second implication is that in the “long run” all variables must adjust, and the price level is one of these.

Finally, anyone familiar with the Mundell-Fleming model knows that its flexible exchange rate, perfect capital flows ‘thought experiment’ when the money supply changes calls for an instantaneous adjustment of the exchange rate if trade is not balanced. There is no logical sequence by which a change in import prices leaves the general price level constant.

We proceed to consider the price effects of exchange rate adjustment, because these cannot be ignored if the MF model would have internal consistency. In what follows, the price level effects are first considered graphically (Section 2), then algebraically (Section 3), after which statistics are used to assess the likely magnitude of these effects in developing countries. The final section draws policy conclusions which prove substantially different from standard presentations. The discussion is carried out according the analytical rules of the model, and its static character is accepted without criticism for sake of presentation.

II. MF and Flexible Exchange Rates: Diagrammatic Analysis

We begin with a definition of the “effectiveness” of monetary policy, $\epsilon_{y,m}$, as the elasticity of output with respect to the money supply. This is ratio of the proportional change in real output to the proportional change in the nominal money supply. This, “the index of effectiveness of monetary policy”, or “effectiveness index”, has a maximum value of unity if the economy is not resource constrained and prices were constant; i.e., in a fixed-price closed economy. The excess supply of money created by the increase in the nominal money supply is entirely eliminated by an increase in real output.

In an open economy with perfectly elastic capital flows and a flexible exchange rate, an increase in the nominal money supply (+ ΔM) shifts the LM curve to the right, which causes devaluation of the currency. If markets are competitive, devaluation must lead to a rise in prices of imported goods, which reduces the real money supply, where $[-\Delta m] = -[\Delta M/\Delta P]$. This lowers the potential increase in output sought by the initial increment in the nominal money supply, and the effectiveness of monetary policy is less than unity. If capital flows are not perfectly elastic with respect to the difference between external and internal interest rates, the effectiveness index is further reduced.

Figure 1 shows the case of perfectly elastic capital flows. From an initial equilibrium at e_1 given by the IS and LM schedules (IS1 and LM1), if the nominal money supply increases by x percent and prices were constant, then output increases by the same percentage, shown as equilibrium point e^* (IS* and LM*), further out the balance of payments' schedule (BP). This is the standard analysis found in textbooks. However, in general the domestic price level will rise as a result of the devaluation, which lowers the real money supply, which will reduce the rightward shift of both the LM and IS schedules. The new equilibrium will be a point such as e_2 (for IS2 and LM2).

Figure 2 shows the case of less than perfectly elastic flows. Point e^* is as before, an equilibrium with a horizontal BP schedule. Since the BP curve now has a positive slope, the constant price equilibrium as a result of a given percentage increase in the nominal money supply must correspond to a higher domestic interest rate and lower level of output than e^* . Again, devaluation increases the domestic price level and lowers the real money supply, so the final equilibrium is at a point such as e_2 . The diagram shows that the impact on the effectiveness index has two parts, an interest rate effect and a real money supply effect.

In both diagrams, the effectiveness index can be expressed as follows:

$$\epsilon_{y,m} = [Y^* - Y_2]/Y_2$$

To summarize the effects in words, if capital flows are less than perfectly elastic, an increase in the nominal money supply: 1) via devaluation increases the price level, reducing the expansionary effect of the nominal money increase; and 2) via the shift in the IS curve the expansion raises the domestic interest rate; and both lower the effectiveness of monetary expansion in increasing output. The interactions among the three schedules as a result of devaluation are so complex that it is not possible to assess the quantitative importance of the price level effect of exchange rate changes from the diagrams. Rigorous investigation the impact requires a formal model. It is instructive to note that no standard macro textbook presents the Mundell-Fleming model in algebra, but confine themselves to diagrams.¹²

Prior to the algebra, several points can anticipate the analysis. First, the larger the share of imports in GDP, the larger will be the price impact of an exchange rate change, and the less effective will be monetary policy. Second, the more elastic are imports and exports with respect to the exchange rate, the smaller will be the devaluation required to equilibrate the balance of payments, increasing the effectiveness of monetary policy. Thus, the standard Mundell-Fleming presentation with no price effect implicitly assumes that imports are a negligible share of national income and imports and exports are infinitely elastic with respect to the exchange rate *in the short run*. Third, if capital flows are less than perfectly elastic, the more elastic private investment is with respect to the interest rate the less effective will be monetary policy. This mechanism operates via the IS schedule. When the interest rate rises, the outward shift of the IS schedule as a result of devaluation affecting trade flows will be countered by a fall in investment. Fourth, because no equilibrium is possible to the right of the BP schedule, *ceterius paribus*, the less interest rate elastic is that schedule, the less effective is monetary policy.

It should be intuitively obvious that the effectiveness of fiscal policy is the converse of the effectiveness of monetary policy. That is, under a flexible exchange rate, the price effect of devaluation makes fiscal policy effective by the same degree it renders monetary policy ineffective.

III. MF and Flexible Exchange Rates: The Algebra and its Implications

To investigate interaction of the exchange rate and monetary policy, we consider the “small country” case, in which the country’s demand for imports and supply of exports do not affect world prices.¹³ A change in the nominal exchange rate only affects internal prices, altering the profitability of traded goods relatively to domestic goods. The balance of payments schedule (BP) is defined by the following equation:

$$1) \quad 0 = (X - N) + F, \text{ and}$$

$$(N - X) = F$$

Because of the small country assumption, we can measure exports (X), imports (N) in constant price units,¹⁴ and measure capital flows in constant prices. The standard

behavioral assumptions are made for exports and imports. The former is determined by the real exchange rate, and the latter by the real exchange rate and the level of real output. The following explicit functions are assumed:

$$1.1) \quad 0 = (X' + a_1 E^*) - (a_2 E^* + a_3 Y) + a_4 (R_d - R_w)$$

1.2)

Real output is Y , and E^* is the real exchange rate (E/P) measured in units of the domestic currency to some composite world currency. The domestic interest rate is R_d and the “world” rate R_w . With R_w constant and X' a parameter, the total derivative is:

$$1.2) \quad 0 = (a_1 - a_2)dE^* - a_3dY + a_4dR_d$$

1.3)

If capital flows are perfectly elastic, $R_d = R_w$, and the final term is zero. The exchange rate is defined as units of the national currency to the “world currency”, so $a_1 > 0$ and $a_2 < 0$. The marginal propensity to import is assumed equal to the average ($a_3 = APN$). If the total differential of equation 1.1 is solved for the rate of growth of output, one obtains the following equation, where y , e^* and r are the rates of change of the upper case variables.¹⁵

$$1.3) \quad y = (a_5 \mathcal{E}_1 - \mathcal{E}_2)e^* - (1 - a_5)\mathcal{E}_4 r$$

Where $X = a_5 N$, $a_5 = X/N$, $F = (N - X) = (1 - a_5)N$; and $\mathcal{E}_3 = 1$. \mathcal{E}_4 is the elasticity of capital flows with respect to the domestic interest rate.

The \mathcal{E} 's are elasticities corresponding to the numbered parameters. Since $MPN = APN$, $\mathcal{E}_3 = 1$. If capital flows are perfectly elastic, $a_5 = 1$, $(1 - a_5) = 0$, and the equation reduces to $y = (\mathcal{E}_1 - \mathcal{E}_2)e^*$, with $\mathcal{E}_1 > 0$ and $\mathcal{E}_2 < 0$, and their sum is always positive. The small country assumption ensures that the Marshall-Lerner condition is met ($\mathcal{E}_1 - \mathcal{E}_2 > 0$), if the elasticities are not zero.¹⁶ When output is not capacity constrained, its growth rate is determined by the proportional change in the exchange rate and the sum of the trade elasticities. Define $(a_5 \mathcal{E}_1 - \mathcal{E}_2) = \mathcal{E}_T^*$, where $\mathcal{E}_T^* = \mathcal{E}_T$ if $a_5 = 1$ (capital flows are perfectly elastic). In the case of perfect elasticity the relationship between changes in the exchange rate and output becomes quite simple:

$$1.4) \quad y = \mathcal{E}_T^* e^* = \mathcal{E}_T e^* \text{ (perfect capital flows)}$$

By definition in a one commodity model, the rate of change of the real exchange rate is the rate of change of the nominal rate minus the rate of inflation. If the prices of domestic goods are constant and the market for imports competitive, then the rate of inflation (p) is the change in the nominal exchange rate times the import share.¹⁷

$$1.5) \quad y = \mathcal{E}_T^* e^* = \mathcal{E}_T (e - p) = \mathcal{E}_T (e - a_3 e) = \mathcal{E}_T (1 - a_3) e$$

To investigate monetary policy it is necessary to include money in equation 1.5. Let the demand and supply for money be:

$$\begin{aligned} 2) \quad M_d &= vPY + a_6R \\ M_s &= M^* \\ M_s &= vPY + a_6R \end{aligned}$$

Where P is the price level, M^* is the nominal money supply, v is the velocity of money, and a_6 is the derivative of money demand with respect to the domestic interest rate. From equation 2 it follows that if the velocity of money and the interest rate are constant, the inflation rate is

$$\begin{aligned} 2.3) \quad p &= m - y \\ a_3e &= m - y \\ e &= (m - y)/a_3 \end{aligned}$$

We can now substitute for e in equation 1.5:

$$2.4) \quad y = \epsilon_T[1 - a_3][(m - y)/a_3]$$

Again, we solve for y ,

$$2.5) \quad y = \epsilon_T[(1 - a_3)/(a_3 + \epsilon_T)]m$$

By dividing through by m one obtains the index of effectiveness of monetary policy:

$$3) \quad \epsilon_{y,m} = \epsilon_T[1 - a_3]/[a_3 + \epsilon_T]$$

From equation 3 it is immediately obvious that the effectiveness of monetary policy declines as the import share rises (a_3) and the trade elasticities decline (ϵ_T). The larger is the former, the greater will be the price impact of a given devaluation. The lower is the latter, the larger must be the devaluation in order to maintain the balance between imports and exports.

Equation 3 can be adapted to the case when capital flows are less than perfectly elastic. As Figure 2 showed, the slope of the BP curve affects the effectiveness of monetary policy, and that slope is given by the ratio of R_w to R_d . Therefore, the effectiveness of monetary policy in the general case is given by:

$$4) \quad \epsilon_{y,m} = \epsilon_T^*[(1 - a_3)/(a_3 + \epsilon_T^*)][R_w/R_d]$$

$0 \leq [R_w/R_d] \leq 1$ in general, and $R_w/R_d = 1$ for perfect elasticity.

The equation is algebraically and analytically composed of three components:

1) $(1 - a_3)$, the difference between the changes in the nominal and real exchange rates;

2) $\epsilon_T^*(1 - a_3)/(a_3 + \epsilon_T^*)$, the difference between the nominal and real change with respect to its impact on the money supply; and

3) R_w/R_d , the interest rate differential.

For a given import share, the first component is invariant, and reduces the effectiveness of monetary policy by the same degree independently of the value of the trade elasticities or the elasticity of capital flows. The second increases with the sum of the trade elasticities, approaching infinity as its limit. And the third approaches unity as its limit. In the following section this equation is applied to empirical evidence.

IV. Empirical Relevance

Despite an apparent policy consensus on floating exchange rates, the IMF in 2004 placed only thirty-six of 187 countries in the category of a “free” float, and nine of these were developed countries. Less than one in five developing country governments pursued a floating exchange rate regime without frequent interventions.¹⁸ This is not entirely surprising, since the institutional characteristics of developing countries suggest that the appropriate conclusion to draw from Mundell-Fleming analysis is that monetary policy would be *ineffective* under a flexible exchange rate. This is because of the probable values of the three key parameters determining monetary effectiveness: import shares in GDP, the trade elasticities, and the elasticity of capital flows with respect to interest rate differentials.

The marginal and average propensities to import in developing countries are quite high. Of 129 developing countries, excluding city states and small island republics, the median import share during the first half of the 2000s was over forty percent, and thirty-seven percent of countries had shares in excess of one-half.¹⁹ The relationship between import shares and the relative effectiveness of monetary policy is determined by the sum of the trade elasticities. Under a flexible exchange rate with perfect capital flows, monetary and fiscal policy will be equally effective ($\epsilon_{y,m} = .5$) when

$$\epsilon_T = .5a_3 / (.5 - a_3),$$

and fiscal policy the more effective instrument if

$$\epsilon_T < .5a_3 / (.5 - a_3).$$

This implies that monetary policy is always less effective than fiscal policy if the ratio of imports to GDP exceeds fifty percent. In the early 2000s this was the case for thirty-seven percent of developing countries, as noted above. In this, the special case of perfect capital flows, if the maximum realistic value of the sum of the trade elasticities were judged to be unity, then in no country with an import share greater than one-third of GDP would monetary policy be the more effective instrument. If the maximum realistic value were judged to be .5, monetary policy would be less effective for all countries with trade shares greater than one-quarter.

The value of the trade elasticities depends critically on the time period over which they are measured (Pikoulakis 1995, 9-13). Assuming perfect capital flows, the rapidity with which a trade deficit would need to be closed would depend primarily on the foreign exchange reserves held by a country’s central bank. According to World

Bank and IMF statistics average *gross* reserves in the early 2000s for the major developing regions varied from below three months of imports for sub-Saharan Africa to about six months for middle income Asian countries (World Bank 2006). These numbers imply that the Mundell-Fleming trade adjustment mechanism would need to be realized in less than a year.

The trade elasticities tend to be quite small over such a short time. For countries that are primarily exporters of agricultural products, the elasticity of export volume with respect to the exchange rate may not be significantly different from zero. This would be the case for most sub-Saharan countries and some low income Asian countries. Exporters of manufactures could have positive short run export elasticities, especially if producers hold inventories. On the import side, the exchange rate elasticity will be determined by the degree to which there are domestic substitutes. As for exports, this elasticity is likely to be small in the short run in low income countries, especially in the sub-Saharan region where production of intermediate and capital goods, and many consumer goods, is quite limited. It would seem realistic to assume that the sum of the trade elasticities would be positive but less than unity for most countries, and considerably less for the sub-Saharan region.

Table 1 calculates the effectiveness of monetary policy in the case of perfect capital flows for forty-six developing countries using the actual trade share and two hypothetical values for the sum of the trade elasticities, unity and .05, for two periods, 2000-2003 and 2004-2006.²⁰ The table represents a counterfactual exercise, since it requires that each country have balanced trade. Because of a cross country increase in the import share in the later period, the effectiveness of monetary policy declines. Using the lower sum for the trade elasticities (0.5), for 2000-2003 for sixteen of forty-six countries monetary policy was more effective than fiscal policy, and for nine of forty-six in 2004-2006. For a trade elasticities sum of unity, the numbers rise to twenty and twenty-three. That is, for an optimistic value of the trade elasticities, in the more recent period for only half the countries was monetary policy more effective than fiscal policy in the favorable case of perfect capital flows. Figure 3 compares the outcome for 2004-2006 using the two values of the trade elasticities.

Having established the high probability that monetary would be less effective than fiscal policy for a large number of developing countries when capital flows are perfectly elastic, the less than perfectly elastic outcome can be considered. In this case, the slope of the BP schedule is added to the import share and trade elasticities in determining effectiveness.

Table 2 provides the data on the same forty-six developing countries to assess the case of flexible exchange rate with imperfect capital flows. The London Inter-bank Offer Rate (LIBOR) is used as the “world” rate of interest (R_w) and the central bank discount rate for the domestic rate of interest in each country (R_d). Data columns 1 and 2 report the ratios for 2000-2003 and 2004-2006. Columns 3 and 4 use these to calculate the implied effectiveness on monetary policy with the higher trade elasticity sum of unity.²¹ The ratios of the LIBOR to the central bank rate indicate a low degree

of capital mobility in some countries as suggested by various authors (see Willet, Keil and Young 2002). With imperfect capital flows, the order of countries changes substantially and there is a dramatic decline in the average effectiveness of monetary policy. Because of the rise in the ratio of the Libor to central bank rates across countries, the average effectiveness is slightly higher in the second period. However, monetary policy is at least fifty percent effective for only four of the forty-six countries for the 2004-2006 calculations, compared to twenty-three countries when capital flows are assumed to be perfect (see Table 1).

V. Concluding Remarks

A major argument in favor of monetary policy is that whether policy makers like it or not, governments operate in a world of flexible exchange rates. Therefore, fiscal policy is ineffective as a tool of demand management, while monetary policy is effective. This paper has shown that even in the case perfect capital flows, both conclusions are partly wrong. With imperfect capital flows they both can be false. This is because of the difference between the nominal and real values of changes in the exchange rate and money supply, aggravated by the difference between world and domestic interest rates.

Empirical evidence on the key parameters suggests that under flexible exchange rates the generalization that monetary policy is more effective than fiscal policy requires the assumption of unrealistically high trade elasticities even in the case of perfect capital flows, and is false if the import share is half or more of GDP. In the general case of imperfectly elastic capital flows, the probability that monetary policy would be as effective as fiscal policy under flexible exchanges is quite low.

The impact on domestic prices exchange rate is theoretically beyond challenge and empirically verified. It is implied by the exchange rate itself. The necessity to incorporate the price effect of the exchange rate means that the logically valid formulation of the policy rule for a flexible exchange rate regime would be, “under flexible exchange rates the effectiveness of fiscal or monetary policy depends on the import share, the trade elasticities and the degree of capital mobility”. In other words, when formulated with theoretical consistency, the Mundell-Fleming framework demonstrates there can be no specification of an open economy model yielding the general conclusion that monetary policy is effective. It is not that the standard presentation of the MF theoretical analysis of flexible exchange rates is incorrect under particular assumptions, or that it is correct in theory but irrelevant in practice; it is incorrect in theory.

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² It is difficult to identify the “original” sources, because the model emerged in a series of articles by Fleming and Mundell, and the evolution is discussed in detail in Darity and Young (2004). Representative of the full version of the model are Fleming (1962) and Mundell (1963).

³ The word “synthesis” refers to a putative integration of Keynesian and pre-Keynesian theory. The closed economy IS-LM model is typically attributed to Alvin Hansen (1949) and John Hicks (1937). An alternative graphical approach which presents each market separately is found in Smith (1956).

⁴ In a commonly used textbook form the 1990s one reads:
Since the early 1960s, the dominant policy paradigm for studying open-economy monetary and fiscal policy issues has been the Keynesian framework developed by Mundell and Fleming. (Obsteld & Rogoff 1996, 609)
See also Agenor and Monteil, “The most common analytical framework adopted in modelling the production structure in open-economy models of industrial countries is the Mundell-Fleming framework” (Agenor & Monteil 1996, 44).

⁵ Taylor has persuasively argued that the fixed/flexible dichotomy is invalid in theory and practice (Taylor 2000). This paper accepts the distinction for purposes of inspecting the validity of Mundell-Fleming within the rules of the model.

⁶ Kenen gives the following summary:

Fiscal and monetary policy under a flexible exchange rate

1. with perfect capital mobility, the effectiveness of monetary policy is maximized, but fiscal policy is deprived of any effect on the domestic economy;
2. as capital mobility falls, the effectiveness of monetary policy diminishes, but its effect on income is always larger than the effect obtained with a pegged exchange rate and complete sterilization;
3. as capital mobility falls, the effectiveness of fiscal policy grows, and its effect on income can be larger than the effect obtained with a pegged exchange rate and complete sterilisation... (Kenen 1994, 379)

Dunn and Mutti provide one the most complete discussions, considering fiscal expansion with flexible exchange rates for the three possible cases in the Mundell-Fleming model: perfect capital mobility (fiscal policy completely ineffective); when the balance of payments schedule is flatter than the LM schedule (currency

appreciates, partially effective); and when the balance of payments schedule is steeper than the LM schedule (currency depreciates, with fiscal policy more effective).

⁷ For example,

For the sake of simplicity, the theoretical discussion of this chapter assumes a clean float; accordingly, it is assumed that the exchange rate moves sufficiently to maintain equilibrium in the payments accounts. These assumptions permit rather clear distinctions between the workings of a flexible and fixed exchange rate system. The board conclusions of this theory hold for the real world, though in a less precise way. (Dunn & Mutti 2004, 432, emphasis added)

⁸ In the 2004 edition of their textbook, Dunn and Mutti wrote, “There is now relatively little serious discussion of abandoning flexible [exchange] rates” (Dunn and Mutti 2004, 431)

⁹ A typical treatment where price effects are ignored is found in Romer:

...[T]he exchange rate does not affect money demand...

The fact that the LM curve is vertical means that output for a given price level – that is, the position of the AD curve – is determined entirely in the money market... [S]uppose that government purchases rise. This change shifts the IS curve to the right... At a given price level this leads only to appreciation of the exchange rate and has no effect on output. (Romer 1996, 207)

In their introduction to the discussion of flexible exchange rates, Dunn and Milner point out the price effect of exchange rate changes: “Since the exchange rate, rather than the balance of payments, moves constantly, domestic prices of traded goods are affected (Dunn & Milner 2004, 434). On the following and subsequent pages exchange rate changes are analyzed assuming all prices are fixed. For example, they write, “...depreciation also increases domestic prices of tradable goods...*The original increase in the domestic money supply remains intact...*” (*Ibid.*, 436, emphasis added).

The same analysis is presented in Dunn and Mutti. However, in they call a “monetarist” the price effect of exchange rate changes renders monetary policy ineffective except in the short run. No comment is made on the implicit contradiction between the standard Mundell-Fleming argument and the “monetarist” though they are presented within a few pages of each other (Dunn & Mutti 2004, 438-440).

¹⁰ That this effect is ignored in macro analysis is all the more surprising because it is dealt with in detail in trade theory (for example, see van der Ploeg 1994, 53ff).

¹¹ It is the invalid interpretation of Mundell-Fleming as fixed-price that allows the model to exclude consideration of the *real* exchange rate. I thank Anwar Shaikh for pointing this out to me. His review of the exchange rate literature aided the analysis of this paper (Shaikh 1999).

¹² Williamson and Milner begin an algebraic presentation with an open economy national income equilibrium, but do not develop a full model (Williamson & Milner 1996, 244, equation 14.1).

¹³ Agenor and Montiel call this the “dependent economy” model (1996, 48-52).

¹⁴ The constant price unit of measurement requires the assumption that the economy produces only one product.

¹⁵ Equation 1.3 is obtained as follows:

$$y = [(a_1 - a_2) / a_3] dE^* / Y - (a_4 / a_3) dR_d / Y$$

For the first term, multiply numerator and denominator by E^*/X and substitute $N/a_5 = X$. Since $a_3 = N/Y$, this produces:

$$y = (a_5 \varepsilon_1 - \varepsilon_2) e^* - (a_4 / a_3 Y) dR_d$$

For dR_d , multiply numerator and denominator by F/R , substituting $(1-a_3)N = F$. Equation 1.3 is the result.

¹⁶ If the sum of the export and import *revenue* elasticities is ε_{TR} , $\varepsilon_T = (\varepsilon_{TR} - 1)$.

¹⁷ The price level, P , is equal to the weighted average of domestic prices (P_d) and import prices.

$$P = (1 - a_3)P_d + a_3E$$

When domestic prices are constant and product markets competitive, the rate of change of the price level is the import share in income times the change in the exchange rate (see Agenor and Montiel 1996, 44-45).

$$p = a_3e$$

¹⁸ Even this category, “independently floating”, allowed for policy intervention: “The exchange rate is market-determined, with any official foreign exchange market intervention aimed at moderating the rate of change and preventing undue fluctuations in the exchange rate, rather than at establishing a level for it” (IMF 2004, 2).

¹⁹ See World Bank, World Development Indicators, web address given in notes to Tables 1 and 2.

²⁰ The countries were selected on the basis of the availability of statistics consistent across the sample. See the notes to Tables 1 and 2.

²¹ Note that Table 2 uses ε_T^* not ε_T . See equation 1.4.