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A NOTE ON MUNDELL-FLEMING AND DEVELOPING COUNTRIES

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Abstract

This paper inspects the statement found in macroeconomic text books 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 the domestic price level effect of devaluation be ignored. The price level effect is noted in some textbooks, but not analysed. 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. Monetary policy will be more effective than fiscal policy if and only if the sum of the trade elasticities exceeds the import share. Inspection of data from developing countries indicates a low effectiveness of monetary policy under flexible exchange rates.

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 even more restrictive. Use of 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. In any case, the general theoretical assertion that monetary policy is more effective is incorrect.

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I. Introduction

The Mundell-Fleming analysis concludes that under a 'flexible' exchange rate regime and 'perfectly elastic' capital flows, monetary policy is effective and fiscal policy is not.[2] 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.[3]

This analysis would appear to ignore an obvious, simple and fundamental economic relationship, the impact of appreciation on the price level.[4] The logically complete story would be: an increase in the money supply results in a trade deficit, which is instantaneously eliminated by depreciation of the currency; the depreciation

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[2] Early versions of what became the Mundell-Fleming model are found in Fleming (1962) and Mundel (1963). A thorough history of the development of the model is found in Darity and Young (2004). 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.

[3] 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 sterlization;
> 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)

[4] 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)

If one incorporates the price level effect of exchange rate changes, then the demand for money is affected.

of the currency raises the price level via its impact on imported goods,[5] which lowers the real money supply, such that the shift of the LM curve is less than what would be implied by the increase in the nominal money supply. Thus, monetary policy is not completely effective.

Some might argue that Mundell-Fleming is a 'fixed price' model,[6] and to raise the exchange rate effect on prices is not playing according to the rules of the model. This argument is clearly wrong: 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 presents 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.

Second, 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. 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. Finally, it might be asserted that Mundell-Fleming refers to some chronologically unspecified 'long run', not to short run adjustment. Like the first two, this argument cannot eliminate the need to consider price effects; indeed, it makes that need all the greater. The first implication of the 'long run' argument is that the model has little policy importance, since 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.

We proceed to consider the price effects of devaluation, 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), statistics are used to assess the likely magnitude of these effects in

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

[6] 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).

developing countries, and the final section draws policy conclusions which prove substantially different from standard presentations.

II. MF and Flexible Exchange Rates: Diagrammatic Analysis

We begin with a definition of the 'effectiveness' of monetary policy. Define $\varepsilon_{y,m}$ as the elasticity of output with respect to changes in the money supply, and its maximum value is unity if there are unutilised resources and the price level were constant. This we shall call the 'the index of effectiveness of monetary policy', or 'effectiveness index'. If there are perfectly elastic capital flows and the exchange rate is flexible, an increase in the nominal money supply ($+\Delta M$) shifts the LM curve to the right, which causes devaluation of the currency. If markets are competitive, devaluation must lead to in a rise in prices of imported goods, which reduces the real money supply, $-\Delta m = -[\Delta M/\Delta P]$. This reduces 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 are 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 impact on the effectiveness index has two parts, the interest rate effect and the real money supply effect.

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

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

To summarise the effects in words, if capital flows are less than perfectly elastic, an increase in the money supply a) via devaluation increases the price level, reducing the expansionary effect of the nominal money increase; and 2) via the IS curve, the expansionary effect of the devaluation raises the domestic interest rate, which reduces the shift in the IS curve. The interactions among the three schedules as a result of devaluation are so complex that it is not possible to assess the practical importance of the price level effect of devaluation from the diagrams. Rather, one must investigate the impact of devaluation from a formal model. In this context, it is instructive to note that no standard macro textbook presents the Mundell-Fleming model in algebra, but confine themselves to diagrams. Any student who attempts to specify the model in algebra, with or without success, will teach her- or himself considerably more about the interactions of markets than could ever be learned from the IS-LM-BP framework.

Prior to the algebra, several points can be made to guide 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 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 potential 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.

Figure 1: Monetary Policy, Flexible Exchange Rate and Perfectly Elastic Capital Flows

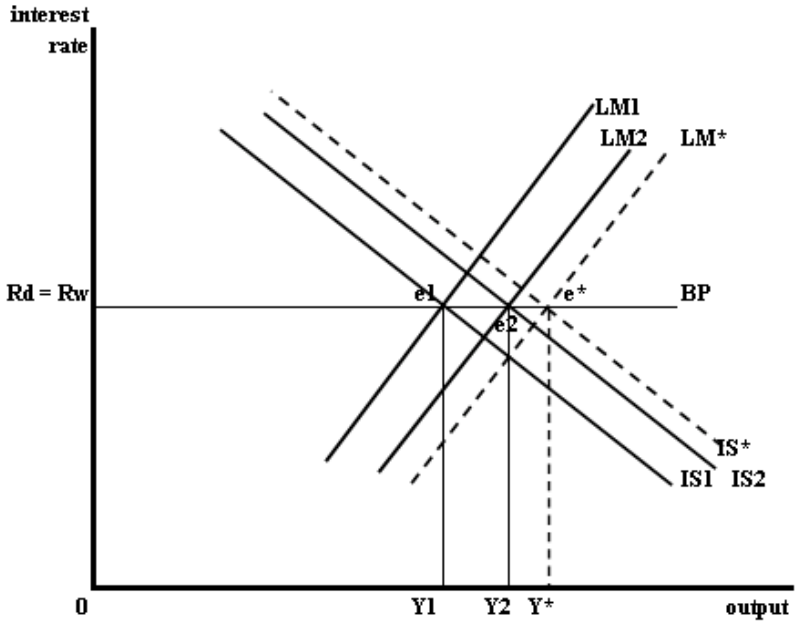
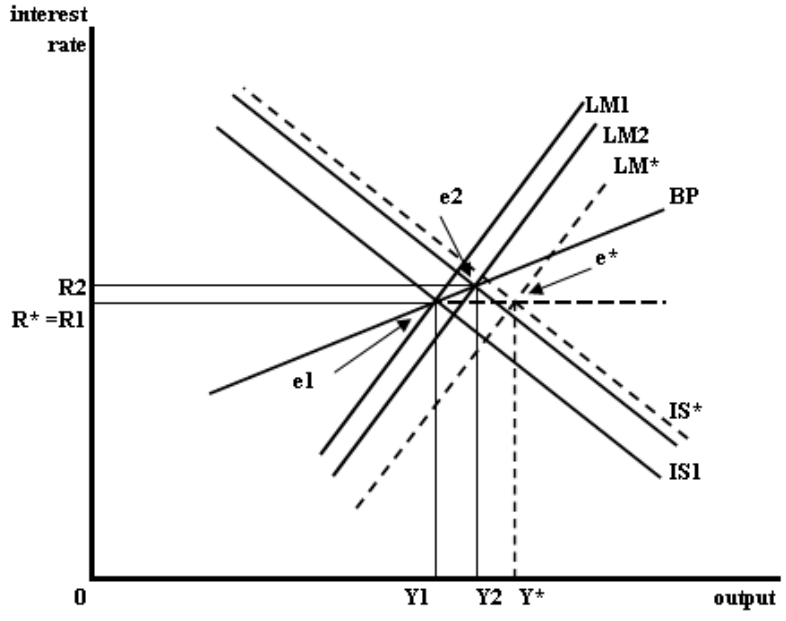


Figure 2: Monetary Policy, Flexible Exchange Rate and Less than Perfectly Elastic Capital Flows



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.[7] A change in the nominal exchange rate affects only 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) $0 = (X - N) + F$, and

$(N - X) = F$

Because of the small country assumption, we can measure exports (X), imports (N) in constant price units,[8] and we measure capital flows in constant prices. The standard 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) $0 = (X^* + a_1E^*) - (a_2E^* + a_3Y) + a_4(R_d - R_w)$

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

If capita 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, where y, e and r are the rates of change of the upper case variables.[9]

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[7] Agenor and Montiel call this the 'dependent economy' model (1996, 48-52).

[8] The constant price unit of measurement assumes that the economy produces only one product.

[9] 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:

$y = (a_5\varepsilon_1 - \varepsilon_2)e^* – (a_4/a_3Y)dR_d$

1.3) $y = (a_5\varepsilon_1 - \varepsilon_2)e^* - (1 - a_5)\varepsilon_4 r$

Where $X = a_5N$, $a_5 = X/N$, $F = (N - X) = (1 - a_5)N$; and $\varepsilon_3 = 1$. ε_4 is the elasticity of capital flow with respect to the domestic interest rate.

The ε's are elasticities corresponding to the numbered parameters. Since MPN = APN, $\varepsilon_3 = 1$. If capital flows are perfectly elastic, $a_5 = 1$, $(1 - a_5) = 0$, and the equation reduces to $y = (\varepsilon_1 - \varepsilon_2)e$, with $\varepsilon_1 > 0$ and $\varepsilon_2 < 0$, so their sum is always positive. The small country assumption ensures that the Marshall-Lerner condition is met as long as $(\varepsilon_1 - \varepsilon_2) > 0$.[10] 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 $(a_5\varepsilon_1 - \varepsilon_2) = \varepsilon_T^*$, where $\varepsilon_T^* = \varepsilon_T$ if capital flows are perfectly elastic. N the case of perfect elasticity the relationship between changes in the exchange rate and output becomes quite simple:

1.4) $y = \varepsilon_T^* e^* = \varepsilon_T e^*$

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 domestic prices are constant and the market for imports competitive, then the rate of inflation is the change in the nominal exchange rate times the import share.[11]

1.5) $y = \varepsilon_T^* e^* = \varepsilon_T(e - p) = \varepsilon_T(e - a_3 e) = \varepsilon_T(1 - a_3)e$

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

2) $M_d = vPY + a_6 R$

$M_s = M^*$

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

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

[11] The price level, P, is equal to the weighted average of domestic prices (P_d) and import prices. Let the initial values of P_d and E be unity.

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

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).

$p = a_3 e$

$M_s = dR_d = vPY + a_6R$

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:

2.3) $p = m - y$

$a_3e = m - y$

$e = (m - y)/a_3$

We can now substitute for e in equation 1.5:

2.4) $y = \varepsilon_T^*[1 - a_3][(m - y)/a_3]$

Again, we solve for y,

2.5) $y = \varepsilon_T^*[1 - a_3]/[a_3 + \varepsilon_T^*]m$

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

3) $\varepsilon_{y,m} = \varepsilon_T^*[1 - a_3]/[a_3 + \varepsilon_T^*]$

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. 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 shows, 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) $\varepsilon_{y,m} = [1 - a_3][\varepsilon_T^*/(a_3 + \varepsilon_T^*)][R_w/R_d]$

$0 \leq R_w/R_d \leq 1$ and $R_w/R_d = 1$ for perfect elasticity.

The equation is algebraically and analytically composed of three components: 1) the difference between the nominal and real exchange rate change, $(1 - a_3)$; 2) the difference between the nominal and real change in the money supply, $\varepsilon_T(1 - a_3)/(a_3 + \varepsilon_T^*$; and 3) the interest rate differential, R_w/R_d. For a given import share, the first

is invariant, and reduces the effectiveness of monetary policy by the same degree no matter what is the value of the trade elasticities or the elasticity of capital flows. The second increases with the sum of the trade elasticities, approaching infinity at its limit. And the third approaches unity as its limit. In the following section this equation is applied to empirical evidence.

III. Empirical Relevance

Despite an apparent consensus on freely 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. Thus, less than one in five developing country governments pursued a floating exchange rate regime without regular interventions.[12] This is not entirely surprising, since the institutional characteristics of developing countries suggested 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, as Figure 4 shows. 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. 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, monetary and fiscal policy will be equally effective when

$$\varepsilon_T^* = .5\, a_3/(.5 - a_3),$$

and fiscal policy the more effective instrument if

$$\varepsilon_T^* < .5\, a_3/(.5 - a_3).$$

[12] 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).

In 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. Figure 3 suggests that $\varepsilon_T^* < N/Y$ would be a likely outcome for a large number of countries, if not the majority. The relationship between the import share (N/Y) and the sum of trade elasticities is shown in Figure 4 for three values of the former parameter and various trade elasticities.

If we assume perfect capital flows, only two parameters are relevant as in figure 4, the import share, which is available from many data bases, and the sum of trade elasticities. The value of the latter depends critically on the time period over which it is 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 *net* 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). Thus, one can conclude that the MF trade adjustment mechanism would need to be realised in less than a year.

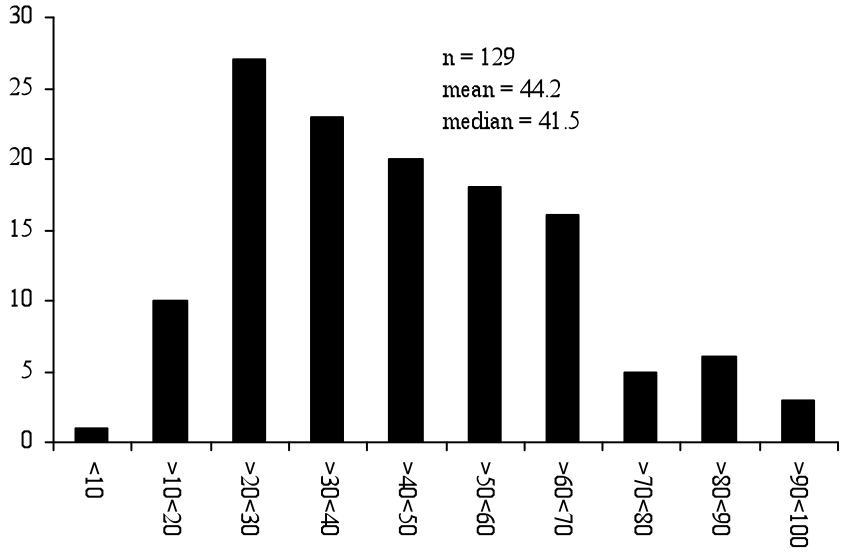
It is likely that the trade elasticities would be quite small over such a short time. For countries that are primarily exporters of agricultural products, the elasticity of export volume with respect to the exchange rate may not be significantly different from zero. This would be the case for most of the sub-Saharan countries and some of the low income Asian countries. Exporters of manufactures could have positive 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 very low 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.

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 1 provides the data on twenty-one developing countries to assess the case of flexible exchanges rate with imperfect capital flows. The London Inter-bank Offer Rate is used as the 'world' rate of interest (R_w) and the central bank thirty day bond rate for the domestic rate of interest in each country (R_d). Data column 1 reports the average of these for 2001-2005, and the next four columns the ratio R_w/R_d, the export share in GDP (X/GDP), the import share (N/GDP) and the ratio of exports to imports (X/N). The last parameter is used to calculate ε_T^* in the case of imperfect capital flows. Column 2, the ratio of the LIBOR to the central bank rate suggests a low degree of capital mobility in some countries as suggested by various authors (see Willet, Keil and Young Seok Ahn). The final four columns report the calculated effectiveness of monetary policy. For comparison Table 1 and Figures 5 and 6 provide the calculations for the perfect capital flows case as well as the more general case, both for hypothetical sums of the trade elasticities of .5 and 1.0.

For the lower, and more realistic for the short run, sum of trade elasticities the average effectiveness of monetary policy across the twenty-one countries for perfect capital flows is .46, and for fifteen of the countries fiscal policy would be the more effective instrument. For the case of imperfect capital flows, the average effectiveness of monetary policy falls to .15, and fiscal policy would be more effective in every country. When the sum of trade elasticities rises to unity, monetary policy is more effective in seventeen under perfect capital flows, with no country achieving seventy-five percent effectiveness. For the case of imperfect capital flows, monetary policy is the more effective in no country (Malaysia and Korea), and less than twenty-five percent effective in sixteen of the twenty-one.

Figure 3: Distribution of Import Shares in GDP for 129 Developing Countries, early 2000s (number of countries by range)



Source: *World Development Indicators 2006*.

Figure 4: Effectiveness of Monetary Policy (vertical axis) for different values of trade elasticities (horizontal axis), with different import shares (flexible exchange rate with perfectly elastic capital flows)

Note: 'Trade elasticities' are the sum of the export and import elasticities with respect to the real exchange rate. N is imports and Y is national income, measured in constant price units.

Table 1: Calculation of Effectiveness of Monetary Policy (using 2001-2005 data)

Libor & by Countries	Interest Rates (average)	Key Ratios				Effectiveness of monetary policy Perfect Capital flows		Imperfect capital flows	
						$\varepsilon_1+\varepsilon_2=$	$\varepsilon_1+\varepsilon_2=$	$\varepsilon_1+\varepsilon_2=$	$\varepsilon_1+\varepsilon_2=$
Libor = R_w	3.1	R_w/R_d	X/GDP	N/GDP	X/N	0.5	1.0	0.5	1.0
Argentina	9.6	.32	.23	.15	1.53	.65	.74	.22	.24
Bolivia	9.2	.17	.26	.27	.96	.47	.57	.08	.10
Brazil	18.5	.17	.14	.13	1.11	.69	.77	.12	.13
Chile	4.7	.65	.37	.33	1.12	.40	.50	.27	.33
Colombia	9.6	.32	.20	.22	.91	.54	.64	.17	.20
Ecuador	5.9	.52	.27	.30	.90	.44	.54	.22	.28
Mexico	9.2	.33	.29	.31	.94	.43	.53	.14	.17
Peru	6.9	.45	.19	.18	1.06	.60	.69	.27	.31
Uruguay	22.8	.13	.25	.25	1.00	.50	.60	.07	.08
Indonesia	12.5	.24	.33	.25	1.32	.50	.60	.13	.15
Korea	4.4	.70	.39	.31	1.26	.43	.53	.31	.38
Malaysia	3.0	1.00	1.16	.96	1.21	.01	.02	.01	.02
Philippines	7.7	.40	.50	.53	.94	.23	.31	.09	.12
Bangladesh	5.6	.55	.15	.21	.71	.56	.65	.29	.35
India	6.0	.27	.16	.18	.89	.60	.69	.16	.18
Sri Lanka	7.9	.17	.36	.44	.82	.30	.39	.05	.06
Egypt	8.8	.35	.23	.28	.82	.46	.56	.15	.19
Kenya	7.7	.40	.25	.31	.81	.43	.53	.16	.20
South Africa	9.5	.32	.29	.28	1.04	.46	.56	.15	.18
Zambia	10.9	.28	.22	.29	.76	.45	.55	.12	.15
Turkey	41.0	.07	.29	.34	.85	.39	.49	.03	.04
Averages	10.55	.37	.31	.31	.99	.45	.55	.15	.18

Notes:

Effectiveness of monetary policy is calculated by the equation

$$\varepsilon_{y,m} = \varepsilon_T^*/[a_3 + \varepsilon_T^*][R_w/R_d]$$

Where $\varepsilon_T^* = (a_5\varepsilon_1 + \varepsilon_2)$, and ε_1 and ε_2 are the elasticities of export and import volume with respect to the exchange rate, and a_5 the ratio of exports to imports. The calculations assume $\varepsilon_1 = \varepsilon_2$. R_d is the central bank thirty day bond rate in each country and R_w is the London inter-bank offer rate (LIBOR). The national rates are taken from the central bank websites for each country. Libor is from (http://www.economagic.com/em-cgi/data.exe/libor/day-us3m). Source for the trade ratios is: http://ddp-ext.worldbank.org/ext/DDPQQ/member.do?method=getMembers&userid=1&queryId=135

Figure 5: Calculated Effectiveness of Monetary Policy in 21 Countries, $\varepsilon_T^* = 0.5$

(using 2001-2005 data for N/GDP, X/GDP and R_w/R_d)

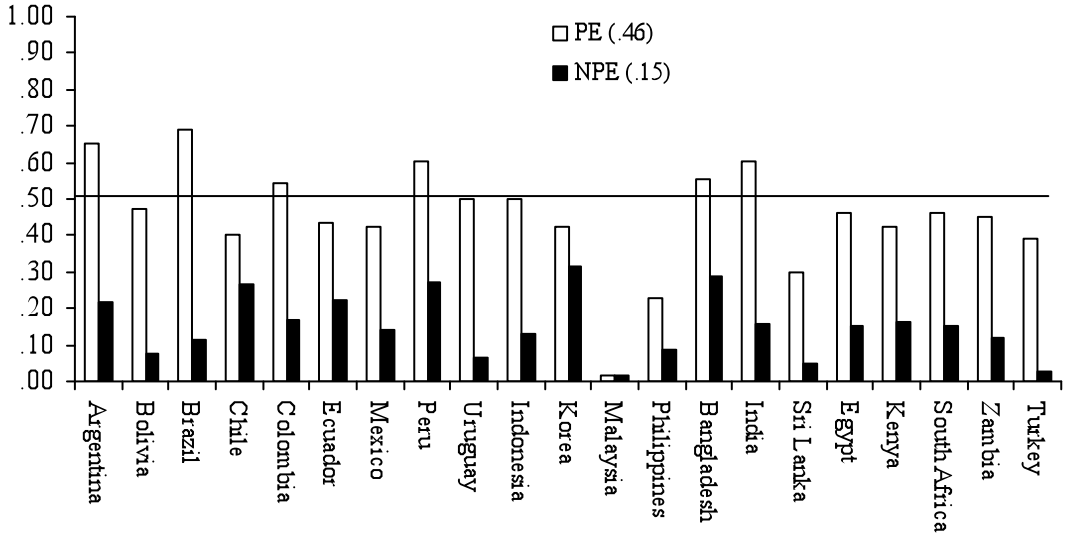
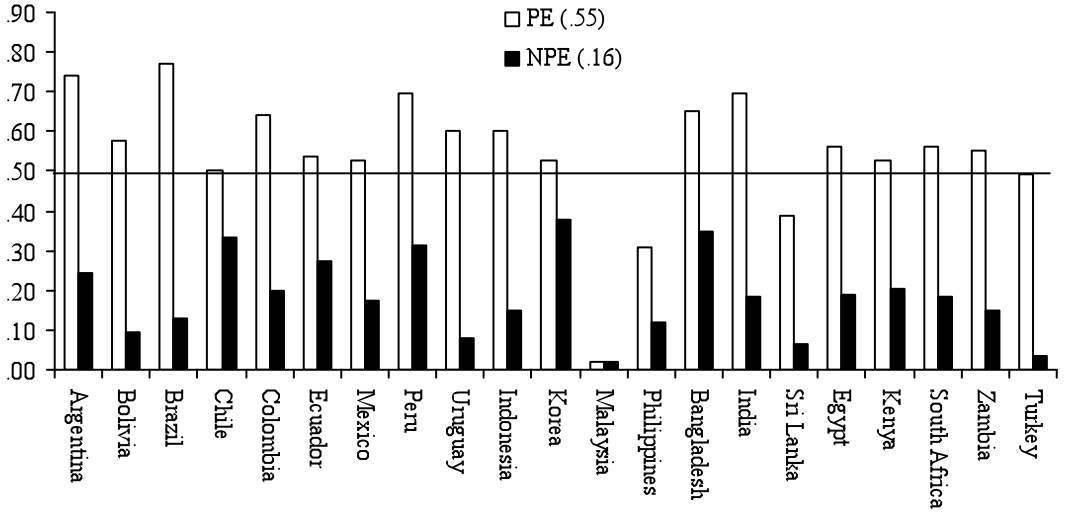


Figure 6: Calculated Effectiveness of Monetary Policy in 21 Countries, $\varepsilon_T^* = 1.0$

(using 2001-2005 data for N/GDP, X/GDP and R_w/R_d)



Notes for Figures 3 and 4:

PE is the result assuming perfectly elastic capital flows, and NPE uses the actual trade balance and actual R_w/R_d. R_d is the central bank 30 day bond rate in each country and R_w is the London inter-bank offer rate (LIBOR). Numbers in parenthesis are cross-country averages. Calculation of ε_T^* explained in the text and the notes to Table 1.

IV. Concluding Remarks

A major argument in favour 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 useless 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 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 determining parameters indicate that under flexible exchange rates the generalisation 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. 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.

That the exchange rate has an impact on domestic prices is theoretically beyond challenge and empirically verified. It is as theoretically fundamental to an open economy as the concept of the exchange rate itself. The necessity to incorporate the price effect of the exchange rate implies that the logically valid formulation of the flexible exchange rate regime policy rule 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 in which monetary policy is effective as the general theoretical conclusion. It is not that 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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