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Real Shocks, Credibility & Stabilization Policy in a Small Open Economy

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Abstract

Intermittent exchange rate instability and attendant high interest rates have led some observers to argue that there is need for an alternate monetary regime such as a currency board or official dollarization. Against this background, this paper compares the welfare costs of various stabilization policies for the Jamaican economy. The analytic framework used is a stochastic model of a small open economy based on micro-foundations. When calibrated to Jamaican data, the results suggest that policy regimes that allow for some flexibility in monetary policy are superior, in terms of welfare, to a currency board or the extreme of dollarization. Further, at low levels of inflation policy could shift towards a full fledge inflation-targeting regime. The results however rely on the critical assumption that the policy regime is credible. Thus whilst dollarization may be inferior, policy makers are still confronted with the issue of the credibility of their stabilization policies.

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1. INTRODUCTION

Stabilisation policies in small developing economies have to varying degrees used the exchange rate as a nominal anchor for prices and expectations[2] with varying success. However, the choice of an exchange rate regime for a small open economy has recently re-emerged in the literature following the recent financial crises and the debt problem in the currency board regime of Argentina.

One solution, which is to have no exchange rate, has recently emerged as an alternate stabilization option within Latin America[3]. This is against a background that dollarization underwrites the credibility of a government's anti-inflationary policy by ensuring monetary discipline. However, a number of studies[4] has pointed to the role of external shocks in explaining aggregate fluctuations in small open developing economies. The inability to adjust to these shocks may result in a situation where the welfare cost of losing monetary policy exceeds the benefits. Schmitt-Grohe and Uribe (2001) argue that given that the shocks affecting the dollarized economy often differ from the host country or have asymmetric effects on the two economies, dollarization can result in higher macroeconomic instability. Further, Edwards and Magendzo (2001) find that although dollarised economies have a lower rate of inflation, economic growth tends to be lower due to the inability of the countries to accommodate external disturbances such as terms of trade shocks and shocks to capital flows[5].

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[2] See Kiguel and Liviatan (1992) and Végh (1992).
[3] Ecuador dollarized in 2001while Bolivia and Argentina have considered this option.
[4] See for example Calvo, Leiderman and Reinhart (1993), Schmitt-Grohe and Uribe (2001) and Agenor, McDermott and Prasad (1999)

Following on these conclusions and given the vulnerability of the Jamaican economy to external shocks, this paper evaluates alternate stabilization measures for the economy. Specifically the paper compares the welfare costs of four policy regimes: (i) inflation targeting (ii) money-based stabilization (iii) currency board and (iv) a dollarized economy. Given that the economy is open, the policies considered have as their objective some form of inflation/exchange rate stabilization.

Some of the more influential papers that studied the effects of different stabilization policies include Calvo (1986), Calvo and Vegh (1994) and Uribe (1999). Calvo (1986) focuses on the commitment and duration of an exchange rate based stabilization programme. He shows that temporary stabilization is pareto inferior to a permanent rate of devaluation, as a temporary policy gives rise to current account deficits and lower consumption relative to that of a permanent monetary policy. Calvo and Vegh (1994) extend Calvo's (1986) model to include staggered prices and currency substitution and show that temporary monetary based stabilization programmes generate a contraction in aggregate demand. However, a temporary exchange rate based programme results in an initial expansion followed by a subsequent recession. Uribe (1999) extends this framework to allow for a one-time jump in the money supply. He shows that the welfare gains of a permanent money base policy exceed that of its rivals and that a temporary policy is more costly.

There is a number of recent applied papers that compares various monetary arrangements and stabilization strategies for various emerging market economies subject to exogenous shocks. Schmitt-Grohe and Uribe (2001), show that in the

[5] See Robinson (2001) for a discussion on the pros and cons of dollarizing the Jamaican economy.

presence of business cycle shocks, a credible exchange rate based stabilization programme is to be preferred to inflation targeting, monetary stabilization and dollarization in the case of Mexico. Mendoza (2001) arrives at the converse conclusion when account is taken of financial market imperfections. Similarly, in the case of Argentina, when account is taken of the shocks to risk premia, Ghironi and Rebucci (2002) argue that dollarization is to be preferred to inflation targeting or a currency board.

The theoretical framework used in this paper is a stochastic discrete time version of the general equilibrium model of Calvo (1986). We extend this framework in two important ways. First, foreign currency balances enter the utility function, similar to Ghironi and Rebucci (2002), which gives rise to currency substitution and unofficial dollarization that typify developing economies with a history of high inflation such as Jamaica. Secondly, we introduce a stochastic production function similar to that in Cooley and Hansen (1989) in which output and productivity are subject to exogenous shocks, which give rise to business cycle fluctuations. In this model, exchange rate and monetary policies can have real effects even in the long run[6].

The model is calibrated to Jamaican data. To ensure the models validity, we compare the observed business cycle trends to those predicted by the model. Simulations are then done wherein the welfare cost of various stabilization regimes are evaluated. The results show that policy regimes, which allow for some flexibility in monetary policy, given the vulnerability of the economy to external shocks, are superior in terms of welfare, to the extreme of dollarization. The most optimal policy

from the perspective of consumer welfare is monetary stabilization. However, as inflation falls, economic agents become indifferent between a monetary targeting and an inflation-targeting regime. The results, howeve,r rely on the critical assumption that the policy regime is credible. Thus whilst dollarization maybe inferior, the Jamaican policy makers are still confronted with the issue of ensuring the credibility of their stabilization policies.

The rest of the paper is organised as follows. Section 2 establishes the vulnerability of the economy to shocks, by identifying the variables driving the Jamaican business cycle in a structural VAR. Section 3 presents the theoretical model, while section 4 outlines the calibration and the simulated results. Section 5 compares the welfare costs of the different policy options. Some concluding comments are given in Section 6.

2. AGGREGATE FLUCTUATIONS AND EXTERNAL SHOCKS

In this section we delineate the various sources of output fluctuations in the Jamaican economy over the past twenty years. We estimate the share of k-quarters ahead forecasts error variance in output (y) that is explained by fluctuations in external price shocks -real exchange rate (*rer*) and terms of trade (*tot*), domestic interest rates (r) and foreign output (y^*). [7]

We estimate a vector autoregression of the cyclical component and the aggregate of the differences of the logs of these variables using annual data from 1970

[6] See obstfeld (1981) for a similar model in which monetary policy can have real effects in the long run.

[7] The terms of trade was obtained from the Bank of Jamaica and the real exchange rate is calculated as sP*/P. US real GDP is used foreign output and interest rates used were the domestic treasury bill rate. Data on output, interest rate, exchange rates and prices were obtained from the IMF's CD-ROM.

to 2000. External shocks and foreign output are assumed to be exogenous. The innovations in the terms of trade are not affected by domestic output since the economy is a price taker, domestic interest rates and the real exchange rate. Domestic interest rate fluctuations are assumed to respond to variations in prices and not output[8]. With these identification assumptions the VAR structure is given by

$$X_t = B(L)X_{t-1} + u_t$$

such that

$$E(u_t u_t') = \Sigma$$

$$Au_t = v_t$$

$$E(v_t v_t') = \Lambda$$

where X is the vector $(y_t^*, tot_t, rer_t, r_t, y_t)'$, u_t residual vector, v_t vector of own innovations that are orthogonal, A is 5x5 lower triangular matrix, Σ is zero mean and diagonal variance-covariance matrix and Λ a diagonal matrix. Likelihood ratio tests and the Schwartz criterion favoured four lags.

Table 1 below shows the results of the fraction of the K-quarter ahead forecast error variance of output explained by external shocks –terms of trade and US GDP, and domestic shocks –interest rates and the real exchange rate, and own innovations to GDP. The tables show that external shocks account for much of the fluctuation in Jamaican GDP. In the case of aggregate GDP fluctuation, US GDP accounts for half of the variations in Jamaican GDP, primarily through its effect on tourism and capital flows. Terms of trade shocks are the second most important external source of variation in both cases. The most significant domestic factor is the variation in domestic interest rate, the effect of which is more prominent for the business cycle.

[8] Monetary policy has been mostly concentrated on minimizing exchange rate and inflation and less on output fluctuation.

TABLE 1a
VARIANCE DECOMPOSITION OF JAMAICAN OUTPUT (Aggregate)

k	*y*	*rer*	*r*	*tot*	*y**
2	8.84	3.89	3.08	31.36	52.83
4	6.04	2.85	18.48	23.25	49.38
8	3.72	4.69	14.36	25.03	52.20
10	3.61	4.87	14.96	25.88	50.67

TABLE 1b
VARIANCE DECOMPOSITION OF JAMAICAN OUTPUT (Cyclical)

k	*y*	*rer*	*r*	*tot*	*y**
2	10.93	23.49	15.37	22.61	27.59
4	8.53	23.04	22.04	23.44	22.94
8	6.47	21.05	18.67	28.46	25.37
10	6.56	2.13	26.09	22.38	22.39

3. MODEL

We consider a small open economy of infinitely lived households that are identical in preferences over consumption and money. In this model for simplicity the population is normalized to one and the variables are in per capita terms. In this economy there is a single consumption good, *c,* which is a traded good[9]. The household's wealth is divided between domestic fiat money, *M*, that pays no interest, foreign currency *M**, domestic government and internationally traded bonds (net), b_g and *b** and physical capital *k.* There are no restrictions to capital and domestic and foreign bonds pay a real rate of return per period of *r* and *r*,*[10] respectively. The economy is small and as such is a price taker and does not influence international interest rates. The domestic price level then follows the PPP relation $P_t = S_t P_t^*$, where

[9] See also Backus et al (1995) for another example in which there is a single traded good.
[10] We assume at all time a positive interest rate, such that money is return dominated by bonds.

S is the domestic currency price of one unit of foreign currency and P* is the foreign price level. Assuming that foreign inflation is negligible the domestic rate of inflation is given by $\mathrm{P_t} - P_{t-1}/P_{t-1} \cong \mathrm{S_t} - S_{t-1}/S_{t-1} = \varepsilon_t$. The government gives a lump-sum transfer to the household, issues domestic currency at the rate of ω per time period (i.e. monetary policy) and sets the exchange rate policy. The amount of domestic currency issued is equal to a portion, ψ, of the economy's net foreign assets.

3.1 Households

Households have identical preferences over real consumption and real domestic $(\mathrm{M/P})$and foreign currency $(\mathrm{SM^*/P})$ holdings. The household maximises its lifetime utility

$$E_t \sum_{t=0}^{\infty} \beta^t U\left[c_t, m\left(\frac{M_t}{p_t}, \frac{S_t M_t^*}{p_t} \right) \right] \qquad (1)$$

Money enters the utility motivated by the same rationale as in Sidrauski (1967), i.e. the liquidity services provided. *U(.)* is assumed to be strictly concave, continuously differentiable and increasing in *c* and *m*, which are normal goods.

In each time period *t*, the household allocates its income towards current consumption and wealth accumulation. Income is derived from the output of the economy, y,[11] government lump-sum transfers (net of taxes and other claims), g, and returns on financial assets and capital. Similar to Schmitt-Grohe and Uribe (2001) capital accumulation is given by

$$i_{t+1} = k_{t+1} - (1 - \delta)k_t \qquad (2)$$

[11] For simplicity and without loss of generality, we assume that the household owns the firm.

The household therefore faces the following inter-temporal budget constraint

$$S_t b_t^* + b_{gt} + i_{t+1} + \frac{M_t}{P_t} + \frac{S_t M_t^*}{P_t} \le (1 + r_t)b_{gt-1} + \frac{M_{t-1}}{P_t} + (1 + r_t^*)S_t\left(b_{t-1}^* + \frac{M_{t-1}^*}{P_t}\right) + r_t^k k_t + g_t + y_t - c_t \tag{3}$$

and the no-Ponzi –game condition $\lim_{T\to\infty} (1+r)^{-T} b_{gt+T} = 0$ and

$\lim_{T\to\infty} (1+r^*)^{-T} b^*_{g_{t+T}} = 0$.

The household chooses the paths for *c*, *m*, *k*, *b* and *b** to maximise (1) subject to (2), (3) and the transversality condition. The first order conditions for the household's maximisation problem are

$$U_c(c_t, m_t) = \lambda_t \tag{4}$$

$$\lambda_t S_t = \beta^t E_t \lambda_{t+1} S_{t+1}(1 + r_t^*) \tag{5}$$

$$\lambda_t = \beta E_t \lambda_{t+1}(1 + r_t) \tag{6}$$

$$\frac{1}{P_t} U_m(c_t, m_t).m_{m/p}\left(\frac{M_t}{P_t}, \frac{S_t M_t^*}{P_t}\right) + \beta E_t \lambda_{t+1} \frac{1}{P_{t+1}} = \lambda_t \frac{1}{P_t} \tag{7}$$

$$\frac{S_t}{P_t} U_m(c_t, m_t).m_{m^*/p}\left(\frac{M_t}{P_t}, \frac{S_t M_t^*}{P_t}\right) + \beta E_t \lambda_{t+1} \frac{(1 + r_t)S_{t+1}}{P_{t+1}} = \lambda_t \frac{S_t}{P_t} \tag{8}$$

$$\lambda_t[1 - \phi_k(k_{t+1} - k_t)] = \beta_t E_t \lambda_{t+1}(f_k(k_{t+1}) + r_t^* - \phi_k(k_{t+1} - k_t) - (1 - \delta)) \tag{9}$$

where λ_t is the Lagrange multiplier.

Using equation (4) and the first order condition for holding domestic bonds given in equation (6) we obtain the Euler equation for the optimal consumption path

$$U_c(c_t, m_t) = \beta(1 + r_t) E_t U_c(c_{t+1}, m_{t+1})$$

which is the standard intuitive result that the rate of growth in consumption is a function of the rate of interest. In an open economy, this is a function of the returns on a substitutable foreign bond and the expected price of the consumption good in terms of the foreign currency. This can be seen by combining equations (5) and (6) to yield the following no-arbitrage condition for holding domestic and foreign currency bonds

$$1 + r = E_t \varepsilon_{t+1} + (1 + \mathrm{r}^*)$$

Additionally, given equation (4) and the fact that U(.) is twice continuously differentiable and c and m are normal, then there exists some function,

$$U_c(c, L(c, \varepsilon + r^*)) = \lambda$$

Since $U(.)$ is concave and $L_c>0$, $L_i<0$, then the implicit partial derivative of the above expression satisfies

$$sign \frac{\partial c}{\partial \varepsilon} = -sign U_{cm}$$

(see Calvo(1986)). This implies that the effect of monetary/exchange rate policy on consumption depends on the value of the cross derivative $U_{cm}(.)$. Specifically, policy will be non-neutral if $U_{cm}(.) \neq 0$ which implies that *c* and *m* are Edgeworth dependent.

3.2 Firms

Without loss of generality the production function is highly simplified in this economy. Because we want to focus on exogenous shocks to the economy, we abstract from business cycle fluctuations arising from the labour market. For simplicity we assume that there is a freely accessible constant returns to scale technology and that output can be costlessly transformed into either consumption or investment. The production function in intensive form is therefore given by $y = f(\mu, k)$,

where μ is an iid exogenous shock, which is uncorrelated with monetary policy and f satisfies the Inada conditions. Firms will employ capital up to the point where the marginal returns are equal to the cost i.e. $r^k = f_k(uk)$.

3.2 Government

Similar to Calvo (1987), in this model we consolidate the balance sheets of the government and the central bank in an overall public sector budget constraint given by[12]

$$\Delta b^*_{gt} = \Delta b_{gt} - g_1 - r_t\, b_{gt-1} + r^*_t\, b^*_{gt-1} \qquad (10)$$

where b^*_{gt} is the net foreign assets which earn the foreign rate of interest r^*. Equation (10) implies that the rate of accumulation of foreign assets by the government is equal the difference between domestic borrowing and the fiscal deficit.

3.3. Equilibrium

Using equation (10) and the household's budget constraint we obtain the following resource constraint[13]

$$s_t \Delta f_t = y_t + (r^*_t - \omega\psi) s_t f_{t-1} - c_t - i_t \qquad (12)$$

where $f_t = b^*_t + b^*_{gt} + m^*_t$ is the net foreign asset position of the country and

$\lim_{T\to\infty} (1+r^*)^{-T} f_{t+T} = 0$. This condition simply states that the net accumulation of foreign assets by the economy must be equal to the current account surplus or

[12] We suppress the role of seigniorage in government.

domestic absorption. Here the accumulation of foreign assets depends on both monetary and fiscal policy and the household's preferences.

Given the stochastic processes $\{\varepsilon r_t\}_{t=0}^{\infty}$ and ε_t, the exogenous sequence $\{r_t^*\}_{t=0}^{\infty}$ and the initial conditions k_0, b_0, m_0, m_0^*, a competitive equilibrium can be defined as a set of stationary stochastic sequences $\{c_t, m_t, m_t^*, s_t, b_t, k_t, i_t, y_t, f_t, r_t\}_{t=0}^{\infty}$ and a positive scalar λ which satisfy equations (4) –(9) and (12).

3.4. *Policy Credibility*

Since the collapse of the Bretton Woods system, Jamaica has used various exchange rate regimes as an essential element of almost all its stabilization programs. However, the lack of credibility of the various exchange rate based stabilization programme over the past thirty years, has led to the demise of the different exchange rate systems and hence the stabilization policies. To capture the role of private expectations in economic stabilization, monetary policy is modelled as a regime switching process. The private sector, under each policy regime forms expectations about the ability of the government to maintain the regime.

The government announces a low depreciation stabililization policy in which it sets $\varepsilon_t = \varepsilon^L$. Agents assign an exogenous probability to the government's monetary policy stance given by $z = Pr\left[\varepsilon_t = \varepsilon^H \middle| \varepsilon_{t-1} = \varepsilon^L\right]$ and $\varsigma = Pr\left[\varepsilon_t = \varepsilon^H \middle| \varepsilon_{t-1} = \varepsilon^H\right]$. We assume that the stochastic process driving the policy stance follows the standard

[13] This is equivalent to the balance of payments condition found in Calvo (1987)

regime switching process, where the transition probabilities are defined by an irreducible erogodic Markov chain, with the following AR(1) representation

$$\xi_{\mathrm{t}} = \Pi\xi_{\mathrm{t}-1} + \nu_{\mathrm{t}}$$

where is $\xi_{\mathrm{t}-1} = (1, 0)'$ when $\varepsilon_{t-1} = \varepsilon^{H}$, $\xi_{\mathrm{t}-1} = (0, 1)'$ when $\varepsilon_{t-1} = \varepsilon^{L}$ and the transition matrix is

$$\Pi = \begin{pmatrix} \varsigma & 1-\mathrm{z} \\ 1-\varsigma & \mathrm{z} \end{pmatrix}$$

Given this AR(1) representation the average duration of an expansionary episode is $1/1-\varsigma$ and stable monetary policy is $1/\mathrm{z}$. More importantly the unconditional expectation of ε_t is

$$E_{t-1}(\varepsilon_t) = \frac{z}{1+z-\varsigma} \qquad (11)$$

4. MODEL CALIBRATION

The model is solved and calibrated to the Jamaican economy using a linear quadratic approximation (LQ) around the non-stochastic steady state. The calibrations make use of the certainty equivalence principle, which follows from the fact that in LQ problems the optimal value and policy functions are independent of the covariance among the random variables. Using the certainty equivalence, we can then replace the conditional expectations of the random variables with their unconditional expectations. We make the assumption that in the steady state net external claims are zero. The time unit chosen is a year and the period of analysis covers 1970 to 2001[14].

The following functions are used to characterize preference and technology

$$U(C_t, m_t) = \frac{(C_t^{\theta} m_t^{1-\theta})^{1-\sigma}}{1-\sigma} \tag{12}$$

$$m\left(\frac{M_t}{P_t}, \frac{S_t M_t^*}{Pt}\right) = \left(\frac{M_t}{P_t}\right)^{(1-\gamma)} \cdot \left(\frac{S_t M_t^*}{Pt}\right)^{\gamma} \tag{13}$$

$$y_t = e^{\mu_t} k_t^{\alpha} \tag{14}$$

$$\mu_{t+1} = \rho\mu_t + \upsilon_{t+1} \tag{15}$$

Equation (12) gives a CRRA utility function and equation (13) is a weighted aggregator function for money balances, θ is the intra-temporal elasticity if substitution between consumption and liquidity services. From equation (13) the condition $U_{cm}(.) \neq 0$ requires that θ≠1 and σ≠1, similarly $U_{cm}(.) > 0$ requires that $\sigma + \theta - \sigma\theta < 1$. Equation (14) is a standard AK production function used in Cooley and Hansen (1989), where μ_t is a AR(1) exogenous shock, with υ_t an iid zero mean random variable.

The calibrated parameters of the model are given in Table 3 below. Drawing on the results of Giovanni (1985), the elasticity of the marginal utility of consumption is set at –1.67, which then implies an inter-temporal elasticity of substitution (1/σ) of 0.26. Although empirical estimates of the elasticity of substitution using Sidrauski's utility functions do produce values above one[15], this estimate is generally in line with those for a number of other developing countries[16]. Since there is no exact measure, the rate of capital depreciation was set at 0.25 consistent with other studies on small

[14] The data used is taken from the IMF's IFS CD-ROM
[15] See for example Arrau (1990).

open economies. The discount rate is derived from the steady sate condition in the model, with the steady state real interest rate calculated as the average of the trend component over the sample period.

Because Jamaica is a small open economy, reliant on exports, exchange rate policy invariably has sought to allow adjustments in the exchange rate so as to offset the inflation differential. In this context we define a low depreciation stabilization scenario as one in which the change in the exchange is less than or equal to the inflation differential. Using this definition, the average duration of high depreciation over the sample period is 1.7 years, which implies that ς is 0.5. The average duration of low depreciation policy is 2.6 years, implying that z is 0.3.

The parameters θ and γ, characterise the demand for real money balances. From the first order conditions, equations (9) to (15) and Fisher parity, the demand for domestic and foreign currency balances are given by

$$\frac{M_t}{p_t} = \frac{(1-\gamma)\theta}{1-\theta} \cdot \frac{c_t}{p_t} \left(\frac{r_t}{1+r_t} \right)^{-1}$$

and

$$\frac{S_t M^*_t}{p_t} = \frac{S_t \gamma \theta}{1-\theta} \cdot \frac{c_t}{p_t} \left(1 - \frac{S_t}{1+r^*_t} \right)^{-1}$$

[16] See Reinhart and Végh (1995) for a summary.

Table 3: Parameter Values			
	Description	*definition*	*value*
r	Domestic real treasury bill interest rate	$i_t - \pi_{t+1}$	-0.01
r^*	foreign real treasury bill interest rate	$i_t^* - \pi_{t+1}^*$	0.015
γ	rate of unofficial dollarization		0.25
z	conditional probability of high given low inflation		0.3
ς	conditional probability of high given high inflation		0.5
σ	preference parameter	$1 - \frac{1+\eta_{cc}}{\theta}$	3.81
θ	preference parameter		0.41
η_{cc}	elasticity of the marginal utility of consumption	$\frac{U_{cc}(c,m).c}{U_c(c,m)}$	-1.67
ω	steady state growth in money supply		0.21
ψ	steady state money to foreign assets		1.1
α	share of capital		0.30
ρ	autocorrelation coefficient		0.92
δ	steady state capital depreciation		0.25

Table 4: Actual and Predicted Co-Movements				
	gdp	*c*	*i*	*m**
Std.Deviation. (%)				
Actual	4.24	3.92	13.53	42.62
Model	7.66	7.74	24.95	14.39
Serial Correlation				
Actual	0.89	0.81	0.79	0.20
Model	0.67	0.64	0.82	0.52
Corr. With GDP				
Actual	1.00	0.91	0.68	-0.36
Model	1.00	0.85	0.62	-0.85

We set $\gamma = 0.25$, average ratio of foreign currency to domestic currency liabilities of the banking system. Using this, θ is obtained from a non-linear least squares estimation of the equation for domestic money demand, where the domestic180-day Treasury bill rate was used as the measure for the opportunity cost measure.

To evaluate the model we compare the co-movements in the aggregate variables, measured in per capita terms, implied by the model to that observed in the data for the Jamaican economy over the period 1970-2001. The evaluation of foreign currency holdings is done over the period 1991-2001 as holdings of these balances were only possible after 1990. The results, presented in Table 4, suggest that the dynamics of the model is broadly consistent with that observed in the data. The implied volatility of investment is higher than the actual, which maybe due to the fact that adjustment costs of capital stock are not accounted for in the model. The evidence on serial correlation indicates that the persistence in the variables generated by the model is similar to that in the actual data. The model correctly predicts that consumption and investment are positively correlated with output and foreign currency holdings are negatively correlated. Thus the model generally captures the co-movements of the main macroeconomic variables and thus permits a sensible analysis of the welfare effects of alternative stabilization policies.

5. WELFARE ANALYSIS

As is standard, the welfare costs of alternative stabilization policies is measured by the fraction of steady-state consumption that households would be willing to forego such that they would be indifferent with respect to their utilities under the various regimes. Specifically, following Grohe and Uribe (2001) let c and m be the non-stochastic steady state values of consumption and currency holdings and $\{c_t, m_t\}$ the equilibrium values for consumption and money for a particular stabilization policy, then the welfare cost of such a policy is given by a constant φ such that

$$U\left((1-\varphi)c,m\right) = EU(c_t, m_t)$$

This implies that a particular stabilization regime is costly if φ is positive and beneficial if negative. φ is estimated by taking a second order Taylor expansion of the above expression around (ln(c), ln(m)). This yields

$$\varphi = 1 - \left[1 + \frac{(1-\sigma)^2}{2} Var(\hat{x}_t)\right]^{\frac{1}{\theta(1-\sigma)}}$$

where $x_t = c_t^{\theta} m_t^{1-\theta}$ and $\hat{x}_t = lnx_t - x$. The welfare costs will be increasing in $Var(\hat{x}_t)$ if σ>1. It should be noted however, than when assessing welfare this way one should see the results as more indicative rather than concrete statements about utility costs.

We consider three different types of stabilization policies. The first is an inflation-targeting regime. This monetary policy framework has been studied extensively in the literature recently for small open economies[17] and has been adopted by a number of emerging market economies. Similar to previous studies, in this paper we assume that

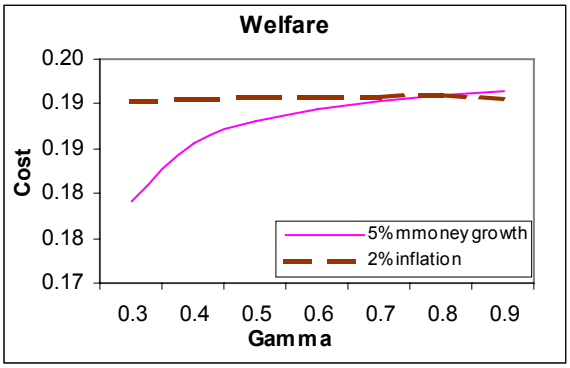
[17] See for example Svensson (2001)

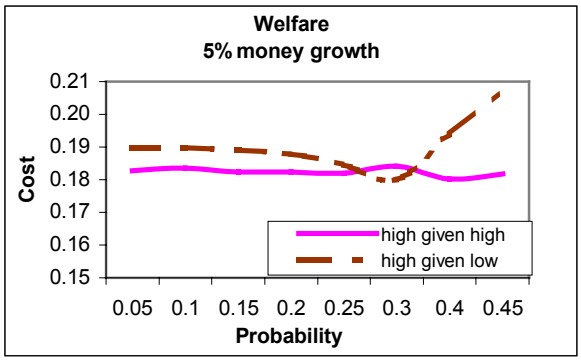
inflation targeting corresponds to a constant inflation rate. Given the assumption about purchasing power parity this implies that $\varepsilon_t = \bar{\varepsilon}$ for all *t*. Inflation targeting in this setting therefore corresponds to a perfectly credible exchange rate based stabilization policy under a free float. The second policy involves monetary stablization, in which the money growth rate is fixed at $\varpi_t = \bar{\varpi}$. The third regime is that of a currency board in which the stock of domestic currency is held in a fix proportion to foreign reserves at a fixed rate. We therefore set ψ=1, $S = 1$ and $\varepsilon_t = 0$. The final policy option considered is the extreme case where the domestic currency is abandoned and monetary policy ceded to an external authority i.e. official dollarization. The only difference between this and the currency board is that there is no domestic currency and as such $\gamma = 1$, $S = 1$, $\varepsilon_t = 0$, ψ=1 and ω is set equal to the trend growth rate of US M2. The nominal interest rate also falls to the US rate.

Table 5 gives the welfare costs associated with the different policy alternatives. The results indicate that dollarization is the most inferior option among the policy alternatives considered. Agents would be willing to give up between 10 percent and 11 percent of their non-stochastic steady state consumption rather than have a dollarized regime. In other words for agents to be as well off in a dollarized economy relative to an inflation targeting or monetary stabilization regime, their consumption path would have to increase by 11 and 10 percent per period. The rationale behind this result arises from the fact that interest rates and relative prices are determined externally in this model under dollarization, thus consumption smoothing would entail either lower levels of consumption overall or higher external debt in the event of a shock to output.

Table 5: Welfare Costs of Alternative Stabilization Policies		
Policy	Welfare Costs	Output (% Std. Dev.)
Inflation Target		
10%	0.190	18.2
5%	0.190	18.2
2%	0.181	18.3
Money Growth Target		
15%	0.187	18.7
10%	0.185	19.6
5%	0.180	23.6
Currency Board	0.191	18.4
Dollarization	0.287	19.9

The most optimal stabilization policy from the perspective of consumer welfare is monetary stabilization. However agents are indifferent at very low levels of inflation between money-based stabilization and inflation targeting. Further, consistent with most predictions, output is generally least volatile in an inflation targeting regime. This is consistent with some of the observations of Mishkin (2000) who concludes that an inflation targeting regime relative to one based on monetary rules does not lead to increase output fluctuations. One reason is that the link between money, output and prices, particularly in the short run, can be obscure and changes from time to time. Given that agents are indifferent between inflation targeting and money based stabilization at low levels of inflation, the lower output volatility would make the former more appealing. A currency board regime is preferred only to official dollarization.





The figures above show the sensitivity of the simulated results for money-based stabilization to variations in key parameters such as the degree of unofficial dollarization,γ, and policy maker's credibility[18]. The latter is measured by the conditional probabilities z and ς. The regimes used correspond to those which had the lowest welfare cost. While there is a slight inverse relation between costs and unofficial dollarization under inflation targeting, the welfare cost of monetary stabilization increases almost exponentially the higher the degree of unofficial dollarization. Generally, the higher the proportion of banking system liabilities denominated in foreign currency, the more ineffective are money-based stabilization programs and hence a movement to an inflation targeting regime could be more beneficial. With respect to credibility, the key measure is the probability of a reversal from a low inflation to a high inflation regime. At low probability levels the welfare cost declines. Beyond a critical threshold, however, as credibility wanes the cost increases significantly, tending towards the cost associated with official dollarization. Thus one can conclude that there is some low level of credibility for which the welfare costs of money base stabilization would be equivalent to that of dollarization i.e. dollarization would be more appropriate.

[18] The simulations are done for parameter values that permit convergence to the optimal value function.

6. CONCLUDING REMARKS

Robinson (2001) argued that dollarization is not an optimal stabilization policy choice for Jamaica. This paper uses a general equilibrium model to study this proposition. In terms of welfare gains, the analysis finds favour with alternate stabilization policies, in particular monetary stabilization. One implication of the results, however, is that as inflation falls a switch to a full fledge inflation targeting regime could be considered.

While the results do indicate the more optimal policy direction, it is important to note that the simulations assumed that the policies were credible and to a lesser extent permanent. In fact the appeal of these results derives from the fact that the private sector believes in the commitment of the policy maker. Ironically this is the same result that extreme policies such as currency boards and dollarization are supposed to ensure. The analysis suggests however, that the alternate mechanisms to establishing credibility are less costly relative to the extreme of relinquishing monetary policy. One such mechanism suggested in the literature is an independent central bank with a conservative governor.

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