Capital Flows, Capital Controls, and Exchange Rate Policy

David Cook
Hong Kong University of Science and Technology

Michael B. Devereux*
Hong Kong Institute of Monetary Research
University of British Columbia
CEPR

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Abstract

Many emerging market economies use different forms of capital controls. Often the use of capital controls is related to the defense of the exchange rate. This paper examines the welfare case for capital controls, and the interaction between capital controls and the exchange rate. The main question is whether capital controls may be justified, in order to gain independence in monetary policy, while at the same time pegging the exchange rate. Our results suggest a very conditional yes to this question, but only when there are capital *outflows*. Surprisingly, there is also a similar case for capital controls in face of capital *inflows* if the economy is on a freely floating exchange rate. But there are always better policies, which if available will eliminate the case for capital controls. As a corollary, our results suggest an optimal exchange rate stance for an economy experiencing capital flows; a country receiving capital inflows should follow a fixed exchange rate, while a country experiencing capital outflows should allow the exchange rate to float .

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Many countries, particularly emerging market economies, impose controls on either inflows or outflows of capital. The arguments for capital controls are quite varied (Dooley 1995), but one central reason for capital controls is that they allow a government to defend a fixed exchange rate while at the same time giving some effectiveness to domestic monetary policy. In a much cited paper, Krugman (1998) makes this case for the imposition of capital controls in the crisis-hit East Asian economies during the 1997-1999 financial crisis in the region.

This paper provides a theoretical analysis of the macroeconomic case for capital controls. Specifically, we ask whether the presence of price setting and nominal rigidities in an open economy offers a case for capital controls. Given that a government may wish to defend an exchange rate, is there a welfare case for imposing capital controls relative to the alternative option of relinquishing domestic monetary policy independence? More generally, we ask whether nominal rigidities offer a case for capital controls at all, even without the constraint of a fixed exchange rate.

Our conclusions are quite novel. We do find a qualified case for capital controls in an economy where the authorities remain committed to a fixed exchange rate. But this pertains only to controls on capital outflows. There is no welfare case for capital inflow controls to protect a fixed exchange rate. Moreover, perhaps surprisingly, we find a symmetric, qualified case for controls on capital inflows when the economy is operating under flexible exchange rates.

The case for capital controls arises because in a macro economy with price stickiness there are generally two distortions, or deviations from efficiency. The first is due to the monopolistic markup of price over marginal cost. The second is due to the stickiness of prices. What we show is that capital controls are only justified when *both* distortions are present. Capital flows may tend to exacerbate the monopolistic distortion when there are sticky prices. For instance, capital outflows under fixed exchange rates are associated with a decline in aggregate demand and a fall in output in the non-tradable goods sector. Because, in our model, output in the non-tradable sector is inefficiently low to begin with, the degree to which capital inflows may exacerbate this under fixed exchange rates may actually decrease welfare. A similar case can be made for capital inflow controls when the exchange rate is freely floating. But the case for capital controls from a macroeconomic welfare perspective is limited because there is always a better policy package, which if it could be employed, would eliminate the need for capital controls. A combination of an optimal monetary rules and an employment subsidy is shown to support a first best policy without the need for capital controls. But even if a country remains committed to a fixed exchange rate, an employment subsidy alone also removes the case for capital controls.

A corollary of our results can also be obtained. Assuming full capital mobility, we show that there is an optimal exchange rate stance for an open economy experiencing capital flows. When the economy is subject to capital inflows, it is better to have a fixed exchange rate. When the economy is experiencing capital outflows, it should follow a flexible exchange rate.

Section 2 lays out the model. Section 3 discusses calibration and solution. Section 4 discusses the case for capital controls and the impact of alternative exchange rate policies. Section 5 concludes.

Section 2: The model

We develop a model of a two sector small economy. The economy produces both tradable and non-tradable goods. Prices in the non-tradable goods sector are pre-set by monopolists. Households wish to consume a composite good that is combined from tradable and non-tradable goods.

2.1 Preferences and budget constraints

The representative agent gets utility from consumption C_t, and disutility from time spent working in the tradables and non-tradables, H_t^T and H_t^{NT}. Work in each sector is perfectly substitutable, so that total work time is $H_t = H_t^{NT} + H_t^T$. We may write the inter-temporal utility function as:

$$E_0 \sum_{t=0} \beta^t (U(C_t) - V(H_t))$$

where U is increasing and concave, and V is increasing and convex. Aggregate consumption is a linear homogenous function of consumption of tradable and non-tradable goods:

$$C_t = \left[a^{-\frac{1}{\phi}} \left(C_t^{NT} \right)^{1-\frac{1}{\phi}} + (1-a)^{-\frac{1}{\phi}} \left(C_t^T \right)^{1-\frac{1}{\phi}} \right]^{\frac{1}{1-\frac{1}{\phi}}}.$$

Where ϕ is the elasticity of substitution between tradable and non-tradable goods. The non-tradable good is in turn defined over the consumption of a continuum of differentiated goods, so that

$$C_t^{NT} = \left[\int_0^1 x_t^{1-\frac{1}{\rho}}(i)di \right]^{\frac{1}{1-\frac{1}{\rho}}}.$$

Standard derivations then imply that the consumer price index and the price index for non-tradable goods are written respectively as:

$$P_t = \left[a\left(P_t^{NT}\right)^{1-\phi} + (1-a)\left(P_t^{T}\right)^{1-\phi} \right]^{\frac{1}{1-\phi}} \qquad P_t^{NT} = \left[\int_0^1 P_t^{NT}(i)^{1-\rho} di \right]^{\frac{1}{1-\rho}}$$

where P_t^T is the common price for all tradable goods, and $P_t^{NT}(i)$ is the price of type i non-tradable good. Each household faces the choice of purchasing current consumption goods, either tradable or non-tradable, working, and accumulating domestic or foreign nominal bonds. The household earns income from wages, profits from the non-tradable goods firms, and returns on domestic and foreign bond holdings. The household's budget constraint is therefore written as:

$$P_t C_t + B_t + S_t B_t^* = W_t H_t + \Pi_t + (1+i_t) B_t + (1+i_t^*) S_t B_{t-1}^* - T_t,$$

where B_t represents the holding of foreign bonds, W_t is the nominal wage, S_t is the nominal exchange rate, and T_t is a government tax.

2.2 Household optimality conditions

The household's optimal choice of bond holdings and labor supply results in the following first order conditions:

(1) $$U'(C_t) = E_t \beta \left(1+i_{t+1}^*\right) \frac{S_{t+1}}{S_t} \left(\frac{P_t}{P_{t+1}} \right) U'(C_{t+1})$$

(2) $$U'(C_t) = E_t \beta \left(1+i_{t+1}\right) \left(\frac{P_t}{P_{t+1}} \right) U'(C_{t+1})$$

(3) $$U'(C_t) \frac{W_t}{P_t} = V'(H_t).$$

Finally, the individual demands for non-tradable and tradable goods are given as:

$$C_t^T = (1-a) \left(\frac{P_t^T}{P_t} \right)^{-\phi} C_t, \quad C_t^{NT}(i) = a \left(\frac{P_t^{NT}(i)}{P_t} \right)^{-\phi} C_t.$$

2.3 Production technologies and profit maximization

A perfectly competitive industry produces tradable goods using the production function:

$$Y_t^T = F^T(H_t^T),$$

where $F^T(.)$ is increasing and concave. The implicit assumption is that there are specific factors, such as capital, that are fixed within each sector. The non-tradable firm *i* has the increasing and concave production function given by:

$$Y_t^{NT}(i) = F^N(H_t^N(i)).$$

Competitive profit maximizing firms in the traded goods sector implies the price is equal to marginal cost.

(4) $$P_t^T F^T{}'(H_t^T) = W_t.$$

In the non-tradable sector, each production firm has market power, and sets the price as a markup over marginal cost. If non-tradable goods prices were perfectly flexible, then the profit maximizing decision for firm *i* would imply:

(5) $$P_t^{NT}(i) F^N{}'(H_t^{NT}(i)) = \frac{\rho}{\rho - 1} W_t,$$

where $\frac{\rho}{\rho - 1}$ represents the monopoly markup.

If non-tradable prices cannot adjust to shocks, then (5) may not hold continually. We discuss this further below.

2.4 Monetary and fiscal policy

We follow the recent literature (Woodford (1999), Clarida et al (2000)) in abstracting from the details of the monetary mechanism, and simply assume that the monetary authority follows a domestic interest rate targeting rule. We may define the domestic nominal interest rate as $(1+i_{t+1})^{-1} = \beta \frac{U'(C_{t+1})}{U'(C_t)} \frac{P_t}{P_{t+1}}$. Then the monetary authority is assumed to follow the rule:

$$(6) \qquad (1+i_{t+1}) = \frac{1}{\beta}\left(\frac{S_t}{S_0}\right)^{\omega}, \quad \omega > 0.$$

The parameter ω represents the coefficient of exchange rate intervention. So long as ω>0, there is a determinate equilibrium value for the nominal exchange rate. The higher, is ω, the closer the monetary rule approximates a pegged exchange rate, where the target for the exchange rate peg is S_0.

The fiscal authority levies taxes, issues bonds, and may offer employment subsidies (see below). We assume that the stock of government bonds outstanding is kept constant. Interest payments and subsidies are financed by the tax levy T_t.

2.4 Equilibrium

An equilibrium of this economy is defined by the conditions resulting from household optimality, profit maximization, satisfaction of the monetary authorities budget constraint, and market clearing conditions. Since non-tradable goods must be both produced and consumed only in the domestic economy, the market clearing condition in the non-tradable sector is written as (since all non-tradable firms are alike, we drop the firm specific subscript hereafter):

(7) $Y_t^{NT} = C_t^{NT}$.

Combining this with the households budget constraint, this implies that the economies external balance of payments relationship is

$$(8) \qquad B_{t+1}^* = (1+i_t^*)B_t^* + \frac{P_t^T}{S_t}(C_t^T - Y_t^T).$$

Finally, we assume that the tradable goods price obeys the `law of one price' condition

(9) $P_t^T = S_t$,

where the foreign currency price of the tradable good is normalized to unity.

Section 3. Capital flows and welfare

3.1 Perfect foresight equilibrium

First take a perfect foresight equilibrium where agents have full knowledge of the path of the money supply and foreign interest rates from date zero. In addition, assume that the foreign interest rate is constant, and equal to the domestic rate of time preference, so that $\beta(1+i^*)=1$. Then if the economy starts out with a zero net foreign asset position, it is easy to establish that a steady state equilibrium is attained at date zero, where the current account is zero, and consumption and output are constant over time. This equilibrium may be described by the following conditions, which give the four equilibrium values of $\bar{H}^{NT}, \bar{H}^T, \bar{p}^N, \bar{C}$

(9) $$F^{NT}(\bar{H}^{NT}) = a\left(\frac{p^N}{\Gamma(p^N)}\right)^{-\phi}\bar{C}$$

(10) $$F^T(\bar{H}^T) = (1-a)\left(\frac{1}{\Gamma(p^N)}\right)\bar{C}$$

(11) $$\frac{\rho}{\rho-1}F^{T}{}'(\bar{H}^T) = p^N F^{N}{}'(\bar{H}^{NT})$$

(12) $$U'(\bar{C})\frac{F^{T'}(\bar{H}^T)}{\Gamma(p^N)} = V'(\bar{H}^{NT}+\bar{H}^T)$$

where $\Gamma(p^N) = \left[ap^{N(1-\phi)}+(1-a)\right]^{\frac{1}{1-\phi}}$, and $p^N = {P^{NT}}/{S}$. From the solutions given by this system, we may recover all other variables.

3.2 Monetary policy

The equilibrium depends on the stance of monetary policy. If all prices are perfectly flexible, then monetary policy determines only the level of domestic prices and the domestic nominal interest rate. If however, the non-traded goods prices is pre-set, then the monetary policy rule is important for the path of real variables in the economy, following an unanticipated shock. The stance of monetary policy is determined by the single parameter ω.

3.3. Interest rate shocks

Our objective is to ask whether from a welfare perspective, it may be warranted for the authorities of the small economy to limit foreign capital inflows (net borrowing) or outflows (net lending). To analyze the effects of capital flows in a simple way, we conduct the following simple experiment. Let the foreign interest rate unexpectedly rise above (fall below) the domestic rate of time preference for period zero $\beta(1+i_1^*) > 1$ ($\beta(1+i_1^*) < 1$). Following this, the foreign interest rate returns back to the domestic rate of time preference, so that $\beta(1+i_t^*) = 1$ for all $t > 1$. If the economy starts out in the steady state position described in the previous paragraph, then the appendix shows that this perturbation in the foreign interest rate will generate a period zero current account surplus (deficit) if the foreign interest rate rises above (falls below) the domestic rate of time preference. Following this however, in period 1 and for all future periods, the current account will be zero, and consumption, labor supply, and the relative price of non-tradable goods will be constant. The effect of this shock will depend critically on whether prices can respond immediately or not. We first illustrate the impact when all prices can respond. But the central results pertain to the case where the non-tradable goods prices cannot adjust at the time of the interest rate shock.

3.4 Calibration

In general there is no closed form solution to this model, except in the steady state, without capital flows. In order to obtain results, we calibrate the model, and obtain the solution numerically. In order to calibrate, we make the following assumptions with respect to functional forms. Let the utility function be:

$$\frac{C^{(1-\sigma)}}{1-\sigma} - \frac{\eta}{1+\psi} H^{1+\psi}.$$

The parameter σ represents the inter-temporal elasticity of substitution, and ψ represents the inverse of the elasticity of labour supply. In addition, the production functions for traded and non-traded goods respectively are:

$$F^{T} = A^{T}(H^{NT})^{\gamma}, \quad F^{NT} = A^{NT}(H^{NT})^{\alpha} \quad \alpha < 1, \gamma < 1.$$

Table 1 reports the baseline calibration assumptions. We follow the open economy macro literature in picking parameter values. The inter-temporal elasticity of substitution is set at 2, following Backus, Kydland and Kehoe (1995). The rate of time preference is set at 0.05, so the subjective discount factor is 0.952. The value of η is unimportant for welfare results, just determining scale, so we set it arbitrarily to unity. The share of non-traded goods in the consumer price index is set at 0.5, following the evidence cited in Schmitt and Uribe (2000) for Mexico and Cook and Devereux (2001) for Malaysia and Thailand. The elasticity of labour supply is set to 0.5, so that $\psi = 2$. This is roughly in the middle of the various estimates of labor supply in the literature, based on micro evidence and aggregate macro data (reference?). The elasticity of substitution between non-traded and traded goods is set at 1.5. This accords with the assumptions made in Backus Kydland and Kehoe (1995) over the elasticity of substitution between home and foreign goods. The elasticity of substitution between varieties of non-tradable goods is ρ, and this governs the equilibrium markup of price over cost in the non-traded good sector. We assume that this markup is 20 percent. This is slightly higher than the common value of 10 percent (e.g. Basu and Fernald 1997) used for international macro studies of the industrial economies, but it is likely that markups are higher in emerging markets. We assume that non-traded goods production is relatively labour intensive, with $\alpha = 0.7$, and traded goods is relatively non-labour intensive, with $\gamma = 0.3$. Evidence of this from East Asian data is presented in Cook and Devereux (2001). Finally, we vary the interest rate adjustment parameter ω, between 0.01, which represents a case where the monetary authority is content to allow significant adjustment in the nominal exchange rate, and 9000, representing a case where the monetary authority essentially keeps the exchange rate pegged. In addition, in the analysis below we examine an optimal monetary rule that lies between these two values.

Table 1: Baseline Calibration

Variable	**Value**	**Variable**	**Value**
σ	2	ϕ	1.5
β	0.952	ρ	6
η	1	α	0.7
a	0.5	γ	0.3
ψ	2	ω	0.01, 9000

Section 4. The impact of capital flows

4.1 Welfare evaluation

We now examine the impact of changes in the rest of the world interest rate (as defined in section 3.3 above) on the current account, the real exchange rate, output and welfare in the domestic economy. As noted above, the starting point is assumed to be the economy in initial steady state with zero net debt, defined by the system (9)-(12). Given the calibration set out in Table 1, a value of the world interest rate of 0.05 produces this steady state.

We define the first period current account as B_1^*, the real exchange rate as $\frac{P_1^{NT}}{P_1}$ (the relative price of non-traded goods in terms of the domestic CPI), and output is defined as the CPI deflated sum of production in the non-traded and traded goods sector:

$$\frac{p_1^N F^{NT}(H_1^{NT}) + F^T(H_1^T)}{\Gamma(p_1^N)}.$$

The impact of an interest rate change is examined under two alternative pricing regimes. In the first regime, it is assumed that the non-traded goods price can adjust immediately so as to ensure that the condition (5) holds at all times. In the second regime, it is assumed that the non-traded goods price is sticky (at the level implied by the original equilibrium with $i^* = 0.05$), and takes one period to fully adjust to the interest rate shock. Since the future path of the interest rate after time period $t = 1$ is known, by assumption, the non-traded goods price will adjust to its new steady state level at time $t = 2$.

4.2 Capital flows with fixed exchange rates

The flexible price case

Figure 1 illustrates the impact of variations in the interest rate on the period 1 levels of output, the real exchange rate, the current account, and overall lifetime welfare. This Figure pertains to the case $\omega = 9000$, so the exchange rate is held fixed. Both the flexible price and case where the price of the non-traded good is sticky for the first period is illustrated. Since the impact of interest rate changes is symmetric, we discuss only the effects of an foreign interest rate increase.

Figure 1a shows that beginning at current account balance, a temporary interest rate increase will raise GDP in the flexible price case. The rise in the interest rate will cause a fall in current consumption and a rise in future consumption, causing a rise in current labour supply and output. But the rise in the interest rate simultaneously generates a real exchange rate depreciation (Figure 1b), as the fall in consumption reduces the current demand for non-traded goods. Figure 1e and 1f shows the breakdown of the response of overall output between the two sectors. Non-traded output is subject to conflicting effects. Consumption falls, reducing demand for non-tradable goods, but then the real exchange rate depreciation generates a counterbalancing increase in demand for non-tradable goods. With flexible prices, these things counterbalance each other, and non-tradable goods output is essentially constant. Traded good output rises, as the fall in the real wage stimulates higher employment in that sector.

From Figure 1d, we then see that lifetime welfare rises in response to the temporary rise in the foreign interest rate. Note that the Figure 1d illustrates that welfare rises for any foreign interest rate change, whether it is a rise or a fall. This is to be expected. When the non-traded goods price can adjust immediately, the small economy gains from capital markets, whether there is a capital outflow ($\beta(1+i_1^*)>1$) or a capital inflow ($\beta(1+i_1^*)<1$).

A key element of the adjustment process, illustrated in Figure 1b and 1g, is that the real exchange rate depreciation cushions the full impact of the rise in world real interest rates on consumption. The first period depreciation leads to a rise in the effective domestic real interest rate defined as $(1+i_1^*)\frac{S_2}{S_1}\frac{P_1}{P_2}$, that is less than the rise in the world interest rate, $(1+i_1^*)$.

The fixed price case

Now let us examine the case where the non-traded good price cannot adjust to the interest rate change. In this case Figure 1a illustrates that domestic GDP falls as the interest rate rises. Again, the rise in the interest rate will cause a fall in current consumption, and a rise in labour supply. But with the non-traded good price temporarily sticky, the lower domestic wage has no affect on output in this sector, and instead output falls due to the fall in domestic demand. Figure 1b shows that the real exchange rate is unaltered by the interest rate increase, as both the nominal exchange rate and the non-tradable good price are fixed. The absence of real exchange rate depreciation has two effects. First, it leads to a greater fall in the demand for non-tradable goods than in the flexible price case, and it leads to a greater fall in consumption than in the flexible price case (Figure 1g). This means that non-tradable goods production (Figure 1e) falls significantly more in the presence of sticky prices. On the other hand, the tradable good sector expands by more, due of the greater fall in the equilibrium wage rate with fixed exchange rates and sticky prices.

Figure 1d shows that welfare falls in response to a rise in the interest rate in the fixed price economy. On the other hand, welfare rises when there is a fall in the interest rate. Conditional on the pre-set price of the non-tradable, welfare is actually higher in this case than in the flexible price economy when the interest rate falls. Numerous sensitivity experiments indicate that this result is quite general. In the presence of price stickiness in the non-tradable goods sector, and fixed exchange rates, capital outflows (the case $\beta(1+i_1^*)>1$) tend to reduce welfare, while capital inflows (the case $\beta(1+i_1^*)<1$) tend to raise welfare. The essential intuition behind this finding is linked to the presence of the monopolistic distortion in price setting. We discuss this further below.

4.3 Capital flows with flexible exchange rates

Now we assume that exchange rates are flexible. We set $\omega = 0.01$ in the interest rate rule above. Figure 2 illustrates the impact of interest rate changes in this case. The results for the flexible price economy are the same as in Figure 1. But with fixed prices, the results are quite different. The flexible exchange rate rule leads GDP to rise in response to a rise in the foreign interest rate, and output rises by even more than in the flexible price economy. The explanation can be seen by looking at Figure 2b and 2g. The rise in the interest rate generates a real exchange rate depreciation. The depreciation exceeds that of the flexible price economy. This acts so as to reduce the effective real interest rate relative to that of the flexible price economy, and so therefore current aggregate consumption falls by less. The combination of a smaller drop in consumption and a larger real exchange rate appreciation leads to a *rise* in output of the non-tradable sector, while the same factors lead to a level of tradable good output that is essentially unchanged. As before, the rise in the foreign interest rate leads to a domestic current account surplus.

Figure 2d illustrates the welfare results. With flexible exchange rates, welfare rises in response to an interest rate increase, by more than it would if non-traded goods prices were flexible. At the same time, welfare falls in response to a fall in the world interest rate. Therefore, in utility terms, the economy under a flexible exchange rate has precisely the opposite implications to that under fixed exchange rates. Capital inflows tend to reduce welfare, while capital outflows tend to increase welfare.

4.4 The role of pricing distortions

Standard results from international macro theory would suggest that a country gains from international capital inflows and outflows. We see that these gains are realized when non-tradable prices are flexible. But in the presence of price stickiness, capital outflows generate losses under a pegged exchange rate, while capital inflows incur welfare losses under a flexible exchange rate (when capital flows are generated by interest rate differentials between the home and the foreign country). What is the explanation behind these findings? The important feature of the economy is that the monopolistic pricing distortions lead to an inefficiently low level of output in the non-tradable good sector. This is a feature of the economy with or without price stickiness. But the combination of capital flows and sticky prices tends to exacerbate this inefficiency. In the initial equilibrium, when $\beta(1+i^*)=1$, the two alternative monetary policies lead to the same outcome, as prices are set at the optimal level. But when there is an unanticipated rise in the foreign interest rate, and the exchange rate is pegged, there is a fall in non-tradable output, and thus output in this sector moves further away from its efficient level. This causes overall welfare to fall. Similarly, with a flexible exchange rate, a fall in the world interest rate causes a big real appreciation, and a fall in non-tradable output, again pushing it further away from its efficient level. The same argument works in reverse when the interest rate falls under a pegged exchange rate, or rises under a flexible exchange. In both cases, non-tradable output increases, and the economy is pushed more towards its efficient level.

4.5 A case for capital controls?

Should capital flows be prevented?

Our results indicate that capital outflows under pegged exchange rates (or capital inflows under flexible exchange rates) may be welfare reducing. At a superficial level, it might seem that this gives a case for imposing controls on capital outflows or inflows. In particular, it could be used to rationalize a policy of controlling capital outflows when the economy is constrained (perhaps for political reasons) to follow a fixed exchange rate. Figure 3 illustrates the implications of capital outflow controls in the case of a pegged exchange rate. A capital outflow control is assumed here to work perfectly and to be dependent on the foreign interest rate. Assume that the monetary authority sets a tax on the foreign interest earnings, so that the domestic nominal interest rate is

$$(1+i)=(1+i^{*})(1-t),$$

where $t=\dfrac{i^{*}-i}{1+i}$. This policy adjusts the domestic interest rate so as to offset the effect of the foreign interest rate change. It implies that a rise in the foreign interest rate has no affect on the current account, the real exchange rate, output or welfare at all. Thus, compared to the effects of a rise in the foreign interest rate under fixed exchange rate without a capital outflow, this policy does better in welfare terms. There is an equivalent policy for the case of a fall in the foreign interest rate under flexible exchange rates.

But while capital controls may raise welfare relative to a situation of unrestricted capital flows, they are themselves inferior to a number of alternative policies. One clear alternative is a subsidy on the production of non-tradable goods (an employment subsidy given to non-tradable goods producers). If non-tradable goods producers are offered a subsidy equal to s, then the effective wage facing non-tradable producer's is $W(1-s)$. A value of $s=\frac{1}{\rho}$ offsets the monopolistic distortion. Figure 4 illustrates the welfare effects of interest rate changes in the fixed exchange rate economy, when an employment subsidy in the non-tradable good sector is utilized (the qualitative impacts on all other variables is the same as in Figure 1). We see that the perverse welfare response of an interest rate increase is eliminated. Welfare rises now, whether the interest rate rises or falls. The standard gains from international capital flows are restored. Note that, due to the sticky price in the non-tradable good sector, welfare is still lower than under flexible prices everywhere except at the point where the non-traded good price is at the optimal level ($\beta(1+i^*)=1$). Nevertheless, when the underlying monopolistic distortion is eliminated directly by fiscal policy, the case for capital controls is eliminated.

Do capital controls allow an independent monetary policy?

A common argument in the discussion of international macroeconomic policy is that capital controls may be used to allow for an independent monetary policy while still maintaining a fixed exchange rate. From the last paragraph, Figure 3 gives an example of this. A tax on foreign lending that varies with the difference between the domestic and foreign interest rate allows the economy to keep it domestic real interest rate constant, despite having a fixed exchange rate. Thus monetary policy independence is obtained by use of capital controls.

But despite this, it would be better for the economy to use an active monetary policy rule that allows for exchange rate adjustment. From the results of Figure 1 and Figure 2, we might guess that there was an intermediate value of ω which did better in welfare terms than either a fixed exchange rate or a flexible exchange rate. From our baseline model, we find that the value $\omega \approx 1.1$ leads the economy with sticky prices to replicate that flexible price economy, in response to fluctuations in the foreign interest rate. Thus, in terms of Figure 1, loci for the flexible and fixed price economies would overlap when monetary policy is adjusted optimally in this way.

Intuitively, an optimal monetary policy rule ensures that all real exchange rate adjustment is accomplished through nominal exchange rate adjustment, so that the non-tradable good price would not change in response to changes in the foreign interest rate, even in the flexible price economy. This therefore eliminates the real consequences of nominal price stickiness.

From this perspective, we see that an optimal monetary policy rule always dominates a policy of capital controls. At most, capital controls can prevent movements in foreign interest rates from causing welfare losses. But if monetary policy is used optimally, then the economy can exploit changes in the foreign interest rate to obtain welfare gains.

Finally, although an optimal monetary rule can cause the economy with sticky prices to mimic the flexible price economy, there is still a monopolistic pricing distortion. A jointly optimal fiscal and monetary rule (a first best rule) would combine the employment subsidy to non-tradable producers with an optimal monetary rule. But capital controls are not a component of this optimal policy package.

4.6 Exchange rate policies and capital flows

The model also has implications regarding the appropriate exchange rate policies to deal with capital flows. It has been quite widely observed that emerging market economies often try to keep their exchange rate fixed in face of strong capital inflows. Sometimes this is rationalized by the argument that the authorities wish to prevent excessive real exchange rate appreciation. Although our model can only partially capture the set of issues related to capital flows in emerging markets, it does provide a welfare-based explanation of why an emerging economy would like to keep its exchange rate fixed in face of capital inflows. Take Figures 1 and 2 again, and imagine that they deal with the situation of an emerging market economy opening up its capital market to the outside world. If the rest of the world's interest rate is lower than the domestic rate of return, then the country will receive capital inflows. If in addition, the adjustment process is characterized by price rigidities in the non-traded goods sector, then Figures 1 and 2 indicate that the authorities are better off to keep the exchange rate fixed in face of the capital inflow. By fixing the exchange rate, they can prevent excessive real exchange rate appreciation that would occur under a fully flexible exchange rate. Under a fixed exchange rate, the economy gains from capital inflows, whereas it would lose under a flexible exchange rate.

The situation is reversed when the capital market liberalization leads to capital outflows. Using the same logic, the country would be better off to allow the exchange to float. By doing so, it would facilitate the necessary real exchange rate depreciation, ensuring that capital outflows raise welfare. A fixed exchange rate, by contrast, would prevent real depreciation, and the capital inflows would reduce welfare.

Of course, in both cases, it is important to qualify the argument by stating that the best policy, if it was available, would still be to eliminate the pricing distortion and use the optimal monetary rule.

Section 5. Conclusions

This paper has provided a welfare-based analysis of the policy trade off between independent monetary policy, exchange rate stability, and capital mobility. A central question was whether it made sense to employ capital controls to give some monetary freedom under the constraint of a fixed exchange rate. We found a limited case argument for capital controls in this context, if controls are designed to prevent capital outflows. But there are always better policies available, even in the presence of the exchange rate constraint. Moreover, surprisingly, we find that there is a symmetric argument for inflow controls under floating exchange rates. Finally, the model suggests that the appropriate exchange rate policy for capital inflows may be different than that for capital outflows.

Of course, there may be other reasons to use capital controls that are not analyzed here. For instance, capital controls might be used to reduce the risk of financial crises by altering the maturity structure of debt, as in the Chilean experiment (see Edwards). Nevertheless, at least some of the impetus for capital controls comes from its ability to gain independence in macroeconomic policy under a fixed exchange rate (e.g. Krugman 1998). Our results suggest that the case for this is quite limited.

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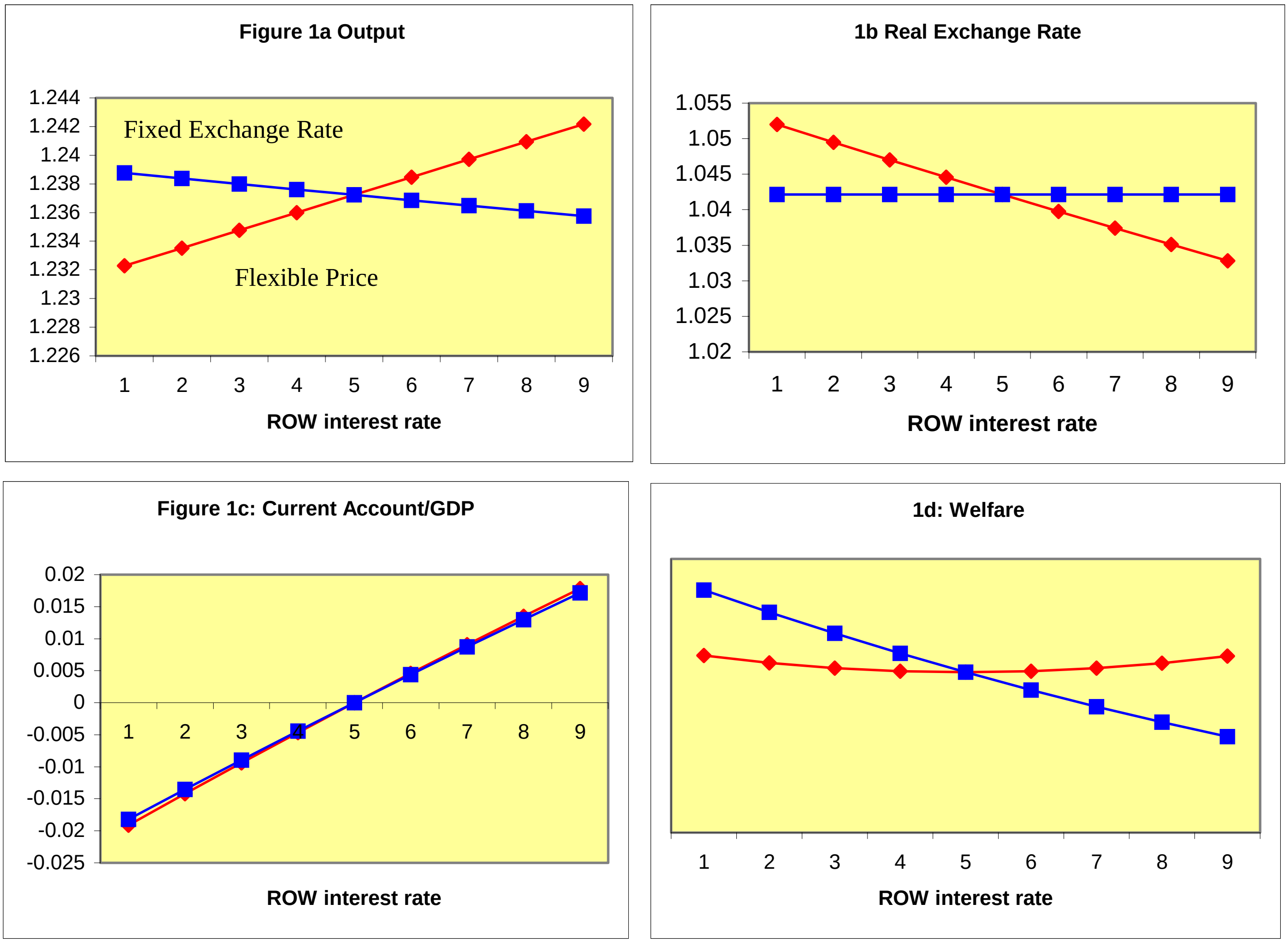
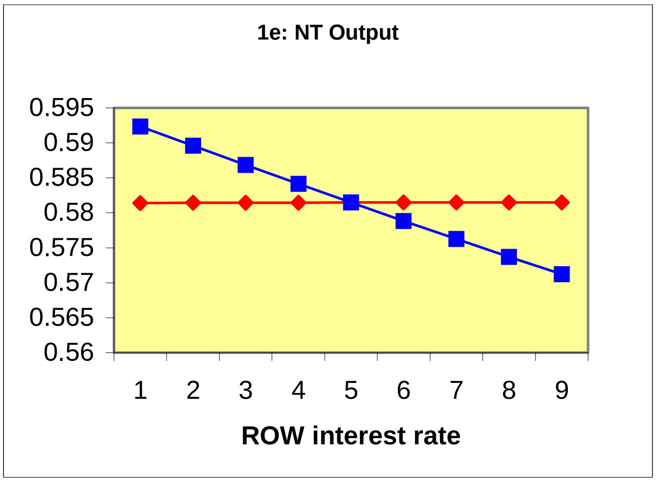


Figure 1a Output
Fixed Exchange Rate
Flexible Price
1.244
1.242
1.24
1.238
1.236
1.234
1.232
1.23
1.228
1.226
1 2 3 4 5 6 7 8 9
ROW interest rate
1b Real Exchange Rate
1.055
1.05
1.045
1.04
1.035
1.03
1.025
1.02
1 2 3 4 5 6 7 8 9
ROW interest rate
Figure 1c: Current Account/GDP
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
1 2 3 4 5 6 7 8 9
ROW interest rate
1d: Welfare
1 2 3 4 5 6 7 8 9
ROW interest rate



1e: NT Output
0.595
0.59
0.585
0.58
0.575
0.57
0.565
0.56
1
2
3
4
5
6
7
8
9
ROW interest rate

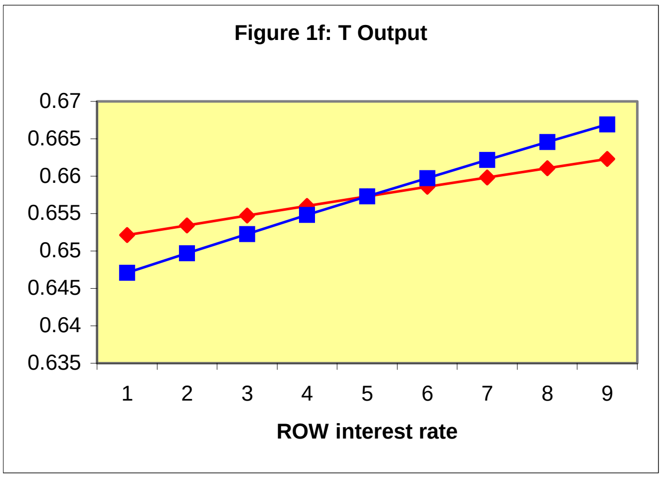


Figure 1f: T Output
0.67
0.665
0.66
0.655
0.65
0.645
0.64
0.635
1
2
3
4
5
6
7
8
9
ROW interest rate

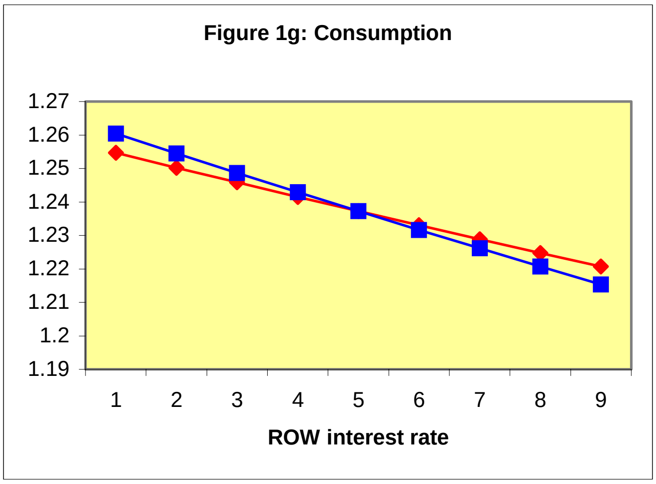
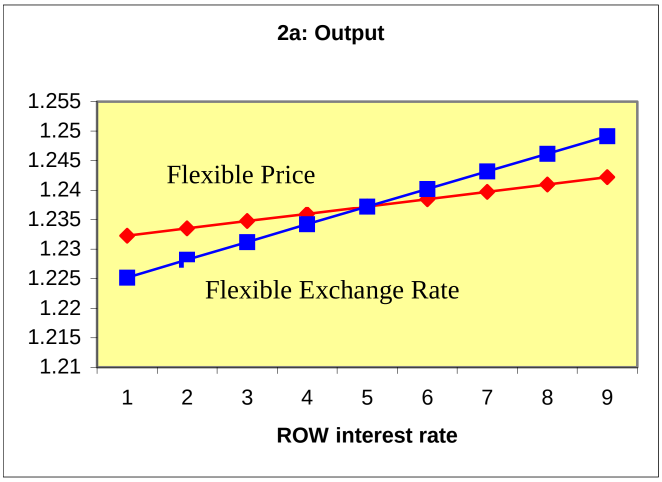


Figure 1g: Consumption
1.27
1.26
1.25
1.24
1.23
1.22
1.21
1.2
1.19
1
2
3
4
5
6
7
8
9
ROW interest rate


2a: Output
1.255
1.25
1.245
1.24
1.235
1.23
1.225
1.22
1.215
1.21
Flexible Price
Flexible Exchange Rate
1 2 3 4 5 6 7 8 9
ROW interest rate

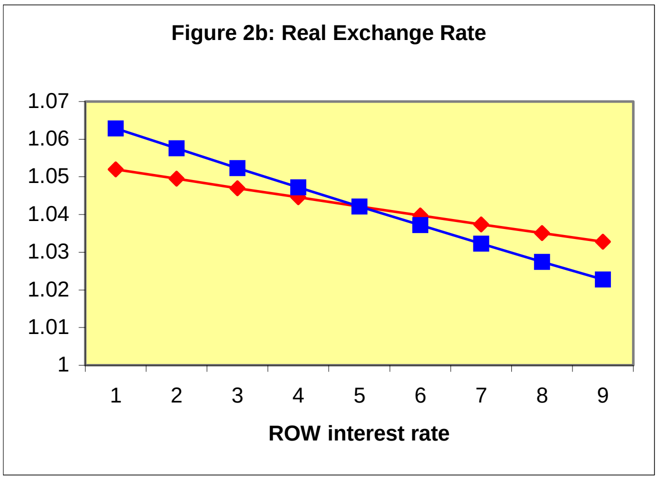


Figure 2b: Real Exchange Rate
1.07
1.06
1.05
1.04
1.03
1.02
1.01
1
1 2 3 4 5 6 7 8 9
ROW interest rate

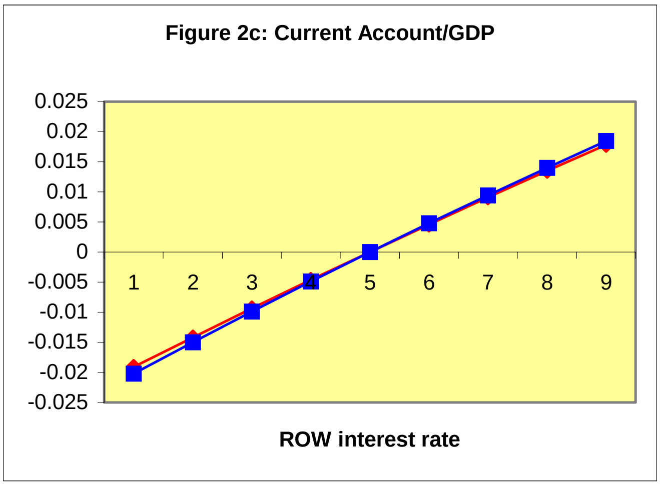
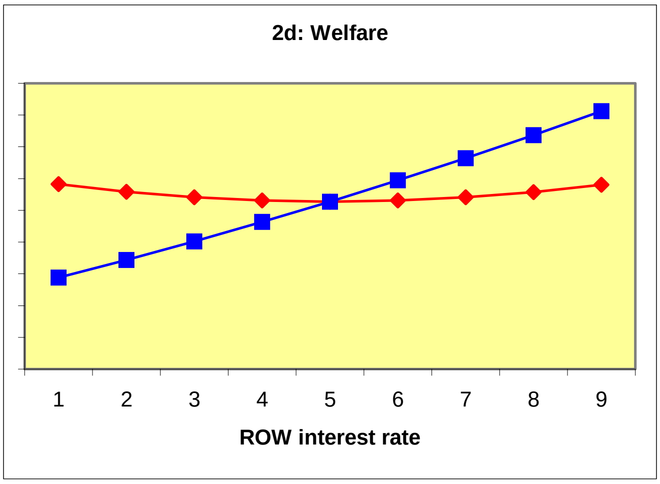


Figure 2c: Current Account/GDP
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
1 2 3 4 5 6 7 8 9
ROW interest rate


2d: Welfare
1 2 3 4 5 6 7 8 9
ROW interest rate

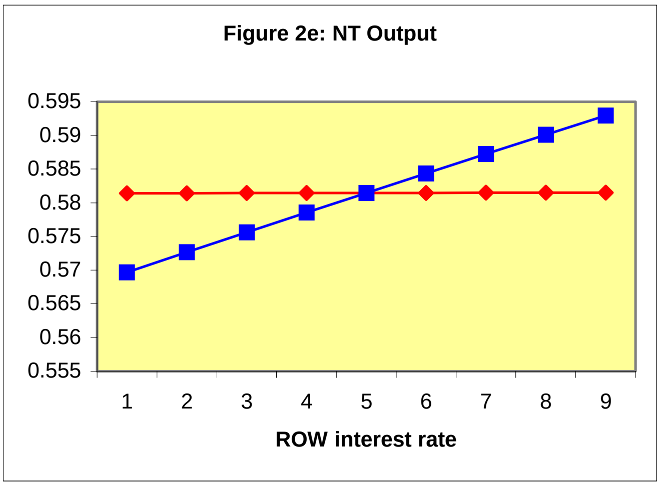


Figure 2e: NT Output
0.595
0.59
0.585
0.58
0.575
0.57
0.565
0.56
0.555
1 2 3 4 5 6 7 8 9
ROW interest rate

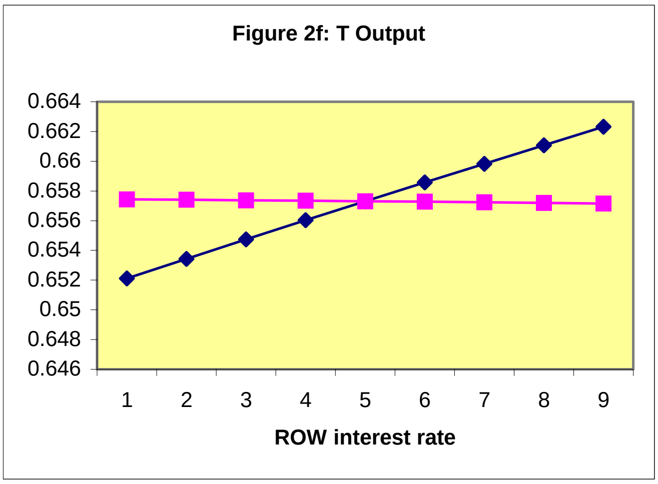


Figure 2f: T Output
0.664
0.662
0.66
0.658
0.656
0.654
0.652
0.65
0.648
0.646
1 2 3 4 5 6 7 8 9
ROW interest rate

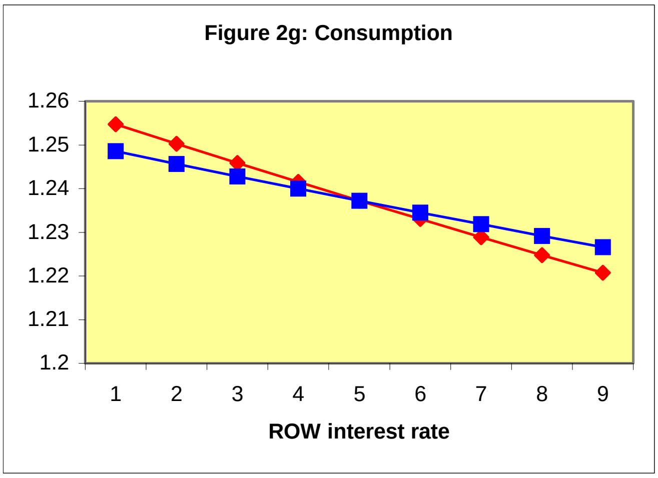


Figure 2g: Consumption
1.26
1.25
1.24
1.23
1.22
1.21
1.2
1 2 3 4 5 6 7 8 9
ROW interest rate

Figure 3a: Output

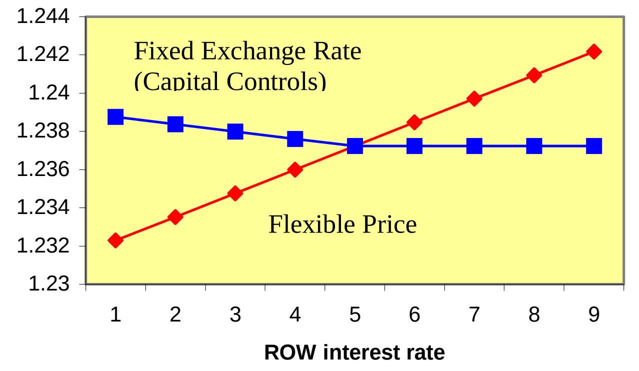


Figure 3b: Real Exchange Rate

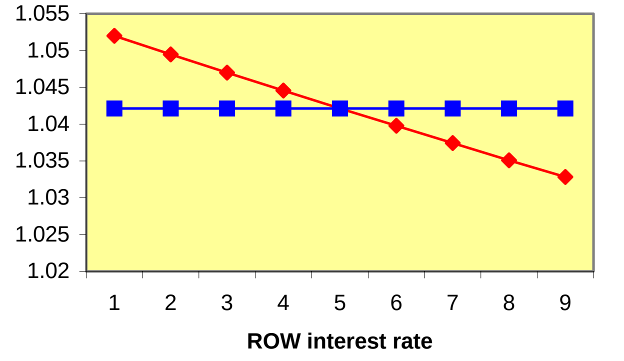


Figure 3c: Current Account/GDP

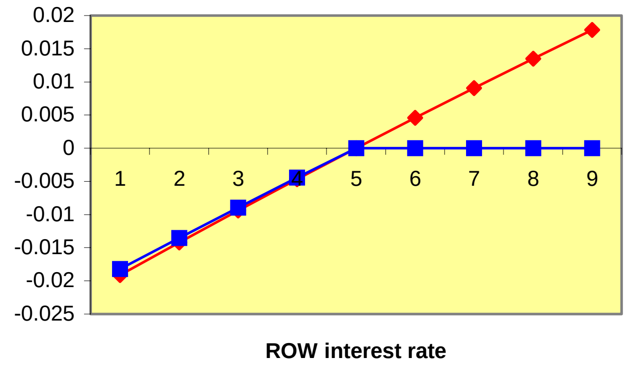
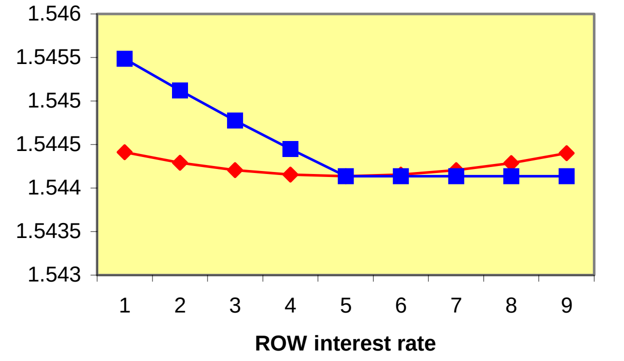


Figure 3d: Welfare



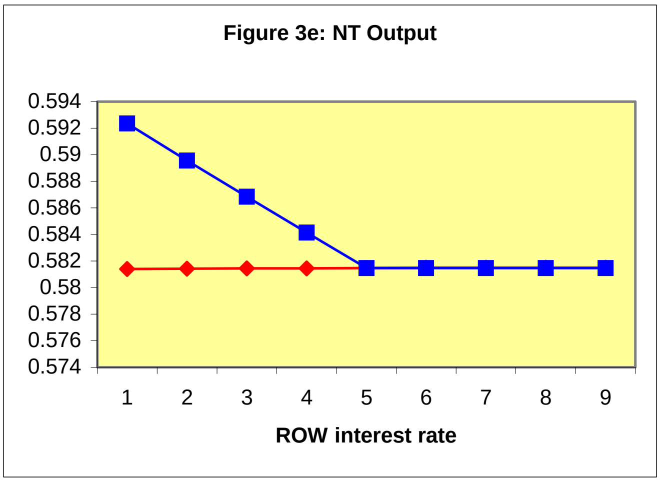


Figure 3e: NT Output
0.594
0.592
0.59
0.588
0.586
0.584
0.582
0.58
0.578
0.576
0.574
1 2 3 4 5 6 7 8 9
ROW interest rate

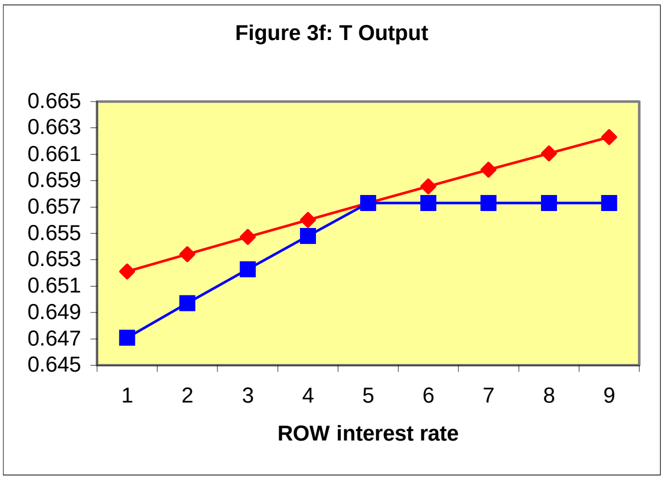


Figure 3f: T Output
0.665
0.663
0.661
0.659
0.657
0.655
0.653
0.651
0.649
0.647
0.645
1 2 3 4 5 6 7 8 9
ROW interest rate

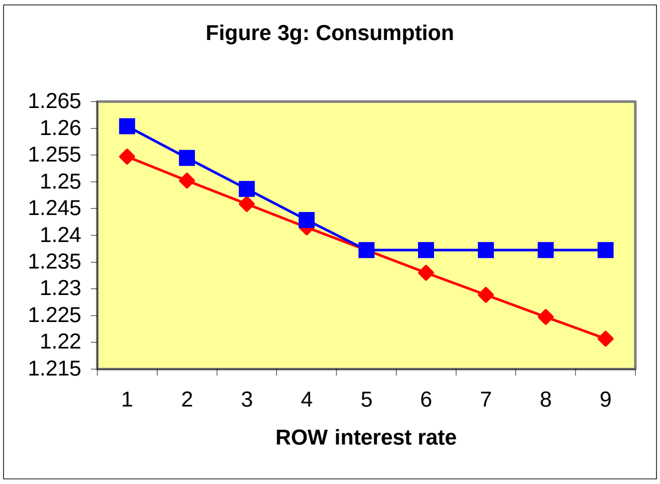


Figure 3g: Consumption
1.265
1.26
1.255
1.25
1.245
1.24
1.235
1.23
1.225
1.22
1.215
1 2 3 4 5 6 7 8 9
ROW interest rate

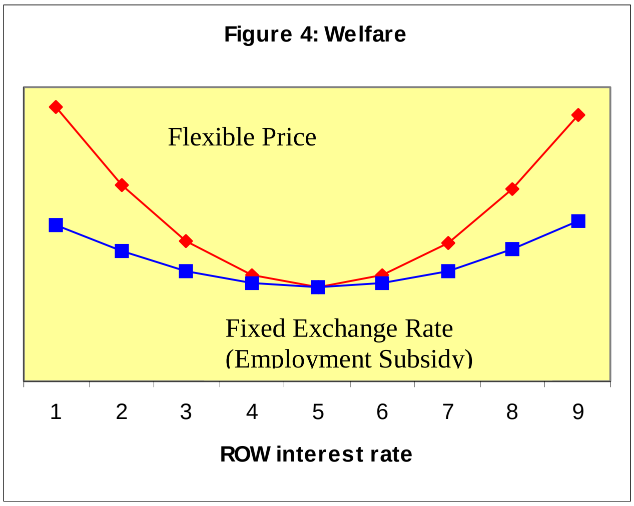


Figure 4: Welfare
Flexible Price
Fixed Exchange Rate
(Employment Subsidy)
1 2 3 4 5 6 7 8 9
ROW interest rate