Chapter three

1. Economic stability and financial flows

In recent years there has been a growing trend towards capital account liberalization and integration of small open economies into world financial markets. According to classical economic theory, access to foreign capital should increase economic stability since economic agents are better able to adjust their assets in order to smooth consumption. However, at the same time, easier borrowing also translates into a more forceful inter-temporal substitution in response to expected changes in relative prices. Thus while counter-cyclical exchange rate policy and free capital transactions might work separately to promote economic stability, the combined results might be less advantageous and possibly counter-productive. Free capital transactions have been reputed to create economic volatility and it is an open question as to what goals exchange rate targeting, either explicit or implicit, can deliver under increasing financial mobility. In this third and final chapter I conduct the exact same policy experiments, analyzing the same export shocks in the same policy regimes; the only thing which differs is that the capital account is now open

1.1. Capital transactions

In order to incorporate capital account transactions in the simplest possible manner, we will assume that world market interest rate r equals the time preference rate ρ to rule out infinite borrowing. We will also assume that the government's foreign exchange reserves are invested in foreign bonds and that interest income from the bonds is rebated to the public in a lump sum fashion. Let F denote private sector holdings of foreign bonds, G the government's foreign exchange reserves and A the asset portfolio of the representative agent. Then we can write budget and wealth constraints as follows,

$$E = P_x Q_x + P_n Q_n - S + re(F + G); \quad (1.1)$$

$$A = M + eF. \quad (1.2)$$

Money creation depends on government reserve accumulation; from the central bank's balance sheet we have;

$$M = eG. \quad (1.3)$$

M is no longer predetermined since each agent can instantaneously swap M and F through capital account adjustments. It is the sum of the assets, $M + eF$, which is now predetermined since total foreign assets can only change by either current account surpluses or deficits. Observe also that asset swaps do not change real income because variations in F and G are offsetting at any given point in time. It should also be noted that exchange rate adjustments do not directly affect the money supply since variations in e only change the valuation of reserves accumulated earlier and do not affect M. We can therefore state the current account as,

$$S = e(G + \dot{F}). \tag{1.4}$$

Time differentiation of (1.2) yields an expression for the asset dynamics,

$$\dot{A} = \dot{M} + e\dot{F} + \omega eF, \tag{1.5}$$

where $\omega = \frac{\dot{e}}{e}$. If equations (1.4) and (1.5) are combined we simply obtain an expression stating that nominal wealth accumulation equals nominal savings plus capital gains or losses brought about by changes in the nominal exchange rate,

$$\dot{A} = S + \omega eF. \tag{1.6}$$

1.2. The optimization problem

The new optimization problem can be written as follows

$$\underset{\{E,S,F\}}{Max} \int \left[V(e; P_n; E) + \phi\left(\frac{M}{P}\right) \right] e^{-\rho t} dt$$

Subject to;

$$(1.1), (1.2) \text{ and } (1.6)$$

After substituting for E and M, we can write the Hamiltonian;

$$H = e^{-\rho t} \left[V(e; P_n; P_x Q_x + P_n Q_n - S + re(F + G)) + \phi\left(\frac{A - eF}{P}\right) + \mu(S + \omega eF) \right]$$

The first order conditions are

$$V_E(e; P_n; P_x Q_x + P_n Q_n - S + re(F + G)) = \mu; \tag{1.7}$$

$$r + \omega = \frac{\phi'}{PV_E}; \tag{1.8}$$

The co-state equation reads,

$$\dot{\mu} = \rho\mu - \frac{\phi'}{P};$$

$$\Rightarrow \dot{\mu} = (\rho - r - \omega)V_E = -\omega V_E \tag{1.9}$$

Now if we combine the budget constraint (1.1) and nominal asset changes (1.6) we obtain the following description of the current account dynamics;

$$S = \dot{A} - \omega eF = P_xQ_x + P_nQ_n + re(F + G) - E \tag{1.10}$$

Furthermore, with the aid of (1.5) we can write;

$$\dot{M} + e\dot{F} = P_xQ_x + P_nQ_n + re(F + G) - E \tag{1.11}$$

Finally if we differentiate the Central Bank's balance sheet identity (1.3) we can substitute for $e\dot{G}$ and obtain a solution for the current account measured in foreign currency;

$$\dot{G} + \dot{F} = \frac{1}{e}(P_xQ_x + P_nQ_n + re(F + G) - E) \tag{1.12}$$

2. Permanent shocks

When capital controls were in place, cash balances were the only asset available as a vehicle for savings. Consequently, dissaving, led to lower money holdings and rising opportunity costs stemming from foregone transaction services. However, under perfect capital mobility, the interest rate is fixed. The private agent has the option of holding foreign bonds and the use of money as an asset becomes secondary to transaction services it provides. Money demand and expenditure will therefore tend to move in same direction since dissaving implies a higher expenditure and increasing numbers of transactions and vice versa. Moreover, since the private agents can instantaneously swap M and F, there is nothing to prevent instantaneous adjustment to a new equilibrium in response to an external change. Intuition therefore suggests that permanent changes in the export price will lead to an immediate adjustment of choice variables in line with either a gain or loss in real income without affecting savings or the current account balance.

To verify that this is indeed the right solution, suppose that μ jumps immediately to its new steady state level and stays there throughout the adjustment process. Since $\omega = 0$ (e jumps at $t = 0$ but does not change thereafter), equation (1.9) then implies that $\dot{\mu} = 0$. Given this, (1.7) and the market clearing condition for the non-tradables sector must imply that the paths E and P_n are flat after an instant reaction to the change in the export price. Equation (1.11) then states that the current account only remains at zero if $d(\frac{E}{e}) = Q_x dP_x^*$. In other words, since the change in the export price is discrete and final the change in the exchange rate must also be discrete and final. After this line of reasoning it is clear that according eq. (1.8) the path of M will stay flat after an initial jump.

We can therefore conclude that a capital account liberalization will only alter the speed of adjustment since the stationary equilibrium is determined by economic fundamentals and external conditions. The variables in question E, e, P_n, F and M will just jump from one stationary equilibrium to the next in response to external changes without any transitional dynamics.

3. Temporary shocks

3.1. Transitional dynamics

When the shocks are transitory the variables are not tied down by economic fundamentals and policy expectations can influence spending and savings decisions. However, the same logical reasoning previously applied for permanent shocks can be used to determine the transitional dynamics. If $\omega = 0$ then according to eq. (1.9) the multiplier μ is constant over the entire time horizon after a possible jump at $t = 0$. Given that, the first order condition (1.7) clearly dictates that the paths of E, P_n and e are flat apart from instantaneous and discrete reactions to changes in P_x^*. Equation (1.8) establishes the same result for M. This discreteness simplifies the current account dynamics. If we time differentiate the budget constraint (1.1) we obtain,

$$\dot{S} = re(\dot{F} + \dot{G}). \tag{3.1}$$

Furthermore, if we use the Central bank's balance sheet (1.3) to substitute for $e\dot{G}$ and the expression for the current account balance (1.4) then the following first order differential equation emerges which describes the path of the savings rate:

$$\dot{S} = r(e\dot{F} + \dot{M}) = rS. \tag{3.2}$$

The general solution to (3.2) can be written as follows;

$$S(t) = ce^{rt} \tag{3.3}$$

Where c is an arbitrary constant which has to be determined by the initial conditions. Given the three exogenous shocks, the time path is marked by three distinct intervals with t_1 and t_2 as the dividing points. Each interval is defined by its own restrictions and therefore the solution in (3.3) applies with three different arbitrary constants:

3.2. Solving for the path of savings

It can first be observed that since the final shock at $t = t_2$ is permanent S must be zero after that point in time as other variables jump to a new steady state. Therefore we can write the equations defining the three intervals as follows

$$S(t) = c_1 e^{rt}; \; 0 \leq t \leq t_1 \tag{3.4}$$

$$S(t) = c_2 e^{rt}; \; t_1 \leq t \leq t_2 \tag{3.5}$$

$$S(t) = 0, \; t_2 \leq t \tag{3.6}$$

The three paths are connected by jumps in S which are caused by export price shocks. These jumps can be used to establish the restrictions that are necessary to pin down the values of the arbitrary constants c_1 and c_2, that is by specifying the relationship between the three equations at the dividing points t_1 and t_2. Let Γ denote the parameter defining the reduced form relationship between changes in S and P_x^*, i.e. $\frac{dS}{E} = \Gamma \hat{P}_x^*$. An explicit solution for Γ can be determined from the first order conditions, keeping in mind that the sum of F and G is predetermined and the multiplier μ remains fixed after a possible jump in the initial period. Total differentiation of (1.7) yields the following relationship at $t = t_2$;

$$V_{EP_m} de + V_{EP_N} dP_n + V_{EE}\left[Q_x dP_x + Q_n dP_n - dS + r(F+G)de\right] = 0 \tag{3.7}$$

Roy's identity can be used derive the relationship $\frac{V_{EP_m}}{V_{EE}Q_i} = \nu_i \tau - 1$; where τ is the elasticity of inter-temporal substitution ($\tau = \frac{V_E}{V_{EE}E}$) and υ_i is the income elasticity of good i: ($\nu_i = \frac{\partial D_i}{\partial E}\frac{E}{D_i}$). If we assume unitary income elasticities of demand, i.e. $\nu_i = 1$, then (3.7) can be written as:

$$V_{EE}E\left[(\tau - 1)\gamma_n \hat{P}_n + (\tau - 1)\gamma_m \hat{e} + \alpha_x \hat{P}_x + \gamma_n \hat{P}_n - \frac{dS}{E} + \frac{er(F+G)}{E}\hat{e}\right] = 0 \tag{3.8}$$

To substitute for the term $er(F + G)$; we can use the initial steady state identity for the current account equilibrium;

$$P_m D_m - P_x Q_x = re(F+G) \tag{3.9}$$

Or expressed as a ratio of current expenditure,

$$\gamma_m - \alpha_x = i \tag{3.10}$$

Where i is the ratio of foreign interest payments to expenditure, i.e. $i = \frac{re(F+G)}{E}$: If the net foreign position is positive then the interest revenue will allow the representative agent to consume more imported goods than the corresponding exports and $\gamma_m > \alpha_x$: If the country is indebted, the reverse holds true. Using (3.10) and substituting for $\hat{e}$ from the policy rule we can simplify (3.8) as

$$(\gamma_n + \gamma_m Z\theta_L^x)\tau\hat{P}_n + (\alpha_x - \tau\gamma_m Z)\hat{P}_x^* = \frac{dS}{E} \tag{3.11}$$

The solution for $\hat{P}_n$ can be found by combining the budget constraint (1.1), eq. (3.9) and the market clearing condition for non-tradables;

$$\hat{P}_n = \frac{(\alpha_x - \varepsilon Z)\hat{P}_x^* - \frac{dS}{E}}{\varepsilon(1 - Z\theta_L^x)} \tag{3.12}$$

In the same way, a solution can be found for changes in expenditure

$$\hat{E} = \frac{[\alpha_x(\varepsilon + \gamma_n) - Z\varepsilon + (\gamma_m - \varepsilon)\alpha_x Z\theta_L^x]\hat{P}_x^* - (\gamma_n + \varepsilon + (\gamma_m - \varepsilon)Z\theta_L^x)\frac{dS}{E}}{\varepsilon(1 - Z\theta_L^x)} \tag{3.13}$$

Finally if we combine (3.11) and (3.12) we have a solution for Γ;

$$\frac{dS}{E} = \Gamma\hat{P}_x^* \tag{3.14}$$

Where,

$$\Gamma = \alpha_x - Z\frac{\tau\varepsilon}{\varepsilon(1 - Z\theta_L^x) + \tau(\gamma_n + \gamma_m Z\theta_L^x)}$$

At this point we have enough information to solve for c_1 and c_2. When $t = t_2$, the difference between the savings rate reported by equations (3.5) and (3.6) immediately before and after the export price shock occurs must equal the jump in S in response to the shock:

$$S(t_2^+) - S(t_2^-) = \Gamma E\hat{P}_x^* \tag{3.15}$$

Since $S(t_2^+) = 0$ and $S(t_2^-) = c_2 e^{rt_2}$; (3.15) implies that;

$$c_2 = -e^{-rt_2}\Gamma E\hat{P}_x^* < 0 \tag{3.16}$$

The export price shock at t_1 has been defined to be the double negative sum of the shock occurring at t_2 and the jump in the savings rate at t_2 is therefore $-2\Gamma\hat{P}_x^*$. Thus we can determine c_1 by using the analogous relationship between the jump and constants c_1 and c_2 at t_1;

$$S(t_1^+) - S(t_1^-) = -2\Gamma E\hat{P}_x^* \qquad (3.17)$$

$$\Rightarrow \; c_2 e^{rt_1} - c_1 e^{rt_1} = -2\Gamma E\hat{P}_x^* \qquad (3.18)$$

Now by substituting in for c_2 we have a solution for c_1;

$$-\left[-\Gamma\hat{P}_x^* e^{-rt_2} + c_1\right] e^{rt_1} = -2\Gamma E\hat{P}_x^* \qquad (3.19)$$

$$\Rightarrow \; c_1 = \left[2 - e^{r(t_1-t_2)}\right] e^{-rt_1}\Gamma E\hat{P}_x^* > 0 \qquad (3.20)$$

As the shocks become more persistent the absolute value of the constants get smaller. At the extreme, when $t_1, t_2 \to \infty$ then $c_1 = c_2 = 0$ and the current account dynamics disappears.

3.3. The transition path

3.3.1. Current account dynamics

Utility optimization in the non-interventionist regime is purely a problem of consumption smoothing under real income volatility. The shocks are temporary, symmetric and do not affect permanent income in a significant way. In the case of a current positive shock and future negative shock, the current account dynamics is characterized by surpluses and accumulation of foreign assets, which are then symmetrically reversed during the adverse period. It is therefore optimal to save the entire early income gain to completely meet the later shortfall in revenue. Thus, the temporary income changes cancel each other out and consumption remains unchanged. This response is invariant to substitution patterns. In fact, apart from the external variables; r and P_x^*; the only relevant variables in a non-interventionist regime are the openness of the economy γ_m and shock duration, since $\Gamma = \alpha_x$ when $Z = 0$.

In the interventionist regime the agents anticipate exchange rate adjustments and relative price changes. This weakens the incentive to save prior to an adverse shock to income, since the relative price of imported goods is much cheaper in the current period than in the future. It is clear from eq. (3.14) that as long as $\tau > 0$ and $\varepsilon > 0$; the savings response is more pro-cyclical in non-interventionist regime, i.e. $-_{non-intervention} > -_{intervention}.$ A closer look at (3.14) also reveals the savings response can be qualitatively different, i.e. negative, given certain range in parameter values. In other words, the current account worsens in the wake of a favorable price shock if,

$$\alpha_x < \frac{\tau\varepsilon}{\varepsilon(1-\theta_L^x) + \tau(\gamma_n + \gamma_m\theta_L^x)} \tag{3.21}$$

To simplify sufficiency condition (3.21) it is useful to express the demand elasticity, ε, in terms of elasticity of substitution, β. Since there are only two goods that enter the demand function and we have assumed homothetic preference we can write the own price elasticity as

$$\varepsilon = \beta\gamma_m. \tag{3.22}$$

where β is the elasticity of substitution,Thus we can write sufficiency condition (3.21) as

$$\frac{\tau}{(1-\theta_L^x) + \frac{\tau}{\beta}\left(\frac{\gamma_n}{\gamma_m} + \theta_L^x\right)} > \alpha_x \tag{3.23}$$

In the benchmark case when $\tau = \beta$

$$\tau > \frac{\alpha_x}{\gamma_m} = 1 - \frac{i}{\gamma_m}; \tag{3.24}$$

as $\alpha_x = \gamma_m + i$

3.3.2. Price dynamics

Given the fixed nominal expenditure in the non-interventionist regime, prices must also be constant. This conclusion is confirmed by the explicit solution for the non-tradable price change at the three given time points;

at t_0

$$\hat{P}_n|_{t=0} = \frac{(\alpha_x - \varepsilon Z) - \left[2 - e^{r(t_1-t_2)}\right] e^{-rt_1}}{\varepsilon(1 - Z\theta_L^x)}\hat{P}_x^*; \tag{3.25}$$

at t_1

$$\hat{P}_n|_{t=0} = \frac{(\alpha_x - \varepsilon Z) + e^{-rt_2}}{\varepsilon(1 - Z\theta_L^x)}\hat{P}_x^*; \tag{3.26}$$

and at t_2

$$\hat{P}_n|_{t=0} = 0. \tag{3.27}$$

3.3.3. The capital account

Since nominal money balances are constant while P_x^* is constant, the capital account is equal but opposite in sign to the current account over the intervals $(0; t_1)$ and $(t_1; t_2)$. There are discrete changes in capital account balances, however, at $t = 0$, t_1 and t_2 when changes in the export price and the exchange rate induce the private agent to swap foreign bonds for domestic money or vice versa. To determine the impact on capital flows at these three dates, differentiate the first order condition (1.8) and solving for the change in money holdings,

$$d\omega = \frac{1}{V_E}\left[\frac{\phi''}{P}\frac{M}{P}\left(\hat{M} - \hat{P}\right) - \frac{\phi'}{P}\hat{P} - \frac{\phi' V_{EE} E}{V_E^2 P}\left((\tau - 1)\left(\gamma_m \hat{e} + \gamma_n \hat{P}_n\right) + \hat{E}\right)\right]; \tag{3.28}$$

where ω is now interpreted as the foreseen percentage change in the exchange rate at times t1 and t2 ($\omega = \frac{e(t_1^+) - e(t_1^-)}{e(t_1^-)}$ at t_1, for example). As before $\frac{\phi''}{\phi'}\frac{M}{P}\frac{V_E}{V_{EE}E} = 1$ under the assumption that the elasticity of money demand with respect to expenditure equals unity. Given this and the facts that $\hat{P} = \gamma_m \hat{e} + \gamma_n \hat{P}_n$ and $\frac{\phi'}{\rho V_E} = r$, the solution in (3.28) simplifies drastically to

$$\hat{M}\,|_{t=0} = \hat{E}\,|_{t=0} \tag{3.29}$$

$$\hat{M}\,|_{t=t_j} = \hat{E}(t_j) - \frac{\tau}{r}\hat{e}(t_j); \quad j = 1; 2 \tag{3.30}$$

Higher expenditure, of course, calls for an increase in transaction services rendered by cash balances. On the other hand, money holdings are also determined by the rates of return from other alternative investments. The term $\frac{\hat{e}(t_j)}{r}$ is in effect the percentage change in the rate of return for foreign assets, as the result of exchange rate adjustments. Thus, the interest elasticity of money demand is equal to the elasticity of intertemporal substitution; τ. World market interest rates are usually in the single digits and exchange rate adjustments can sharply alter relative returns and be a cause of significant portfolio adjustments. Changes in money holdings are therefore likely to be dominated by variation in the rate of return on foreign assets in domestic currency, unless τ is very small.

4. Simulations

4.1. Parameter values

The simulations will use Icelandic structural parameters, to the degree that they are known. There is uncertainty about the precise values of the two demand parameters; the compensated demand elasticity " and the elasticity of inter-temporal substitution ¿; and they are therefore allowed to vary within a given range. Iceland's foreign asset position is negative. Net foreign debts are about 60% of GDP and they bear on average 6 ¡ 7% interest in annual terms. Foreign interest payments therefore amount to about 3 ¡ 4% of GDP in each year. The shock sequence is the same as before. Initially, there are three years in which the export price is 10% higher than equilibrium value and another three years follow when $P_x^{¤}$ is 10% below the same value before there is return to normalcy at t = 6.

Parameter name	Notation	Value
Consumption share; imported goods	$°_m$	40%
Consumption share; non-tradable goods	$°_n$	60%
Labor cost ratio in the export sector	$µ_L^x$	40%
The ratio of highpowered money to E	$\frac{M}{E}$	15%
Time preference rate	½	7%
The elasticity of intertemporal substitution	¿	0.1-0.8
Cross price elasticity	"	0.15-0.75
Elasticity of substitution	¯	0.38-1.88
The ratio of exports to expenditure	$®_x$	43.5%
Net foreign asset position as % of E	$\frac{F+G}{E}$	-50%
World market interest rate	r	7%
Ratio of foreign interest payments to E	i	-3.5%

The initial foreign asset position at t = 0 will a¤ect the consumption level of imported goods, but has no direct impact on the dynamics of the main variables, $\hat{E}$, $\hat{P}_n$, $\hat{M}$ or $\hat{e}$. The net foreign interest payments constitute a …xed factor in the consumer budget and capital account, which does not otherwise a¤ect savings decisions.

4.2. Current account dynamics

In the non-interventionist regime, the export shocks are just temporary income changes, with no effect on prices or expenditure. Simulation results are therefore considerably simplified since the two demand parameters, ε and τ; do not affect saving decisions. However, given the fixed choice of other parameters, the current account is characterized by a trade surplus, which accumulated over three years amounts to 14.5% of GDP. However, after the adverse shock hits a deficit appears which is symmetric to the surplus previously observed.

In the interventionist regime, the agents will have a devaluation on their mind as well as future income loss when they make decisions. A greater degree of substitution, whether between goods or time periods, will weaken the incentive to save during the three first years in order to prepare for negative export price shock, which both constitutes an income loss as well as a change in relative prices. However, unless substitutability is zero ($\varepsilon = 0$ or $\tau = 0$), the trade surplus in the three first years is always lower than in the non-interventionist regime. The current account dynamics are characterized in terms these two parameters, in table 1.

Table 1

Parameter values	Current account balance in the first year (as % of E)
$\tau\varepsilon < 0.04$ or $\beta\tau < 0.1$	$2\% <$ surplus
$0.04 < \tau\varepsilon < 0.2$ or $0.1 < \beta\tau < 0.5$	$1 - 2\%$ surplus
$0.2 < \tau\varepsilon < 0.3$ or $0.5 < \beta\tau < 0.75$	$0 - 1\%$ surplus
$0.3 < \tau\varepsilon < 0.6$ or $0.75 < \beta\tau < 1.5$	$0 - 2\%$ Deficit
Range; $0.1 < \tau < 0.8$; $0.15 < \varepsilon < 0.75$ or $0.375 < \beta < 1.875$	

The simulations display that the exchange rate policy will promote greater current account stability, given the parameter range, though at the expense of a higher variability of consumer expenditure. Moreover, if the degree of substitutability is moderately large (i.e. $0.3 < \tau\varepsilon$) then the there is a qualitative difference in the current account between the two regimes, as trade deficit is observed in the interventionist case and consumption thus becomes more volatile than income.

4.3. The capital account and the balance of payments

When the capital account was closed and cash was the only financial asset available, saving as well dissaving was discouraged since changes in money holdings incurred rising opportunity costs. Swift variations in the current account could occur, although an imbalance would never persist since the cost of holding either too much or too little cash, given the expenditure level, was too large. Therefore, when a negative income shock was expected, a trade surplus or deficit would emerge at a small scale and then rapidly built up to reach a peak just before the shock. When foreign bonds are available at fixed rate of interest, changes in asset holdings are much less costly and a current account imbalance becomes much more persistent. Otherwise, the implications of free capital transactions differ widely between the two regimes.

In the non-interventionist regime, changes in foreign bond holdings are just a mirror image of the current account dynamics, as money holdings remain unchanged. The agent will save in anticipation of a temporary shortfall in income and accumulate foreign assets and therefore a trade surplus appears, totalling 14.5% of GDP during the three first years, which will improve the foreign asset position. However, after the shock has occurred at $t = 3$; foreign bonds are sold off to finance current account deficits which mirror the surpluses in periods before, and maintain a fixed level of consumption during the three adverse years, until the former equilibrium level in foreign asset holdings has been reached. The overall balance of payments remains unchanged in the non-interventionist regime since none of these flows will affect government reserves or nominal money holdings.

In the interventionist regime, the option of trading foreign assets will increase the likelihood of persistent current account deficits in the wake of a positive export price shocks. Therefore, cœterus paribus, free capital transactions can increase demand volatility since inter-temporal substitution is encouraged. However, current account variations are minor disturbance to balance of payments in the interventionist regime compared with the incentive for arbitrage trading between foreign and domestic assets that exchange rate alignments create. This is essentially a frictionless economy, and the resulting asset changes can be quite dramatic. Tables 2a-2c list the elasticity of money demand with regard to export price changes at the three time periods in question, t_0, t_1 and t_2.

Table 2a:Elasticity of money demand, $\frac{\hat{M}}{\hat{P}_x^{¤}}$ at t_0					
°$_m$ = 0:4	" = 0:75	" = 0:65	" = 0:45	" = 0:25	" = 0:05
¿ = 0:8	0.142	0.130	0.103	0.0656	0.0157
¿ = 0:65	0.278	0.257	0.206	0.135	0.0334
¿ = 0:45	0.520	0.488	0.404	0.279	0.0739
¿ = 0:25	0.879	0.840	0.733	0.534	0.1705
¿ = 0:1	1.283	1.255	1.170	0.996	0.4245

Table 2b:Elasticity of money demand, $\frac{\hat{M}}{\hat{P}_x^{¤}}$ at t_1					
°$_m$ = 0:4	" = 0:75	" = 0:65	" = 0:45	" = 0:25	" = 0:05
¿ = 0:8	2.917	2.804	2.489	1.873	2.092
¿ = 0:65	2.587	2.48	2.183	1.600	2.017
¿ = 0:45	2.170	2.075	1.804	1.267	1.904
¿ = 0:25	1.793	1.78	1.489	1.012	1.749
¿ = 0:1	1.560	1.509	1.347	0.968	1.493

Table 2c:Elasticity of money demand, $\frac{\hat{M}}{\hat{P}_x^{¤}}$ at t_2					
°$_m$ = 0:4	" = 0:75	" = 0:65	" = 0:45	" = 0:25	" = 0:05
¿ = 0:8	2.526	2.441	2.175	1.565	2.939
¿ = 0:65	2.160	2.057	1.758	1.185	2.133
¿ = 0:45	1.865	1.768	1.513	1.118	1.743
¿ = 0:25	1.693	1.614	1.420	1.227	1.306
¿ = 0:1	1.612	1.550	1.421	1.361	1.740

The tables indicate well the implication exchange rate expectations. At t_0 (table 2c) the exchange rate change is unanticipated and the change in money demand is determined by changes in expenditure. However, at t_1, the exchange rate appreciation is anticipated and the private agents will swap domestic currency for foreign bonds and therefore much higher elasticities are observed (table 2b). It should be noted again that the interest elasticity of money demand is equal to ¿; the elasticity of inter-temporal substitution. Therefore, the sensitivity of money demand towards export price changes and resulting exchange rate adjustments will thus be hugely a¤ected by higher values of ¿. This highlights the importance of maintaining foreign exchange reserves, although in the this experiment the task is made easier by the fact that a large inflow will precede the outflow.

4.4. Price changes

When the exchange rate is fixed and capital movements are free, complete price stability is achieved. That is a significant improvement from the earlier case of closed capital account. Greater price stability is also achieved in the interventionist regime, in all cases (see tables 4a-4d) unless the degree of substitutability becomes very high, i.e. $\varepsilon_{\tau} > 0.5$. Prices become more stable because free capital transactions make it less costly to move income back and forth in time. The agents are able, by trading foreign bonds, to steer their purchases away from periods where prices are expected to be high. Thus, the budget constraint within in the period becomes less binding for consumers' decisions and the spikes in the price level are significantly reduced. In this sense, demand becomes more autonomous or self-regulating with the aid of foreign funds. This, however, also implies that current policy actions become less effective in controlling demand or pushing against inflation using the exchange rate. In fact, the simulation results confirm that if cross price elasticity is sufficiently low then exchange rate appreciation will actually lead to increases in the price of non-tradable goods.

5. Extensions; openness

5.1. Exposure to foreign trade

Imports constitute about 40% of GDP in Iceland and are for the most part, goods for final consumption. This ratio of imports to total output may be larger in gross terms in other relatively small countries, although in most cases a large fraction of that trade is in intermediates or half-finished goods meant for re-export rather than final consumption. However, for various reasons, many resource based small economies are relatively closed to foreign trade. This may be because such economic systems are prone to get infected by the Dutch disease whose symptoms are displayed as a diminished share of foreign trade relative to GDP. In the less developed countries trade restrictions or policies aimed at import substitution have in the past repressed consumption of imported goods. In any case, it is likely that foreign trade shares will be increasing in most countries in the near future, whether the reason is the liberalization of trade in the respective country or just the fact that the growth of foreign trade has exceeded economic growth in the vast majority of world's economies in the last decade. Therefore, it is worth considering the implications of di¤erent degrees of openness for monetary policy. Higher trade shares may, as McKinnon (1963) has maintained, lead to a weaker but more distortionary e¤ects of monetary policy. In light of this, the model will be re-calibrated with the share of imports equal to 15% of total GDP, as opposed to 40% before.

5.2. Current account dynamics

As the trade shares are smaller, the real income e¤ect of export price shocks will of course decrease. The implication is very clear cut in a non-interventionist regime; less counter-cyclical savings variation is needed to stabilize consumption. The same symmetric shock sequence (three years when the export price is 10% above average followed by another three years when it is 10% below average) results in a 5:4% accumulated positive trade balance over the three …rst years when the imports share is a mere 15%, compared with 14:5% before when imports constituted about 40% of GDP.

The outcome in the interventionist regime is more complicated and is reported in tables 5a-5d. Since the income e¤ects of the shock are much reduced, the expected relative price change can potentially have a greater e¤ect. Although at the same time, the possibility of cross substitution must be more limited since imports constitute a much smaller portion of the consumer budget. The elasticity of substitution is directly proportional to the import share, i.e. " = ¯°$_m$; and it is doubtful that the cross price elasticity, "; between the two goods can be presumed to be large when °$_m$ is small. However, even when correcting for that and assuming the same value for the elasticity of substitution, the simulations clearly show that there is a greater tendency to dissave in the wake of a transitory positive shock as the national economy is more closed. Therefore, it is likely that a rapid liberalization which is followed by exchange rate variations may lead to greater demand volatility. The portfolio choice between money and foreign bonds is not much a¤ected by a smaller trade share, as would be expected. Although, a lower income variation means that the sensitivity of money demand towards changes in the foreign rates of return is increased.

5.3. Price dynamics

Given the same level of cross price elasticity, ", it is clear that price volatility will increase as the economy gets more closed, as is clear from table 6a-6d.. However, that may be an unreasonable comparison given the vastly di¤erent implication for 15% trade versus 40% trade share for cross price substitution.. If we correct for the di¤erent trade share and make the comparison in terms of the elasticity of substitution, then the result appears that price volatility will actually decrease by a factor of 1 or 2. This is perhaps not surprising. Exchange rate policy will have a less direct e¤ect on the national economy if its main lever, the price of foreign goods in domestic currency, has a little weight in consumer decisions. Thus, an appreciation will be less e¤ective in decreasing demand for non-tradables or keeping the price level down. On the other hand, the possible adverse e¤ects are also reduced. Since there is a very low likelihood that a temporary appreciation can actually in‡ationary.

6. Conclusion

The conclusion is that capital account liberalization will stabilize the economy in a non-interventionist regime as predicted by classical economic theory since economic agents are better able to smooth their consumption by adjusting their assets to meet temporary disturbances in income. The outcome is more mixed in the interventionist regime. Overall, an open capital account has four major implications in this model. First, the speed of an adjustment will be faster since the agents can instantaneously adjust both expenditure and money balances. Second, the current account volatility will increase and be more persistent. In the case of a non-interventionist regime, the consequence is complete demand stability. In interventionist regime, the increased likelihood and greater persistence of a trade de…cit prior to a negative shock have the potential of actually increasing demand ‡uctuations. Third, the counter-cyclical pull of policy interventions on the price level will be weakened because it is less costly to move income in time. Consumers will therefore be more sensitive to anticipated price changes and the degree of inter-temporal elasticity becomes more relevant for agents' decisions. In fact, given a su¢ciently high degree of inter-temporal substitution and low degree of cross substitution, exchange rate appreciation in the wake of a transitory positive shock will actually lead to in‡ation in the price of non-tradable goods. The fourth and …nal implication is that exchange rate interventions run the risk of causing huge portfolio adjustments between domestic and foreign assets, with the corresponding out-or in‡ow of foreign funds. These results are well in line with the "hot-money" problems which many countries have experienced after capital account liberalization.

If the simulations are repeated assuming smaller trade shares, the effect of the exchange rate policy on prices will be more muted. This is as expected since the exchange rate will less directly affect consumer demand. What is surprising is that the potential current account problems in terms of a pro-cyclical trade deficits are likely to become worse. This occurs since the income effect of a negative shock will decrease, there is a greater incentive to dissave before the devaluation occurs.

7. Conclusion

This thesis provides a rational explanation for the observed tendency of many resource based economies to embark on a "consumption binge" in the wake of a transitory positive terms-of-trade shock, even though the rationale of consumption smoothing should give an incentive for increased savings prior to an anticipated lower income in the future. There is no specific reason to expect the foreign shocks affecting small open economies to have permanent effects. Indeed, most of the supply shocks affecting small countries are variations in the terms of trade, perhaps caused by demand changes in larger economies. When the shocks are temporary, spending and savings decisions are not tied down solely by economic fundamentals; they also depend on policy expectations. Therefore, in a monetary regime bent on short-term stabilization, a transitory positive shock is seen as a signal of current appreciation and future devaluation. Thus, savings incentives are reversed, pro-cyclical demand volatility is increased, an inverse relationship between the current account balance and terms-of-trade appears and exchange rate interventions display a strong inflationary bias.

The thesis also indicates that free capital movements might in effect make short-term stabilization infeasible in the classic Keynesian sense, or at least exacerbate its side effects, especially if the degree of intertemporal substitution is high. On the other hand, free capital movements offer the private sector an increased opportunity for smoothing consumption through borrowing on foreign financial markets, if international transactions are secured with a fixed exchange rate.

The calibration with Icelandic parameters provides results that mimic the cyclic behavior of the Icelandic economy in many crucial aspects, as described above. In the model that features delayed labor market clearing and consensus nominal wage freeze of the labor unions in response to devaluations, (common in Iceland) the above dynamics exacerbated and chronic excess demand in the labor market is observed. This could at least partly explain why 30-40% inflation rate and 1% unemployment rate prevailed for two decades 1970-1990. Furthermore, comparison with the benchmark case of a fixed exchange rate and non-intervention also reveals that the country could have been better off in terms of demand stability without short-term stabilization policies. And, as a matter of a fact, the country moved towards fixing the exchange rate in 1990 and hence lowering the inflation rate to single digits. Further research is needed before a similar policy recommendation is made for other resource based economies, though this could give an indication of the issues at hand in other countries with similar structure, including many less developed economies.

Many extensions can be considered for a further research. Relatively modest changes can be made to increase the realistic appearance of the model. First, by imposing a delayed labor market on the case of open capital account. Second, a more thorough insight can be obtained of the demand dynamics by including capital in production relations and investment spending in aggregate demand. Most capital goods are imported in small open economies, and thus the effect of expected exchange rate movements on investment could be substantial. Third, by allowing for durable goods it is likely the potential incentive for acceleration of consumer purchases is increased. In addition, the research can be extended to include welfare analysis of the micro costs associated with the excess fluctuations.