Part I

Chapter one

In this first chapter the model will be laid out in its simplest version with perfect price flexibility. We will furthermore introduce the Icelandic economy as a case study to provide a real comparison. The objective is to recreate patterns similar to those observed in resource based export economies under certain assumptions about monetary policy. The outcomes will then be compared with the benchmark case of non-intervention, and thus obtain information about the micro principles at work behind the stylized facts mentioned in the introduction. Namely, excess volatility of private consumption, inflationary exchange rate appreciations and current account deficits in the wake of transitory positive export shocks. The sections are arranged as follows: First, there is brief description of the Icelandic economy and the policy environment. Second, the model is introduced and solved. Third, policy experiments are carried out and the model is simulated. Section fourth contains concluding remarks.

1. Case study: Iceland

> The advantages of maintaining an independent exchange rate remains strong. Iceland is too small ever to have a very diversified export sector, too remote from Europe to use labor mobility as an effective alternative to relative wage adjustment, and has less trade volume than one might expect given its small size. Thus an adjustable exchange rate can serve as a valuable tool of macroeconomic stabilization, and need not impose massive microeconomic costs... There remains a pretty good case for a system in which the currency can be adjusted to cope with adverse export shocks... Krugman (1991)

Iceland is an island, located midst in the Atlantic and is populated by 280,000 people. The island's economy is approximately 1000 times smaller than that of the US in absolute terms, but GDP per capita in the two countries are similar. Iceland is almost a textbook case of a fully specialized economy. The island has no forests, oil, coal, metals, mineral, nor is it possible to harvest common crops such as corn or wheat. In fact, almost all tradable goods consumed in

Iceland are foreign made and there is very little import competing production. For example, agriculture (mainly meat and dairy production) is shielded from foreign competition by either a complete ban on imports or very high tari¤s. On the other hand, Iceland is richly endowed with energy, both thermal heat and electricity derived from its many waterfalls, and …sh which is the main export good. In the context of other OECD countries and its small population, Iceland's foreign trade, exports and imports combined, is a relatively low proportion of total GDP or 75%. However, that raw ratio may be misleading since half-…nished goods are largely absent in Iceland´s foreign trade and the foreign sector carries a very large weight in the economy in terms of value added.

Although, the country is blessed with plentiful …shing stocks, the plenty is subject to great variability. The …sh stock is a¤ected by external factors, sea temperature, food supply etc., and therefore the catch ‡uctuates from year to year. Furthermore, a number of other …shing nations in the Atlantic supply the same markets as the Icelanders and their stock variation contributes to a high price volatility in world markets. It is possible to predict these ‡uctuations ahead of time with some accuracy. Marine scientists can make 3-4 year forecasts by measuring the abundance of the young generations of …sh in each stock, which later on will be the staple of the catch. The Icelandic government then issues a quota based on the stock estimates which determines the total allowable catch. The quotas are strictly enforced, perfectly divisible, transferrable and are either owned or rented by individual …rms. This information is public and allows the economic agents to pin-point Iceland's export revenue one year ahead and make somewhat accurate long-range forecasts.

In this paper we will mainly be concerned with the period from 1970-1989, in which the Icelandic monetary regime could be characterized as a managed ‡oat and the Icelandic krona was devalued 25 times and annual price increases averaged about 30-40%. Capital markets were also subjected to heavy restrictions during that time, which in addition to a closed capital account consisted of caps on interest rates and loan rationing. During this time there was a strong correlation between changes in earnings of the …sh industry and economic growth in Iceland, which is perhaps understandable given the fact that of …sh constitutes about 75-80% of good export earnings. Pro…t in the export sector was therefore a bellwether of any external disturbance that was about to be transmitted into the domestic economy. This relationship did foster the perception among Icelanders that the best way to stabilize economic output is to stabilize revenue in the …sh sector by varying the nominal exchange rate. Furthermore, from the standpoint of social policy, the pro…t targeting was seen as a way to transfer rent or ”excessive pro…ts” in the …shing industry to consumers through a high real exchange rate and cheap imports.

About 98% of the Icelandic labor force is unionized and wage bargaining is centralized. The unions are territorial and contain the whole labor force in their area, including the jobless. They are therefore sensitive to swelling numbers of unemployed within their ranks and are willing to make real wage concessions to achieve full employment. From 1970 to 1989, the …sh forecasts were a major factor for the wage demands of the labor unions as they were perceived as a good indicator of economic conditions ahead. When an adverse supply shock was expected, the unions were content with minimal wage increases or even a freeze. On the ‡ip side, the unions expected rapid wage increases when prospects looked better. In most cases the wage was quickly bid up by increased demand during economic upturns, as would be expected in an economy with a rather low rate of natural unemployment. The devaluations have frequently been successful in lowering the real exchange rate in medium to short term, since the unions, eager to preserve full employment, will not attempt to compensate for the decrease in purchasing power due to higher import prices. The results are almost contradictory. Because of heavy union and governmental involvement in wage decisions, real wages have been highly pro-cyclical and rapidly adjust to the forces of supply and demand in the labor market.

Table 1. Shocks to the Icelandic export earnings and nominal and real exchange rate responses

Year	Export earnings	Nominal depreciation	Real depreciation	In‡ation Peak
1967-68	-20%	50%	36.3%	21.7%
1874-75	-17%	36.1%	21.9%	49.0%
1979-80	-4.7%	63.3%	11.6	58.5%
1982	-9.7%	65.3%	13.9%	84.3%
1988-90	-13.6%	37.6	21.1%	25.5%

2. The Model

The model developed here, outlines a completely specialized small open economy that produces a non-tradable good Q_n and an export good Q_x. There is no import competing production and domestic consumption of the exported good is negligible and can be ignored. All tradable goods, Q_m, consumed within the economy are therefore imported. The economy is considered to be a price taker since neither its aggregate demand nor supply has any effect on foreign markets. The foreign price of imports P_m^* is assumed to be constant but the foreign price of exports P_x^* is random.

2.1. Prices and sectoral production

$$P_x = eP_x^*; \tag{2.1}$$

$$P_m = e; \tag{2.2}$$

$$P = P_n^{\gamma_n} e^{\gamma_m}; \quad \gamma_n + \gamma_m = 1 \tag{2.3}$$

The domestic price of the imported good P_m is given by the exchange rate, e, since units have been chosen so the fixed world market price equals unity. The general price level of the economy P is constructed as a geometric average of the imported tradable and non-tradable good prices. The respective consumption shares are γ_n and γ_m. Production in each sector requires capital K_i and labor L_i,

$$\bar{Q}_x = F^x(L_x; \bar{K}_x); \tag{2.4}$$

$$Q_n = F^n(L_n; \bar{K}_n); \tag{2.5}$$

$$P_n F_L = w. \tag{2.6}$$

Capital stock is taken to be fixed and sector specific. Total labor supply is inelastic. Both sectors tap into the same labor pool and the same market wage w therefore applies. Both production technologies $F^i(\cdot)$ are continuous and strictly quasi concave and the firms in each sector operate in a competitive environment. Output in the export sector is dependent on a fixed natural resource and more inputs will not expand production further than the given limit. Therefore, export production is fixed.

2.2. The private sector optimization problem

$$\underset{\{E,S\}}{Max} \int \left[V(e;P_n;E) + \chi\left(\frac{M}{P}\right) \right] e^{-\rho t} dt \tag{2.7}$$

$$s.t.$$

$$E = P_x Q_x + P_n Q_n - S \tag{2.8}$$

$$\dot{M} = S \tag{2.9}$$

Decisions about consumption and savings are made by a representative agent who has homothetic preferences and maximizes utility over an infinite lifetime by choosing between spending E and saving S. Money is the only financial asset in the economy and the capital account is closed. The non-pecuniary services rendered by real money balances, such as the facilitation of transactions etc., are accounted for in the $\chi(.)$ component of the utility function. This separable form allows us to substitute an indirect utility function into the maximization problem to represent the utility derived from consumption. The indirect utility function has the usual properties, i.e. $\frac{\partial V}{\partial P_i} < 0$; $\frac{\partial V}{\partial E} > 0$ and $V_{EE} < 0$.

2.3. Market-clearing conditions

$$L_x + L_n = \bar{L}; \tag{2.10}$$

$$D_n(e;P_n;E) = \bar{Q}_n. \tag{2.11}$$

Constant output in the export sector, inelastic total labor supply and full employment in the labor market essentially fixes non-tradable production, since both output Q_x and capital input K_x are constant, the optimal labor input L_x will not vary. Thus a fixed labor supply and market clearing imply that labor input into the non-tradable sector L_n; is fixed. Therefore the supply of non-tradables $\bar{Q}_n$ must be inelastic since the other input, capital K_n is also constant. In the domestic market, the demand for the non-tradable good must be equal to a fixed supply as is stated in equation (2.11). The foreign supply of the imported good and foreign demand for the exported good are infinitely elastic at a given market equilibrium price.

2.4. Monetary policy

The sole source of disturbance in this economy is price volatility in the export sector and the only transmission channel for monetary interventions is through exchange rate interventions. We will attempt to formalize the monetary policies in small export based economies in terms of a simple instrumental rule focusing on profitability in the export sector. Since the business environment is competitive total revenue must be equal to total cost in the export sector,

$$P_x\bar{Q}_x = w\bar{L}_x + r_x\bar{K}_x. \tag{2.12}$$

The rent from the fixed capital stock essentially captures economic profit in the sector and the government must therefore keep r_x constant in order to achieve profit stability. Given this we can log differentiate (2.12) and with a little re-arrangement the following equilibrium relationship is obtained:

$$\hat{P}_x = \theta_L^x \hat{w}. \tag{2.13}$$

The term $\theta_L^x = \frac{wL_x}{Q_x}$ is the cost share of labor in the export sector and for notational ease, a hat superscript denotes a percentage change, i.e. $\hat{x} = \frac{dx}{x}$. If we now log differentiate the domestic export price as represented in equation (2.1) and then insert into the above expression (2.13) we obtain the following reaction function,

$$\hat{e} = \theta_L^x \hat{w} - \hat{P}_x^*. \tag{2.14}$$

The rationale for this rule is twofold. First, this is precisely the monetary policy that was followed by Iceland from 1970-1999, when the government publicly acknowledged that profitability in the marine sector did determine exchange rate interventions. Second, the instrumental rule that appears above displays similar characteristics as one would expect from stabilization policy according to standard economic theory. Negative terms of trade shocks trigger devaluation, as will excess increases in domestic production cost (in this case only wages). Positive developments on the other hand will lead to appreciations. It is worth noting that it is nominal, not real profit that is being targeted, which implies that the government does not respond to inflation directly, unless higher prices prompt increases in the nominal wages.

We wish to evaluate the outcome of the exchange rate rule by comparing it to the case of non-intervention and therefore we will write equation (2.14) as,

$$\hat{e} = Z\left(\theta_L^x \hat{w} - \hat{P}_x^*\right); \tag{2.15}$$

where Z is a policy parameter which takes the value 0 in the case of the non-interventionist case (i.e. when e is fixed). and is equal to 1 when the exchange rate rule is in place. Since capital stock and output are fixed in the export sector, labor use is fixed as well. Given that labor supply is inelastic and that the wage is perfectly flexible, it follows that employment and output are also constant in the non-tradable sector.

3. Solving the model

To solve the private agent's optimization problem, the following Hamiltonian function is specified,

$$H = e^{-\rho t}\left[V(e; P_n; P_xQ_x + P_nQ_n - S) + \phi\left(\frac{M}{P}\right) - \mu S\right], \tag{3.1}$$

where μ is the Lagrangian multiplier associated with the optimization. The first order conditions are,

$$V_E(e; P_n; P_xQ_x + P_nQ_n - S) = \mu, \tag{3.2}$$

$$\dot{\mu} = \rho\mu + \phi'\left(\frac{M}{P}\right)\frac{1}{P}. \tag{3.3}$$

Since Q_x and Q_n are constants, a time differentiation of (3.2) yields,

$$\dot{\mu} = (V_{EN} + V_{EE}Q_n)\dot{P}_n + V_{EM}\dot{e} + V_{EE}Q_x\dot{P}_x - V_{EE}\dot{S}. \tag{3.4}$$

With a little rearrangement, (3.4) can be written,

$$\dot{\mu} = V_{EE}E\left[\left(\frac{V_{EN}}{V_{EE}D_n}\frac{P_nD_n}{E} + \frac{P_nQ_n}{E}\right)\frac{\dot{P}_n}{P_n} + \left(\frac{V_{EM}}{V_{EE}D_m}\frac{eD_m}{E} + \frac{P_xQ_x}{E}\right)\frac{\dot{e}}{e} - \frac{\dot{S}}{E}\right], \tag{3.5}$$

From Roy's identity $D^i = -\frac{V_i}{V_E}$, a relationship can be derived $\frac{V_{EP_m}}{V_{EE}Q_i} = \nu_i\tau - 1$, 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 (3.5) can be written as,

$$\dot{\mu} = -V_{EE}E\left[\frac{\dot{S}}{E} - \left(\tau\gamma_n\frac{\dot{P}_n}{P_n} + [(\tau - 1)\gamma_m + \alpha_x]\frac{\dot{e}}{e}\right)\right]. \tag{3.6}$$

α_x is the export revenue as a share of total expenditure, i.e.: $\alpha_x = \frac{P_x Q_x}{E} = \gamma_m + \frac{S}{E}$. At this stage it should again be noted that since labor input into the non-tradable sector is fixed, there must be a direct relationship between wage changes and changes in the price of non-tradables goods as is specified by equation (2.6). Thus, $\hat{w} = \hat{P}_n$. Given this information the policy equation (2.15) becomes,

$$\hat{e} = Z\left(\theta_L^x \hat{P}_n - \hat{P}_x^*\right). \tag{3.7}$$

Furthermore, on the transition path,

$$\frac{\dot{e}}{e} = Z\theta_L^x \frac{\dot{P}_n}{P_n}. \tag{3.8}$$

After substituting for $\dot{\pi}$ from (3.3)and for $\dot{e}$ from (3.8), equation (3.6) yields,

$$V_{EE}E\left[\tau\left(\gamma_n + \gamma_m Z\theta_L^x\right) + (\alpha_x - \gamma_m) Z\theta_L^x\right]\frac{\dot{P}_n}{P_n} - V_{EE}S = \rho V_E - \phi'\left(\frac{M}{P}\right)\frac{1}{P}. \tag{3.9}$$

We are still left with the task of solving for changes in P_n in terms of changes in the savings rate S and the exogenous variable P_x^*. In order to do that, the market clearing condition for non-tradables and the budget constraint , can be used. Log differentiation of equations (2.8) and (2.11) yields,

$$\eta_n \hat{P}_n + \eta_m \hat{e} + \hat{E} = 0; \tag{3.10}$$

$$\hat{E} = \alpha_x \hat{P}_x + \gamma_n \hat{P}_n - \frac{dS}{E}. \tag{3.11}$$

Here η_i is the uncompensated demand elasticity for good i. The compensated elasticity ε_i; can directly obtain from the Slutsky decomposition, i.e. $-\varepsilon_i = \eta_i + \gamma_i$, where ε_i is assumed to be positive. Furthermore, since there are only two types of goods being consumed, the own and cross price elasticities of the two respective Hicksian compensated demand functions are equal in absolute value, i.e. $\varepsilon_m = \varepsilon_n = \varepsilon$. Now, keeping in mind that $\hat{P}_x = \hat{e} + \hat{P}_x^*$ and combining equations (3.10) and (3.11) with the policy rule stated in equation (3.7) we obtain the following solution for $\hat{P}_n$,

$$\hat{P}_n = \Delta^{-1}\left(\left[\alpha_x - Z\left(\varepsilon + \alpha_x - \gamma_m\right)\right]\hat{P}_x^* - \frac{dS}{E}\right). \tag{3.12}$$

$$\Delta = \varepsilon\left(1 - Z\theta_L^x\right) - Z\theta_L^x\left(\alpha_x - \gamma_m\right).$$

On the transition path,

$$\frac{\dot{P}_n}{P_n} = -\frac{\dot{S}}{\Psi E}. \tag{3.13}$$

At this point we can also solve for changes in expenditure and the price level.

$$\hat{E} = \left[\Psi^{-1}[(\alpha_x Z\theta_L^x + \gamma_n)[\alpha_x - Z(\varepsilon + \alpha_x - \gamma_m)]] + (1 - Z)\alpha_x\right]\hat{P}_x^* \tag{3.14}$$

$$- \Psi^{-1}[(\alpha_x Z\theta_L^x + \gamma_n) + \Psi]\frac{dS}{E},$$

$$\hat{P} = \Psi^{-1}[\gamma_m Z\theta_L^x + \gamma_n]\left([\alpha_x - Z(\varepsilon + \alpha_x - \gamma_m)]\hat{P}_x^* - \frac{dS}{E}\right) - Z\gamma_m\hat{P}_x^*. \tag{3.15}$$

On the transition path,

$$\frac{\dot{P}}{P} = -\Psi^{-1}[\gamma_m Z\theta_L^x + \gamma_n]\frac{\dot{S}}{E}. \tag{3.16}$$

Equation (3.9) can now be simplified as,

$$-V_{EE}\Psi^{-1}[\tau(\gamma_n + \gamma_m Z\theta_L^x) + (\alpha_x - \gamma_m)Z\theta_L^x + \Psi]\dot{S} = \rho V_E - \phi'(\frac{M}{P})\frac{1}{P}. \tag{3.17}$$

We now have a differential equation which describes the changes in the savings rate over time and will form a two-dimensional dynamic system along with equation (2.9), the growth of money balances. For this system to be solved it needs to be linearized it around a stationary equilibrium, where $\dot{S}$ and the trade balance are initially equal to zero. Taking a first order expansion of (3.17),

$$-V_{EE}\Psi^{-1}[.]\dot{S} = \rho\left[V_{EM}\hat{e} + V_{EN}P_n\hat{P}_n + V_{EE}dE - V_E\right] \tag{3.18}$$

$$-\phi''\frac{M}{P}\left(\hat{M} - \hat{P}\right) + \frac{\phi'}{P}\hat{P}.$$

The solution to the bracketed terms that multiplies ρ, was derived earlier in the course of solving for (3.17). Proceeding as before, (bear in mind that in steady state $\alpha_x = \gamma_m$) we obtain,

$$-V_{EE}\Psi^{-1}[.]\dot{S} = -\rho V_{EE}\Psi^{-1}[\tau(\gamma_n + \gamma_m Z\theta_L^x) + \Psi] - \phi''\frac{M}{P}\left(\hat{M} - \hat{P}\right) + \frac{\phi'}{P}\hat{P}. \tag{3.19}$$

Moreover, in stationary equilibrium the multiplier μ is constant, i.e. $\dot{\mu} = 0$; and therefore the first order conditions state that $\frac{\phi'}{P} = \rho V_E$. From this, the income elasticity of money demand can be derived, which can be assumed to be unitary,

$$\frac{\hat{M}}{\hat{E}} = \frac{\phi''}{\phi'}\frac{V_E}{V_{EE}E}\frac{M}{P} = 1. \tag{3.20}$$

This relationship and Roy's identity allows (3.19) to be rewritten,

$$-V_{EE}^{-1}[\cdot]\dot{S} = -\rho V_{EE}^{-1}[\tau(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon] \tag{3.21}$$
$$\left[-\rho V_{EE}^{-1}(1-\tau)(\gamma_m Z\theta_L^x + \gamma_n)dS + \frac{1}{\chi}dM\right].$$

where $\chi = \frac{M}{E}$. The end result is therefore a linearized differential equation in which $\dot{S}$ is expressed in terms of dS and dM,

$$\dot{S} = \rho\frac{[(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon(1 - Z\theta_L^x)]}{[\tau(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon(1 - Z\theta_L^x)]}dS + \rho\frac{\varepsilon(1 - Z\theta_L^x) - Z\theta_L^x(\alpha_x - \gamma_m)}{\chi[\tau(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon(1 - Z\theta_L^x)]}dM. \tag{3.22}$$

or more compactly,

$$\dot{S} = AdS + BdM. \tag{3.23}$$

Where;

$$A \equiv \rho\frac{[(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon(1 - Z\theta_L^x)]}{[\tau(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon(1 - Z\theta_L^x)]}$$
$$B \equiv \rho\frac{\varepsilon(1 - Z\theta_L^x) - Z\theta_L^x(\alpha_x - \gamma_m)}{\chi[\tau(\gamma_n + \gamma_m Z\theta_L^x) + \varepsilon(1 - Z\theta_L^x)]}$$

We now have a two dimensional simultaneous dynamic system,

$$\begin{bmatrix}\dot{S} \\ \dot{M}\end{bmatrix} = \begin{bmatrix}A & B \\ 1 & 0\end{bmatrix}\begin{bmatrix}S \\ M - M^*\end{bmatrix}. \tag{3.24}$$

The eigenvalues of the system are

$$\lambda_1, \lambda_2 = \frac{A \pm \sqrt{A^2 + 4B}}{2}. \tag{3.25}$$

while the eigenvectors are obtained from,

$$\begin{bmatrix}A & B \\ 1 & 0\end{bmatrix}\begin{bmatrix}Z_{1j} \\ Z_{2j}\end{bmatrix} = \begin{bmatrix}\lambda_j Z_{1j} \\ \lambda_j Z_{2j}\end{bmatrix}; \quad j = 1, 2; \; i = 1, 2. \tag{3.26}$$

Normalizing by setting $Z_{2j} = 1$ gives $Z_{1j} = \lambda_j$: The general solution for the system is therefore,

$$S_t = \lambda_1 h_1 e^{\lambda_1 t} + \lambda_2 h_2 e^{\lambda_2 t}: \tag{3.27}$$

$$M_t - M^* = h_1 e^{\lambda_1 t} + h_2 e^{\lambda_2 t}: \tag{3.28}$$

Since $B > 0$; one eigenvalue, λ_1; is positive and the other, λ_2; negative. Thus, there is a saddlepath solution for the system.

4. Policy experiments: Permanent shocks with and without exchange rate interventions

4.1. Comparative analysis

It is fairly conventional for economic textbooks to assume supply shocks to be uncorrelated and permanent surprises and that does indeed hold true in the first policy experiment. The price shock occurs without notice at time $t = 0$ and is permanent. Since the dynamic system is saddle point stable, the solution path follows "the stable arm" to the new stationary equilibrium. In this case, the constant h_1, associated with the positive eigenvalue λ_1 equals zero. Thus the solution to the dynamic system can be written to only on terms of one unknown constant h_2,

$$S(t) = \lambda_2 h_2 e^{\lambda_2 t}; \tag{4.1}$$

$$M(t) - M^* = h_2 e^{\lambda_2 t}: \tag{4.2}$$

The money stock is pre-determined and the additional information needed to solve for h_2 can be obtained from initial conditions, which relate the change in steady state money holdings to the unknown constant. At $t = 0$; (4:2) yields,

$$M_0 - M^* = h_2: \tag{4.3}$$

Since income elasticity of money demand is assumed to be unitary, the change in steady state expenditure and money balances must be directly related, i.e. $\hat{E}_{ss} = \hat{M}_{ss}: \Rightarrow M^* - M^0 = M_0 \hat{E}_{ss}$: The change in steady state expenditure, as given by equation (3.14), can therefore give a solution for the change in money balances across steady states. Thus we now have an explicit expression for h_2;

$$h_2 = -(M^* - M^0) = -M_0 * \hat{P}_x^*: \tag{4.4}$$

$$\Lambda = \frac{[Z\theta_L^x\gamma_m + \gamma_n][\gamma_m - Z\varepsilon] + (1 - Z)\gamma_m\varepsilon(1 - Z\theta_L^x)}{\varepsilon(1 - Z\theta_L^x)}$$

The solution paths for S and M can now be written as,

$$S(t) = -\lambda_2 M_0 \Lambda \hat{P}_x^* e^{\lambda_2 t}. \tag{4.5}$$

Furthermore, we want to use an expression for change from the initial stationary equilibrium M_0, that is,

$$M(t) - M_0 = M_0\Lambda(1 - e^{\lambda_2 t})\hat{P}_x^*. \tag{4.6}$$

In order to determine the transitional dynamics we need to pin down the stationary equilibrium. The exchange rate rule targets economic profit in the export sector, in other words e is adjusted to keep $\theta_L^x\hat{w} - \hat{P}_x^*$ at zero. Since $\hat{P}_n = \hat{w}$; the net change in e caused by an export price shock can be derived by combining the policy rule (3.7) and the solution (3.12) for $\hat{P}_n$,

$$\hat{e} = \frac{1}{(1 - \theta_L^x)}\left(1 - \frac{\alpha_x\theta_L^x}{\varepsilon}\right)\hat{P}_x^*. \tag{4.7}$$

Equation (4.7) defines the terms under which a negative shock will lead to a lower profit in the export sector and thus prompting a devaluation. If cross price substitutability is sufficiently low and the cost share of labor in the export sector is sufficiently large, then $1 < \frac{\alpha_x\theta_L^x}{\varepsilon}$ and a decrease in the export price will actually lead to higher profits and an appreciation of the currency. Therefore we can state the following necessary and sufficient condition for the nominal exchange rate to depreciate as the result of a negative shock,

$$\varepsilon > \alpha_x\theta_L^x. \tag{4.8}$$

The importance of condition (4.8) is well illustrated if the impact on P_n from an export price shock is considered. By combining equations (3.10) and (3.11) we can define the market equilibrium for non-tradables,

$$\varepsilon\hat{P}_n = \varepsilon\hat{e} + \alpha_x\hat{P}_x^*. \tag{4.9}$$

Using policy equation (2.15) we obtain a solution for P_n,

$$\hat{P}_n = \frac{\alpha_x - \varepsilon}{\varepsilon(1 - \theta_L^x)}\hat{P}_x^*. \tag{4.10}$$

The relative sizes of α_x and ε, are of pivotal importance. If $\varepsilon > \alpha_x$; then imports and non-tradables are gross substitutes. In that case, a decrease in P_x^* and induced change in the exchange rate will raise the demand for non-tradables and increase P_n. Thus we have the following necessary and sufficient condition for the exchange rule to increase aggregate domestic demand in the face of an adverse shock,

$$\varepsilon > \gamma_m. \tag{4.11}$$

If (4.11) does not hold, we can turn to the weaker condition (4.8) which if satisfied ensures that the exchange rate policy will soften the deflationary impact of shock, although not eliminate it.

The conclusion is that the exchange rate rule is beneficial in terms of current account and price stability if condition (4.8) holds and a negative shock will indeed trigger a net devaluation. For Iceland, γ_m = 40% and cost ratio of labor in the fish sector, θ_L^x = 40%; the substitutability ε has to be lower than 0.16 for (4.8) to fail

4.2. Transitional dynamics

The comparison of closed form solutions for the transition period is complicated by the fact that the eigenvalues of the two respective policy regimes differ. However, certain inferences can be drawn on their relative sizes. Firstly, note that $\lambda_2 = \frac{1}{2}\left(A - \sqrt{A^2 + 4B}\right)$ and information on the size of parameter B is sufficient to reach conclusion on how the two eigenvalues rank with regard to each other. Secondly, a comparison (see equation 3.23) reveals that B is always larger in an non-interventionist regime λ_N. Therefore the eigenvalue associated with the interventionist regime λ_I, must always be smaller in absolute value, i.e. $\frac{\lambda_2^N}{\lambda_2^I} > 1.$ The rate of adjustment is therefore faster in the non-interventionist regime, as prices are perfectly flexible. The exchange rate intervention, on the other hand, softens the initial blow and hence delays the adjustment if condition (4.8) holds. This is evident if the initial and most severe impact of the shock at $t = 0$ are compared. The following solution apply for the current account in the transition period. For relatively small changes starting from the stationary equilibrium where $\alpha_x = \gamma_m$,

$$\frac{S(t)}{E} = -\lambda_2 \chi \Lambda \hat{P}_x^* e^{\lambda_2 t}. \tag{4.12}$$

Since λ_2 is negative and Λ is positive in a non-interventionist regime, an adverse supply shock will always cause trade deficits, the persistence of which will be defined by the absolute value of λ_2 in the time component, $e^{\lambda_2 t}$. The outcome for the exchange rate regime in the transition period is determined by same condition as we have defined for steady state changes. If condition (4.11) holds ($\varepsilon > \gamma_m$) and imports and non-tradables are gross substitutes, then $^{*} < 0$, and a devaluation in the wake of an adverse supply shock will lead to a trade surplus. Otherwise, a weaker sufficiency condition on ε can be obtained through a direct comparison between the two regimes, i.e. under which condition on ε equation (4.12) gives lower absolute value when $Z = 1$ as compared with the case when $Z = 0$,

$$\varepsilon \geq \gamma_m \frac{\theta^x_L\left(\gamma_m \frac{1}{\lambda_N} + \gamma_n\right) + \gamma_n\left(\frac{1}{\lambda_N} - 1\right)}{\left(\gamma_n \frac{1}{\lambda_N} + \gamma_m\right) + \gamma_m\theta^x_L\left(\frac{1}{\lambda_N} - 1\right)}. \tag{4.13}$$

Condition (4.13) ensures that an exchange rate adjustment will reduce the deficit in the initial period, although not eliminate it. This is weaker constraint on ε than (4.8) since $\lambda_N > \lambda_I$. However, as $\tau \to 0$, λ_N approaches λ_I, and (4.13) converges to (4.8) ($\varepsilon \geq \gamma_m\theta^x_L$).

A very similar story can be told about the price dynamics. The jump in the price of non-tradables in the initial period, at time $t = 0$ is,

$$\hat{P}_n\Big|_{t=0} = \frac{[\alpha_x - Z\varepsilon] - \lambda_2\chi^*}{\varepsilon(1 - Z\theta^x_L)}\hat{P}^*_x, \tag{4.14}$$

and thereafter

$$\frac{\dot{P}_n}{P_n} = \frac{-\lambda_2\chi^*}{\varepsilon(1 - Z\theta^x_L)}\hat{P}^*_x e^{\lambda_2 t}. \tag{4.15}$$

If non-tradables and tradables are gross substitutes then P_n will increase as the result of an exchange rate intervention. Conversely, by comparing the outcome from the two policy regimes as specified by equation (4.14), a weaker constraint on ε can be defined that suffices to ensure that the exchange rate rule will lessen the deflationary impact of a negative shock in the initial period,

$$\varepsilon > \gamma_m\theta^x_L + \frac{1}{\hat{P}^*_x}\left((1 - \theta^x_L)\left[\frac{S(0)}{E}\right]_N - \left[\frac{S(0)}{E}\right]_I\right). \tag{4.16}$$

Or more specifically,

$$\varepsilon > \gamma_m\theta^x_L + \chi[(1 - \theta^x_L)\lambda_N{}^*_N - \lambda_I{}^*_I]. \tag{4.17}$$

Condition (4.17) is either slightly stronger or weaker than (4.8), depending on the savings rate response and labor intensity of export production, θ_L^x. The jump in the CPI in the initial period, at time $t = 0$ is,

$$\hat{P}\big|_{t=0} = [\gamma_m Z\theta_L^x + \gamma_n]\left(\frac{[\alpha_x - Z\varepsilon] - \lambda_2\chi^*}{\varepsilon(1 - Z\theta_L^x)}\right)\hat{P}_x^* - Z\gamma_m\hat{P}_x^*, \qquad (4.18)$$

and the change thereafter

$$\frac{\dot{P}}{P} = \left(\frac{-\lambda_2\chi^*[\gamma_m Z\theta_L^x + \gamma_n]}{\varepsilon(1 - Z\theta_L^x)}\right)\hat{P}_x^* e^{\lambda_2 t}. \qquad (4.19)$$

If relatively weak sufficiency conditions are satisfied, then the exchange rate rule is advantageous for the economy in terms of current account and price stability, unless ε is very high and a serious inflation results. Not only is the initial blow of the shock considerably softened, the overall nominal change in money stock and prices is smaller across steady states. The analysis so far almost replicates the classical results concerning the benefit of short-term stabilization. However, this represents only one scenario, the one of very persistent shocks. Furthermore, economic agents have no time to adjust their behavior in anticipation of a coming policy measures since the shock occurs at the very beginning and. The devaluation is a one time affair which is not connected to what happened before $t = 0$ or to what happens next time when the steady state is disrupted.

4.3. Simulations

4.3.1. Parameter values

The model will be calibrated with Icelandic parameters, to the degree that they are known. There are no estimates available for two parameters; the elasticity of inter-temporal substitution, τ; and cross price elasticity, ε. These parameters may vary from country to country. Ogaki & Reinhart (1998) estimate, by taking durable goods into account, that the inter-temporal substitution in the US is in the range $0.32 - 0.45$. Others have produced similar or slightly higher estimates, see e.g. Hu (1993) for estimates for G-7 countries. By focusing specifically on import consumption in the US Ceglowski (1988) finds estimates of τ that are close to one. Therefore in this paper we let τ vary in the range $0.25 - 0.8$

The division of consumption into tradable and non-tradable goods is also somewhat artificial since most final goods are composites. In general, compensated demand elasticities for broadly aggregated goods cannot be expected to be very large. However, in the literature, values ranging from 0:10 and up to 0:7 have been reported for broadly aggregated compensated demand elasticities (See for example Deaton & Muellbauer (1980) or a survey by Blundell (1988)) In light of this we feel justi…ed to let the value of " range from 0:15 ¡ 0:75.

The values for other parameters are relatively straightforward. Icelandic foreign trade mainly consists of …nal goods and therefore the share of imported goods to GDP is an accurate indicator of tradable goods consumption; $°_m$ = 40% and $°_n = 1$ ¡ $°_m$ = 60%: The cost ratio of labor in the Icelandic …sh sector: $µ_L^x$ = 40%. The ratio of High-powered money over expenditure: $\frac{M}{E}$ = 15%. The time preference rate, ½ = 7%.

4.4. Results

If the shocks are permanent and unexpected, then the results are not sensitive to the degree of inter-temporal substitution. Therefore we will set ¿ = 0:45 and only the cross price elasticity " will vary in the simulations. In a non-interventionist regime, a negative shock will result in a lower level of steady state nominal money balances and prices. The downward adjustment occurs because a lower income reduces the need for transaction services provided by cash balances. In the exchange rate regime, the policy outcome is sensitive to values assigned to the cross price elasticity, ". If condition (4.8) does not hold and " = 0:15; a negative price shock will not lead to a net nominal devaluation because lower wages will compensate for lower revenue and pro…t in the export sector is not eroded. In that case, given the policy rule, there is no cause for a devaluation and the e¤ect of the shock on the two regimes will be fairly identical (see as graphs 1a ¡ c): However, if condition (4.8) does indeed hold and " = 0:35; then trade de…cits and price volatility are signi…cantly reduced (see …gures 2a ¡ c) by the employment of the exchange rate rule. The in‡ationary side e¤ects are pretty mild since overall price level will only increase by 2% in the …rst year, compared with a 6% de‡ation that would occur without an exchange rate intervention.

Now, if the cross price elasticity is indeed higher so that condition (4.11) holds and tradables and non-tradables are gross substitutes then trade de…cits are completely eliminated and the demand for non-tradables actually increases as the result a negative price shock and induced devaluation (see …gures 3a ¡ c where " = 0:45). In terms of the CPI, the two regimes come close to mirror each other. The intervention leads to about 5% in‡ation compared with 4:5% de‡ation under non-intervention. Inflation may be a greater concern if the substitutability becomes much higher, such as shown in figures 4a – c where $\varepsilon = 0{:}65$. In that case, the trade surplus following an exchange rate intervention becomes quite significant and the CPI does increase by 8% in the in the first period.

The simulations therefore support the conclusion already reached by a comparison of closed form solutions. Given the current assumption about openness (40%) and the domestic cost ratio (40%) in the export sector, the exchange rate regime does seem to outperform the non-interventionist regime unless degree of substitutability between tradables and non-tradables is either very low or very high.

5. Temporary and anticipated shocks

5.1. Solution paths

We will incorporate expectations and temporality into our analysis by increasing the number of shocks. The first shock, at the very start, comes as a surprise as before. It is now followed by two other shocks which are fully anticipated. More specifically, the sequence of shocks is as follows: In the beginning, at $t = 0$, there is 10% price increase, then at $t = t_1$ there will be a 20% price decrease and lastly at $t = t_2$ the price reaches the initial level by a 10% price increase. In other words, the shocks are temporary and the economy follows a full cycle with a return to the initial terms-of-trade at the last shock. In fact, for a low or zero discount rate the shock induces a very little change to life-time earnings.

We will argue that this is more in line with the real-life experience of most small open economies, whose export prices depend on demand conditions in the larger economies. However, the temporality adds to the mathematical complications in retrieving the solution, since different systems govern dynamics during each phase of the price cycle.

The first path The first shock occurs in the beginning at t_0. It only lasts until t_1 and does not imply a fixed end point that pins down a convergent path to a new saddle point equilibrium. Instead, dynamic optimization will create a non-convergent path that is qualitatively different from that of a permanent price change. The following equations characterize the period from t_0 to t_1. Since the path is non-convergent the constant associated with the positive eigenvalue, h_1;

can not be assumed to be zero,

$$S_t = \lambda_1 h_1 e^{\lambda_1 t} + \lambda_2 h_2 e^{\lambda_2 t}; \quad t \le t_1; \tag{5.1}$$

$$M_t - M^* = h_1 e^{\lambda_1 t} + h_2 e^{\lambda_2 t}; \quad t \le t_1. \tag{5.2}$$

M^* is the new steady state for monetary balances implied by price change at t_0. However, for later convenience, the steady state change in money stock will be expressed in terms of the initial stationary equilibrium, which will subsequently prevail at the end. Thus (5.2) becomes,

$$\Rightarrow \; M_t - M^0 = \left(M^* - M^0\right) + h_1 e^{\lambda_1 t} + h_2 e^{\lambda_2 t} = M^0 * P_x^* + h_1 e^{\lambda_1 t} + h_2 e^{\lambda_2 t}. \tag{5.3}$$

The second path The second shock occurs at t_1 and is also temporary. There will be another shift as the economy links up to a second path. Money stock is pre-determined and therefore the change occurs with a jump in the savings rate at t_1. The new path is not convergent either since the third price change is expected at t_2. This period can be characterized in the same way as before except for the fact that the constants have changed. The new constants are h_3 and h_4, neither of which can be assumed to be zero,

$$S_t = \lambda_1 h_3 e^{\lambda_1 t} + \lambda_2 h_4 e^{\lambda_2 t}; \tag{5.4}$$

$$M_t - M^{**} = h_3 e^{\lambda_1 t} + h_4 e^{\lambda_2 t}; \tag{5.5}$$

$$\Rightarrow \; M_t - M^0 = M * \hat{P}_x^{**} + h_3 e^{\lambda_1 t} + h_4 e^{\lambda_2 t}. \tag{5.6}$$

$$t_1 \le t \le t_2$$

Third path The last shock at time t_2 and is permanent. As it occurs the savings rate jumps again and the economy links to the third path which is convergent. In other words, since the shock is permanent utility maximization will imply a "stable arm" path to a saddle point stable equilibrium. Therefore, from t_2 to infinity, the constant h_5 associated with the positive eigenvalue is zero,

$$S_t = \lambda_2 h_6 e^{\lambda_2 t}; \quad t \ge t_2; \tag{5.7}$$

$$M_t - M^0 = h_6 e^{\lambda_2 t}, \quad t \ge t_2. \tag{5.8}$$

5.2. Solutions

To solve for the five unknowns h_1, h_2, h_3, h_4 and h_6, 5 restrictions are needed on the transition path. Firstly, the initial conditions on the stock of nominal money balances can be exploited. As M is pre-determined, equation (5.2) can be used at $t = 0$ to describe the relationship between the change in steady state money stock and the two unknown constants h_1 and h_2,

$$M' - M^* = h_1 + h_2;$$

$$\Rightarrow \; h_1 = -(M_0^* P_x^* + h_2). \tag{5.9}$$

Secondly, at $t = t_1$ the equations (5.2) and (5.6) both report nominal money stock at the same moment in time and must give the same solution,

$$-M'^* P_x^* + h_1 e^{\lambda_1 t_1} + h_2 e^{\lambda_2 t_1} = M^* P_x^* + h_3 e^{\lambda_1 t_1} + h_4 e^{\lambda_2 t_1};$$

$$\Rightarrow \; h_1 e^{\lambda_1 t_1} + h_2 e^{\lambda_2 t_1} - h_3 e^{\lambda_1 t_1} - h_4 e^{\lambda_2 t_1} = 2M^* P_x^*. \tag{5.10}$$

Thirdly, the same condition applies at $t = t_2$, when the next shift occurs and equations (5.6) and (5.8) must give the exact same information for the level of nominal money stock,

$$h_6 e^{\lambda_2 t_2} = -M^* \hat{P}_x^* + h_3 e^{\lambda_1 t_2} + h_4 e^{\lambda_2 t_2}; \tag{5.11}$$

$$\Rightarrow \; h_3 e^{\lambda_1 t_2} + h_4 e^{\lambda_2 t_2} - h_6 e^{\lambda_2 t_2} = -M^* P_x^*. \tag{5.12}$$

However, two other restrictions are still needed. They arrive from the fact that S will jump at time t_1 and again at t_2, as the economy links to a new path. The magnitude of the jump amounts to the difference in how the two respective equations report the savings rate immediately before and after the shocks occurs. If we call J_1 the jump at t_1, and J_2 the jump at t_2, the following must hold,

$$J_1 = \lambda_1 h_3 e^{\lambda_1 t_1} + \lambda_2 h_4 e^{\lambda_2 t_1} - \lambda_1 h_1 e^{\lambda_1 t_1} + \lambda_2 h_2 e^{\lambda_2 t_1}; \tag{5.13}$$

$$J_2 = \lambda_2 h_6 e^{\lambda_2 t_2} - \lambda_1 h_3 e^{\lambda_1 t_2} - \lambda_2 h_4 e^{\lambda_2 t_2}. \tag{5.14}$$

The two jumps can be determined by the fact that the multiplier μ is constant at $t = t_1$ and at $t = t_2$, since no new information will arrive after $t = 0$ and our representative agent is equipped with a perfect foresight. Therefore, the first order conditions, earlier derived, will determine by how much S is affected by changes in P_x^*,

$$V_E(P_n, P_m, E) = \mu.$$

Then by total differentiation,

$$\Rightarrow \tau\gamma_n\hat{P}_n + (\tau - 1)\gamma_m\hat{e} + \alpha_x\hat{P}_x - \frac{dS}{E} = d\pi = 0.$$

Now substitute (3.7) in for e,

$$\Rightarrow \tau\left(\gamma_n + Z\theta_L^x\gamma_m\right)\hat{P}_n + \hat{P}_x^*\left(\alpha_x - Z\tau\gamma_m\right) - \frac{dS}{E} = d\pi = 0.$$

Finally, if we use equation (3.12) to solve for $\hat{P}_n$ and rearrange terms we obtain a complete description of the relationship between the change in export price and savings,

$$\frac{dS}{E} = \frac{\tau\left(\gamma_n + Z\theta_L^x\gamma_m\right)[\gamma_m - Z\varepsilon] + \varepsilon\gamma_m\left(1 - Z\theta_L^x\right)(1 - Z\tau)}{\varepsilon\left(1 - Z\theta_L^x\right) + \tau\left(\gamma_n + Z\theta_L^x\gamma_m\right)}\hat{P}_x^*. \qquad (5.15)$$

Now we have established five equations that can give a complete solution for the five unknowns, i.e. h_1, h_2; h_3, h_4, and h_6. The solutions are as follows,

$$h_1 = -\frac{e^{\lambda_1 t_1}J_1 + e^{\lambda_1 t_2}J_2 + \lambda_2\left(e^{\lambda_1 t_1} - 2e^{\lambda_1 t_2}\right)M^*\hat{P}_x^*}{e^{\lambda_1 t_1}e^{\lambda_1 t_2}\left(\lambda_1 - \lambda_2\right)}; \qquad (5.16)$$

$$h_2 = \frac{e^{\lambda_1 t_2}J_1 + e^{\lambda_1 t_1}J_2 - \lambda_2\left(2M^*\hat{P}_x^* e^{\lambda_1 t_2} - e^{\lambda_1 t_1}\right)}{e^{\lambda_1 t_1}e^{\lambda_1 t_2}\left(\lambda_1 - \lambda_2\right)} - M^*\hat{P}_x^*; \qquad (5.17)$$

$$h_3 = -\frac{J_2 + \lambda_2 M^*\hat{P}_x^*}{e^{\lambda_1 t_2}\left(\lambda_1 - \lambda_2\right)}; \qquad (5.18)$$

$$\begin{aligned} h_4 = &-\frac{e^{\lambda_1 t_1}\left(e^{\lambda_1 t_2}J_1 - e^{\lambda_2 t_1}J_2 - M^*\hat{P}_x^*\left[2e^{\lambda_1 t_2}\lambda_1 + e^{\lambda_2 t_1}\lambda_2\right]\right)}{e^{\lambda_1 t_1}e^{\lambda_2 t_1}e^{\lambda_1 t_2}\left(\lambda_1 - \lambda_2\right)} - M^*\hat{P}_x^* \\ &+ \frac{e^{\lambda_2 t_1}e^{\lambda_1 t_2}\left(2\lambda_2 M^*\hat{P}_x^* - J_1\right)}{e^{\lambda_1 t_1}e^{\lambda_2 t_1}e^{\lambda_1 t_2}\left(\lambda_1 - \lambda_2\right)}; \end{aligned} \qquad (5.19)$$

$$\begin{aligned} h_5 = &\frac{e^{\lambda_1 t_1}\left(e^{\lambda_2 t_1}\left(e^{\lambda_2 t_2}\left(J_2 + \lambda_2\right) - e^{\lambda_1 t_2}\left(J_2 + \lambda_1 M^*\hat{P}_x^*\right)\right)\right)}{e^{\lambda_1 t_1}e^{\lambda_2 t_1}e^{\lambda_1 t_2}e^{\lambda_2 t_2}\left(\lambda_2 - \lambda_1\right)} \\ &\frac{e^{\lambda_1 t_2}e^{\lambda_2 t_2}\left(e^{\lambda_2 t_1}\left(J_1 - 2M^*\hat{P}_x^*\lambda_2\right) + e^{\lambda_1 t_1}\left(2M^*\hat{P}_x^* - J_1\right)\right)}{e^{\lambda_1 t_1}e^{\lambda_2 t_1}e^{\lambda_1 t_2}e^{\lambda_2 t_2}\left(\lambda_2 - \lambda_1\right)} + M^*\hat{P}_x^*. \end{aligned} \qquad (5.20)$$

At this point, a comparison of closed form solutions is not feasible and we will have to refer to numerical simulations.

5.3. Simulations

5.3.1. The Current account

In the non-interventionist regime, export price decreases are purely income shocks and consumer optimization is the elementary problem of consumption smoothing. Thus, there should be strong tendency to save the early windfall in order to sustain consumption in the subsequent, more adverse period. Therefore a significant trade surplus would be expected during the three first years along with a strong deflationary pull due to lower demand. Exchange rate interventions, on the other hand, will alter the relative price of tradables and non-tradables, and thus encourage inter-temporal substitution and dissaving, which contradicts consumption smoothing. Larger values of ε and τ will, as expected, increase the gains from inter-temporal substitution and thus lead to a lower trade surplus and possibly even a trade deficit if the degree of intertemporal substitution is sufficiently high ($\tau \geq 0.8$), as can be seen in figure 10a.

5.3.2. Prices

Since this is a two good economy, compensated demand and cross price elasticity are identical. The price paths of the two regimes are close to converging for low values of ε, although the outcome is not very appealing in terms of price stability, as can be seen from figure 5c. This is in line with sufficiency condition (4.8), which determines the lower bound $\varepsilon > 0.16$ for the exchange rate policy to be effective. Higher values of ε will universally lead to a better policy performance in terms of price stability in the non-interventionist regime since demand is more flexible to price changes. However, the results are more mixed for the exchange rate regime. As long as tradables and non-tradables are not gross substitutes and sufficiency condition (4.11) is not fulfilled, i.e. $\varepsilon < \gamma_m = 0.4$; then higher values of ε will enhance policy performance. If $\varepsilon > \gamma_m = 0.4$, then substitution dominates and a higher degree of price elasticity leads to a greater price instability.

Policy performance is very sensitive to τ; as larger values will make economic agents more tolerant to dents in consumption and weaken the incentive save in anticipation of a negative income shock. A low degree of inter-temporal substitution will make appreciation more effective in stabilizing prices in the three years leading up to a devaluation, although then the devaluation itself becomes more inflationary. The reason for this almost contradictory result is that the agents expect the price of non-tradables as well as tradables to rise in the wake of a devaluation. If the value of ¿ is large there is an incentive to consume non-tradables prior as well prior to the shock. Therefore the price of non-tradables will have greater tendency to increase in the three …rst years and the devaluation itself is less in‡ationary. This is really an example of how in‡ation expectations can create certain inertia for current economic policy.

5.3.3. Real exchange rates

The …rst shock, which is unanticipated, produces very similar response in both regimes in terms of relative prices, i.e. $\frac{\hat{P}_n}{\hat{e}}$. However, the subsequent and anticipated shocks do produce di¤erent responses. In fact, the exchange rate rule leads to a downward swing in relative prices when the adverse shock hits, which is much larger than is observed in a non-interventionist regime. The same phenomenon is displayed when the anticipated positive shock occurs that the exchange rate regime leads to a much higher upward movement in relative prices. This is result which is quite robust and holds almost irrespective of parameter values. Flexible exchange rates will create greater real exchange rate volatility.

6. Conclusion

The most striking result is that short-term stabilization policy may deliver very desirable short-term results in terms of price stability as in‡ation is postponed until the external trade environment is reversed. If " > °$_m$; so that tradables and non-tradables are gross substitutes, then a double digit in‡ation will result from the devaluation at time $t = 3$ when the negative shock occurs. The results thus indicate that an active monetary policy that involves temporary counter-cyclical exchanges rates changes may in e¤ect have a considerable in‡ationary bias, which is revealed after some lag. Furthermore, it is clear that the exchange rate policy will promote greater current account stability, although the tendency for a current account de…cits to appear in the wake of positive supply shocks is clearly displayed. From a microeconomic point of view, this constitutes a distortion or a welfare loss since variation in the current account are an inherent feature of consumption smoothing. The results are overall in line with the Icelandic experience