Step away from the zero lower bound:
Small open economies in a world of secular stagnation

Preliminary and incomplete

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Abstract

We study how small open economies can engineer an escape from deflation and unemployment in a global secular stagnation. Building on the framework of Eggertsson et al. (2016), we show that the transition to full employment requires a dynamic depreciation of the exchange rate, without prejudice for domestic inflation targeting. However, if depreciation has strong income and valuation effects, the escape can be *beggar thy self*, raising employment but actually lowering welfare. We show that, while a relaxation in the Effective Lower Bound (ELB) can work as a means of raising employment and inflation in financially closed economies, it may have exactly the opposite effect when economies are financially open.

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	optimal policy, zero lower bound
JEL-Codes:	F41, E62

1 Introduction

For some years now, world economic activity and real interest rates have been chronically low, a situation that motivated Summers (2013) to raise the issue of whether the global economy may have entered a 'secular stagnation,' echoing Hansen (1938). In a world in secular stagnation, output is depressed because, due to a combination of adverse demographics, low productivity growth and economic frictions, global saving cannot be absorbed at full employment. This hypothesis is by no means unchallenged. Notably, Lo and Rogoff (2015) among others attributes the current protracted slowdown to the need for deleveraging after the build-up of private and public debt before and in the aftermath of the global crisis. Whatever its root causes, the crisis has made policymakers increasingly aware of the extent to which national economies are alarmingly exposed to adverse global economic and financial developments. After three decades of trade and financial globalization, for a typical market economy, exports are a large component of demand, and its interest rates and asset prices are highly correlated with those in world markets.

The question we address in this paper is whether and by which mechanism a small open economy—heavily exposed to world variables but too small to affect them—can attain and maintain full employment and price stability when world demand is chronically depressed and global saving chronically excessive. While the crisis still weighs on global economic activity, indeed, a number of small open economies have been able to maintain a high level of domestic employment and positive growth rates. Classical open macro theory suggests that a single country can insulate its macroeconomy from adverse external conditions by letting its exchange rate absorb the contraction in world demand, and improve its external surplus. In Table 1, we provide evidence based on a large panel of countries for the period 1980-2011. In the Table, we regress measures of domestic economic activity on net foreign assets and the terms of trade, and their interaction with global output (details are reported in the notes of the Table 1). The interaction terms are significant and negative: in a global downturn, unemployment is systematically lower in countries with positive net foreign asset positions and weaker real exchange rates. While these correlations are consistent with a wide range of models, they provide a specific empirical motivation to our study.

In our study, we are specifically interested in understanding how a central bank can engineer an escape from deflation and unemployment in a world of secular stagnation. Our point of departure are the open economy overlapping generations models by Eggertsson et al. (2016) (henceforth EMSS) and Caballero et al. (2015) (henceforth CFG). We modify EMSS to analyse a small open economy that produces a differentiated good. This enables us to analyse the real exchange rate and its attendant welfare and positive implications, while abstracting from

the question of policy spillbacks.

We have two main findings. First, we show that, under plausible conditions on trade elasticities, a small open economy in a world of chronically deficient demand can embark on a path to full employment. The endpoint is characterised by a weaker real exchange rate, a trend depreciation in the nominal exchange rate, inflation at target and, for standard parameter values, an improved external asset position. With strong valuation and income effects, however, the short-term dynamics of the escape from secular stagnation can exhibit exchange rate overshooting, whereby upfront depreciation is followed by temporary appreciation, causing the nominal interest rates to remain temporarily stuck at the zero lower bound. Most importantly, the escape policy may be beggar thy self, raising employment but actually lowering welfare.

Our second main result is that so long as the economy remains in a secular stagnation, cutting the interest rate by relaxing the Effective Lower Bound (henceforth ELB) works as a means of raising employment and inflation when the economy is financially closed. But it can have exactly the opposite effect when the economy is financially open. The kernel of the intuition is simply that, in an economy open to trade in assets, the terminal real interest rate is pinned down at the global level by uncovered interest parity, so that lower nominal rates must eventually translate into lower inflation, a trend exchange rate appreciation, and thereby a more negative output gap. Nonetheless, should the ELB bind along the escape path, relaxing it can help to ease and shorten the transition to full employment.

In accounts of secular stagnation such as EMSS and CFG, output is depressed because of a shortage of stores of value, which are insufficient to absorb the volume of desired savings at full employment at real interest rates attainable in a monetary economy subject to the ELB. In this case, output must fall to restore equilibrium in the asset market. In an open economy, the shortage of assets is global, and the distribution of output depends on who owns these scarce stores of value.

We develop the framework of EMSS, introducing a differentiated domestic good to provide an account of the real exchange rate, and the role of substitution and income effects shaping the transitional dynamics to a full-employment steady state. Domestic real depreciation raises world demand to absorb the country's output on its path to full employment—a substitution effect. But there is also an income effect, in that the lower price of domestic output reduces domestic purchasing power, other things equal. When domestic and foreign goods are sufficiently substitutable, the equilibrium fall in prices and hence the income effect are small, and the rise in the volume of domestic output also raises domestic purchasing power. In this case, domestic households must acquire foreign assets in order to absorb the increased savings that

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result from full employment.

In contrast, when domestic and foreign goods are poor substitutes, the price of home goods must fall a great deal in response to their increased abundance. This fall in price outweighs the increase in volume, leaving domestic households poorer notwithstanding the increase in their employment. The value of domestic savings also falls. Depending on how the supply of domestic assets is specified, domestic savings needs may be satisfied at home, and fewer or even no foreign assets are acquired during the transition. The escape hence creates an adverse trade-off—agents work more but consume less—which raises the possibility of welfare losses. Currency wars, in this context, can be *beggar thy self*, rather than *beggar thy neighbors*.[1] In the empirically-relevant case of low short-run, high long-run trade elasticities, we show that the path to full employment involves a 'jam-tomorrow' policy, sacrificing the welfare of current generations for the sake of future ones.

Along the adjustment path, the path of policy and endogenous variables can look very different to the standard prescriptions for dealing with underemployment in open economies, which counsel cutting nominal interest rates or otherwise loosening monetary conditions. Depending on the characteristics of the economy the dynamics can be very rich. The real exchange rate may overshoot its weaker long run level. The nominal interest rate may rise immediately, or can remain at the ELB before rising to its positive long run level. The real interest rate generally rises to crowd out domestic expenditure before asymptoting back towards the world level.

With a long-run tradeoff between output and inflation, inflation returns to target as the economy converges towards full employment and so, as in EMSS, the nominal exchange must steadily depreciate to keep international relative prices in check, given the conditions of depression and deflation elsewhere in the world. In this sense, the policy prescription is both 'neo-Fisherian' (see Cochrane (2011)), involving higher nominal interest rates from the outset, *and* an instance of the Svensson's 'Foolproof Method' of achieving macroeconomic balance in a small open economy through a trend nominal exchange rate depreciation, see Svensson (2001) and Svensson (2003). Neither policy is sufficient in a financially closed economy, however, because the economy generally requires foreign inflows or outflows to equilibrate the asset market at full employment.

A number of central banks have recently attempted to counter low inflation and/or lacklustre growth by reducing nominal interest rates to unprecedentedly low levels (Danmarks Nationalbank (DN), the European Central Bank (ECB), Sveriges Riksbank and the Swiss National

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[1] Welfare assessment crucially depends on the disutility from involuntary unemployment, a point recently stressed by Schmitt-Grohé and Uribe (2015). For an analysis of beggar thyself depreciation in open economy macro see Corsetti and Pesenti (2001)

Bank (SNB) cut interest rates to below zero during the period from mid-2014 to early 2015, and most recently the Bank of Japan (BoJ) (see Bech and Malkhozov (2016)) and BoE[2] applied similar policies). In a financially closed economy, a sufficiently large reduction in the ELB on nominal interest rates can indeed restore full employment: nominal interest must fall to a level consistent with both the inflation target and the market-clearing real interest rate. But in an economy open to trade in assets, the real interest rate is pinned down at the world level. So by the Fisher equality, a permanent cut in nominal interest rates must eventually reduce inflation. Given the long-run tradeoff between output and prices in EMSS, this implies a lower future level of output, raising the real exchange rate today and causing output to fall immediately. This is not to say that ELB policies are necessarily counterproductive: if the economy is already on the escape route, we show that cutting interest rates can help smooth this adjustment path.

There are two points worth highlighting. Firstly, in line with the recent literature reviving secular stagnation, our paper focuses on the case where the world is *permanently* in a liquidity trap with negative neutral rates. Secondly, as we study on a small open economy, we do not discuss the cross-border spillovers that may stem from different domestic adjustment paths — amply discussed by the Eggertsson et al. (2015) and Caballero et al. (2016). By no means do we mean to downplay the issue. In particular, if a sufficient number of small open economies pursue the escape path depreciating their currencies, their joint behaviour is bound to have a first-order effect on the world real interest rates and allocation. In this case, domestic policymakers might need to focus on domestic stimulus rather than relying solely on the exchange rate channel, while support from other policies, including structural policies and asset-supply policies, might be necessary to lift global neutral rates. It is precisely because each small country has a strong incentive to pursue an individual escape path from stagnation that international policy coordination may be required.

Finally, our analysis naturally relates to contributions that study open economies in a *temporary* liquidity trap, either using a two-country model, see Cook and Devereux (2013), or taking the perspective of a small open economy, see Corsetti et al. (2016). As in our contribution, also in these frameworks exchange rate adjustment is key to moderate the negative implications of a global liquidity trap for the domestic economy. In particular, the nominal exchange rate needs to depreciate persistently to allow domestic inflation to rise above the world deflationary drift. Different from our analysis, however, in these frameworks ELB policies are generally desirable.

The remainder of this paper is organised as follows. Section 2 outlines the two-country

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[2]Monetary Policy Summary, 4 August 2016, http://www.bankofengland.co.uk/publications/minutes/Documents /mpc/mps/2016/mpsaug.pdf

Table 1: Partial correlation between net foreign assets, terms of trade and domestic output gap

VARIABLES	(1) y-gap	(2) y-gap	(3) u-gap_neg	(4) u-gap_neg
NFA/Y	0.040	0.107	0.292***	-0.020
	[0.15]	[0.15]	[0.10]	[0.11]
Terms of Trade	8.731***	9.852***	2.045*	0.051
	[2.26]	[2.25]	[1.21]	[1.22]
NFA * mean(y-gap)		-0.136**		
		[0.06]		
Terms of Trade * mean(y-gap)		-4.374***		
		[0.82]		
NA * mean(u-gap_neg)				-0.490***
				[0.11]
Terms of Trade * mean(u-gap_neg)				-6.558***
				[1.10]
Observations	1,965	1,965	1,029	1,029
R-squared	0.008	0.029	0.014	0.079
Number of countryno	85	85	37	37

The table reports the results from running the following regressions

$$y_{it} = \alpha_i + \beta_0 nfay_{it}\left(1 + \beta_1 y_t\right) + \gamma_0 tot_{it}\left(1 + \gamma_1 y_t\right) + \epsilon_{it} \tag{1}$$

where y_{it} is a measure of domestic activity relative to potential (the output gap or the negative of unemployment or the unemployment gap); y_t is its global average, $nfay_{it}$ is the ratio of net foreign assets to GDP and tot_{it} is the terms of trade (with a depreciation defined as an increase). The sample period is 1980-2011, the frequency is yearly. Unemployment or the unemployment gap are from the IMF WEO database; the net foreign asset positions used to calculate $nfay_{it}$, the ratio of net foreign assets to GDP, are from the database by Lane and Milesi-Ferretti (2007)); tot_{it}, the terms of trade, is taken from the Penn World Tables version 9.0.

mode used in our analysis. Section 3 analyses the stagnation and full employment steady states. Section 4 studies how a small open economy can escape from global secular stagnation. Sections 5 and 6 discuss, respectively, alternative monetary policy measures and asset supply policies. Section 7 concludes.

2 The model

We consider a model of a small open economy under perfect foresight, integrated with the rest of the world (ROW) on both goods and asset markets. The framework is one of overlapping generations (OLG), as in Eggertsson and Mehrotra (2014) and Eggertsson et al. (2015). Each country specializes in the production of one good, but consumes both goods. With home bias in demand, this leads to fluctuations in the terms of trade and the real exchange rate. Furthermore, international asset markets are incomplete, and we assume that each country saves in terms of a CPI-indexed, real bond. In each country, households live for three periods: young, middle-aged, and old. All the income accrues to the middle aged, such that the young borrow to be able to consume subject to a borrowing constraint, whereas the old consume their savings from last period. Labour supply is exogenous, and wages are assumed downwardly sticky.

2.1 Households

Domestic households maximize

$$\max_{\{C_t^y, C_{t+1}^m, C_{t+2}^o\}} \left\{ \frac{(C_t^y)^{1-\rho}}{1-\rho} + \beta \frac{(C_{t+1}^m)^{1-\rho}}{1-\rho} + \beta^2 \frac{(C_{t+2}^o)^{1-\rho}}{1-\rho} \right\}$$

subject to

$$C_t^y = -B_t^y$$
$$C_{t+1}^m = P_{H,t+1}/P_{t+1}Y_{t+1} + (1+r_t)B_t^y - B_{t+1}^m$$
$$C_{t+2}^o = (1+r_{t+1})B_{t+1}^m$$
$$-(1+r_t)B_t^y \leq D_t.$$

Here, P_t is the consumer price index (CPI—the price of domestic consumption), $P_{H,t}$ is the producer price index (PPI—the price of domestic output), r_t is the (domestic consumption-based) real interest rate, and D_t is the borrowing constraint faced by the young. Furthermore, $C_t^i, i \in \{y, m, o\}$, represent consumption by the young, middle-aged, and old, respectively, and $B_t^i, i \in \{y, m\}$ are bond holdings/savings by the young and middle-aged, respectively. Finally, $0 < \beta < 1$ denotes the time-preference rate, and $\rho^{-1} > 0$ denotes the intertemporal elasticity of substitution.

We consider an equilibrium in which the young borrow all the way up their borrowing constraint

$$C_t^y = -B_t^y = \frac{D_t}{1+r_t}.$$

Note that there are no prices appearing in the borrowing constraint, as the borrowing limit is defined in real terms (as is the bond). The middle-aged satisfy an Euler equation

$$(C_t^m)^{-\rho} = \beta(1 + r_t)(C_{t+1}^o)^{-\rho}$$

while the old consume all their savings from last period

$$C_t^o = (1 + r_{t-1})B_{t-1}^m.$$

By combing these equations, we obtain that

$$C_t^m = \left(1 - \frac{1}{1 + [\beta(1 + r_t)^{1-\rho}]^{-\frac{1}{\rho}}}\right)\left[\frac{P_{H,t}}{P_t}Y_t - D_{t-1}\right]$$

$$B_t^m = \frac{1}{1 + [\beta(1 + r_t)^{1-\rho}]^{-\frac{1}{\rho}}}\left[\frac{P_{H,t}}{P_t}Y_t - D_{t-1}\right]$$

for the middle-ages as well as

$$C_t^o = (1 + r_{t-1})\left(\frac{1}{1 + [\beta(1 + r_{t-1})^{1-\rho}]^{-\frac{1}{\rho}}}\right)\left[\frac{P_{H,t-1}}{P_{t-1}}Y_{t-1} - D_{t-2}\right]$$

for the old in equilibrium.

2.2 Goods market integration

We assume the domestic consumption basket is made up of domestically-produced and ROW-produced goods as follows

$$C_t^i = \left[(1 - \omega)^{\frac{1}{\sigma}}(C_{H,t}^i)^{\frac{\sigma-1}{\sigma}} + \omega^{\frac{1}{\sigma}}(C_{F,t}^i)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \quad i \in \{y, m, o\},$$

where $C_{H,t}$ is demand for the domestically-produced, $C_{F,t}$ demand for the ROW-produced good, and where $0 \leq 1 - \omega \leq 1$ is the degree of home-bias in consumption and $\sigma > 0$ the intratemporal elasticity of substitution. Expenditure minimization interlinks consumer and producer price indexes as

$$P_t = [(1 - \omega)(P_{H,t})^{1-\sigma} + \omega(P_{F,t})^{1-\sigma}]^{\frac{1}{1-\sigma}}, \tag{2}$$

where $P_{F,t}$ is the price of the ROW-produced good (expressed in terms of domestic currency). If we assume the law of one price holds at the level of each good

$$P_{H,t} = \mathcal{E}_t P_{H,t}^* \quad P_{F,t} = \mathcal{E}_t P_{F,t}^*,$$

where $\mathcal{E}_t$ is the nominal exchange rate (the price of foreign currency in terms of domestic currency) and where an asterisk indicates variables in the ROW (here: the price of the

domestic and the ROW-produced good, expressed in terms of foreign currency), then the domestic terms of trade (the price of imports in terms of exports) are given by

$$S_t = \frac{P_{F,t}}{P_{H,t}}, \tag{3}$$

and the real exchange rate (the price of ROW-consumption in terms of domestic consumption) obtains from

$$Q_t = \frac{\mathcal{E}_t P_t^*}{P_t}. \tag{4}$$

2.3 Asset market integration

We assume that domestic and foreign households can, in addition to their saving in CPI-denoted bonds, also save in non-indexed bonds which pay in terms of domestic and foreign currency, respectively. All these bonds are in zero net supply, such that we may ignore them in the household problem above. However, as a result, the following no-arbitrage conditions have to be satisfied in equilibrium

$$(1 + r_t^*) = (1 + i_t^*)\frac{P_t^*}{P_{t+1}^*} \tag{5}$$

$$(1 + r_t) = (1 + i_t)\frac{P_t}{P_{t+1}} \tag{6}$$

$$(1 + i_t) = (1 + i_t^*)\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} \tag{7}$$

where i_t (i_t^*) is the domestic (foreign) nominal interest rate. The first two equations are the Fisher equations in the domestic and foreign country, respectively, while the last equation is an interest parity condition.

2.4 Firms

Output is produced using labour from residents of the respective country, according to

$$Y_t = L_t^\alpha,$$

where $0 < \alpha \le 1$. Optimality requires $W_t = P_{H,t}\alpha L_t^{\alpha-1}$. Moreover, we adopt the specification in Eggertsson and Mehrotra (2014) and assume that nominal wages are downwardly sticky of degree $0 \le \gamma \le 1$:

$$W_t = \max\{\tilde{W}_t, W_t^{flex}\},$$

where $W_t^{flex} \equiv P_{H,t}\alpha(L^f)^{\alpha-1}$ (here, $L^f > 0$ denotes full employment), and where $\tilde{W}_t$ is a wage norm which solves

$$\tilde{W}_t = \gamma W_{t-1} + (1 - \gamma)W_t^{flex}.$$

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Using the above, Eggertsson and Mehrotra (2014) derive a Phillips curve of the form

$$Y_t = \left[\gamma \frac{Y_{t-1}^{\frac{\alpha-1}{\alpha}}}{\Pi_{H,t}} + (1-\gamma)(Y^f)^{\frac{\alpha-1}{\alpha}} \right]^{\frac{\alpha}{\alpha-1}} \tag{8}$$

whenever $\Pi_{H,t}$ $(:= P_{H,t}/P_{H,t-1}) < (Y^f/Y_{t-1})^{\frac{1-\alpha}{\alpha}}$, and

$$Y_t = Y^f \tag{9}$$

else, where $Y^f = (L^f)^\alpha$ is output under full employment. Note that the Phillips curve is a function of current, not expected inflation.

2.5 Market clearing

Because the domestic economy is small, the CPI in ROW will correspond to the price of foreign output, $P_t^* = P_{F,t}^*$, from which follows

$$Q_t = \frac{P_t^* \mathcal{E}_t}{P_t} = \frac{P_{F,t}}{P_t} = S_t \frac{P_{H,t}}{P_t}. \tag{10}$$

Domestic goods market clearing is then given by

$$Y_t = (1-\omega)\left(\frac{P_{H,t}}{P_t}\right)^\sigma C_t + \omega S_t^\sigma Y_t^*, \tag{11}$$

where $C_t := C_t^y + C_t^m + C_t^o$ denotes aggregate domestic consumption. Furthermore, asset market clearing requires

$$NFA_t = B_t^y + B_t^m = -\frac{D_t}{1+r_t} + \frac{1}{1+[\beta(1+r_t)^{1-\rho}]^{-\frac{1}{\rho}}} \left[\frac{P_{H,t}}{P_t}Y_t - D_{t-1}\right], \tag{12}$$

where NFA_t is the domestic country's net foreign asset position, which from the households' budget constraint implies

$$C_t + NFA_t = (1+r_{t-1})NFA_{t-1} + \frac{P_{H,t}}{P_t}Y_t, \tag{13}$$

the flow budget of the domestic country.

2.6 Monetary policy

We posit that the monetary authorities target inflation subject to a zero-bound constraint on nominal rates:

$$\Pi_{H,t} = \bar{\Pi} \quad \text{subject to} \quad i_t \geq 0, \tag{14}$$

If inflation falls below target, nominal rates fall to zero:

$$i_t = 0 \quad \text{if} \quad \Pi_{H,t} < \bar{\Pi}. \tag{15}$$

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We assume that policymakers cannot commit and follow a standard interest rate rule. So, once the economy is in a stagnation steady state and policy rates are at the zero lower bound, nominal interest rates are inelastic to current as well as target inflation: a change in the inflation target per se does not affect agents expectations about the current and future monetary stance.

Alternatively, we consider regimes in which the monetary authorities can credibly pursue exchange rate targets in the form crawling pegs

$$\mathcal{E}_t = \bar{\mathcal{E}}_t, \tag{16}$$

at some (time-varying) pre-announced rate $\bar{\mathcal{E}}_t$.

To be clear, we should stress that, in the model, credible exchange rate policies cannot be conceptually separated from credible policies targeting inflation, as one imply the other at the corresponding equilibrium rates.

2.7 Rest of the world

In modelling the ROW, we specify parameters values such that, in a symmetric steady state, the two economies have the same real interest rate. Specifically, we assume that

Assumption 1. *The two economies have the same parameters: the same degree of risk aversion, time preference, inflation target, curvature of the production function, full-employment (per capita) output, degree of downward stickiness. Moreover, we let $D_t^* = D_t$ for all t.*

As a result, even when both economies are financially integrated, in a symmetric steady state there will be no current account imbalances. Below, we will see that current account imbalances can arise along the equilibrium path that allows a small open economy to escape stagnation.

Since the domestic economy is small, the rest of the world effectively is a closed economy. We will assume that ROW will remain in steady state throughout: all shocks accrue in the domestic economy. As in Eggertsson and Mehrotra (2014), ROW finds itself in a steady state of stagnation if D^*, the borrowing limit imposed on the young, is sufficiently tight. Inflation and output (Π^*, Y^*) then jointly solve

$$D^* \Pi^* = \left(\frac{1}{1 + [\beta (\Pi^*)^{-(1-\rho)}]^{-\frac{1}{\rho}}} \right) [Y^* - D^*]$$

as well as

$$Y^* = (Y^f)^* \left(\frac{1 - \gamma^*/\Pi^*}{1 - \gamma^*} \right)^{\frac{\alpha}{1-\alpha}},$$

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where we have used the fact that $i^* = 0$ such that $(1 + r^*) = (\Pi^*)^{-1}$ from the Fisher equation
(5). It is easy to show that, in this steady state, both $\Pi^* < 1$ and $Y^* < (Y^f)^*$, hence

$$(1 + r^*) = (\Pi^*)^{-1} > 1, \qquad (17)$$

even though the *natural* real interest rate in this economy is negative.[3] Thus, the output gap
and deflation are a reflection of the fact that real interest rates are above their natural, or
"equilibrium" level. As emphasized by Eggertsson and Mehrotra (2014), this steady state is
unique to the extent that policy makers are unwilling to raise the inflation target above the
negative of the natural real interest rate. For instance, if the inflation target is zero percent,
a negative natural real interest rate is sufficient for ROW to be trapped in stagnation. As we
are concerned with policy options in a depressed world economy, we shall assume that ROW
finds itself in such a steady state for the remainder of the paper.

2.8 Equilibrium definition in the small open economy

Given initial conditions $\{Y_{-1}, NFA_{-1}, P^*_{-1}, P_{-1}, P_{H,-1}\}$ and for given variables in the rest of
the world $\{D^*, r^*, Y^*, \Pi^*, P_t^* = \Pi^* P^*_{t-1}, i^* = 0\}$, an equilibrium in the domestic economy is a
set of sequences $\{C_t, Y_t, Q_t, S_t, P_{H,t}, P_{F,t}, P_t, \Pi_{H,t}, \Pi_t, \mathcal{E}_t, i_t, r_t, NFA_t, D_t\}$ that solve equations
(2)-(3),(6)-(13), equations $\Pi_{H,t} \equiv P_{H,t}/P_{H,t-1}$ and $\Pi_t \equiv P_t/P_{t-1}$, equation $D_t = D^*$, and
either policy rule (14)-(15) or policy rule (16).

3 Macroeconomic equilibrium in the small open economy

In this section, we explore how a small open economy can cope with the fact that its trading
partners are permanently trapped in stagnation—accompanied by deflation, zero nominal
interest rates, employment below potential, and a negative output gap. Most importantly, we
ask whether it can *not be* in stagnation in such a situation. We start with a characterization
of steady states, before we move on to dynamics and a discussion of the various policy regimes
further below.

3.1 The closed economy benchmark: secular stagnation in both countries

To fix ideas, suppose $\omega = 0$, implying that the two economies are completely closed—no
reasons to trade goods and assets. By assumption, the two countries have symmetric features

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[3]The natural or "equilibrium" real interest rate, that is, the real interest that would prevail absent nominal
rigidities, is implicitly defined by

$$\frac{D^*}{1 + (r_{\mathrm{nat}})^*} = \left(\frac{1}{1 + [\beta(1 + (r_{\mathrm{nat}})^*)^{1-\rho}]^{-\frac{1}{\rho}}} \right) \left[(Y^f)^* - D^* \right].$$

Note that $(r_{\mathrm{nat}})^* < 0$ for sufficiently small D^*, which is the assumption made in the main text.

as regards frictions and potential output, as well as policy parameters (e.g. inflation target). If the ROW is in a secular stagnation, the domestic economy would also find itself, necessarily, in a stagnation steady state. Formally, with complete home-bias ($\omega = 0$), we will have $P_t = P_{H,t}$ from (2), $Y_t = C_t$ from (11) and $NFA_t = 0$ from (13). The domestic steady state then solves

$$\frac{D}{1+r} = \left(\frac{1}{1 + [\beta(1+r)^{1-\rho}]^{-\frac{1}{\rho}}} \right) [Y - D] \tag{18}$$

from (12), as well as

$$Y = Y^f \left(\frac{1 - \gamma/\Pi}{1 - \gamma} \right)^{\frac{\alpha}{1-\alpha}}, \tag{19}$$

from (8). These are the same equations as in the rest of the world (Section 2.7), once we replace $(1+r)$ by Fisher equation (6)

$$(1+i) = (1+r)\Pi. \tag{20}$$

Precisely, if the domestic inflation target is the same as the one in ROW, then the solution is unique and characterized by $i = 0$ along with $Y = Y^* < Y^f, \Pi = \Pi^* < 1$, and $(1+r) = (1+r^*) = (\Pi^*)^{-1} > 1$. Thus, the domestic economy finds itself in the same state of stagnation as the rest of the world.

3.2 An asymmetric full-employment steady state in open economy

For an small open economy integrate in the world goods and bond markets, the stagnation steady state is still a possibility, but a second steady state emerges, characterized by full employment, inflation on target, and a strictly positive nominal interest rate. We summarize this key result in the following proposition:

Proposition 1. *If $\omega > 0$, the domestic economy can find itself in one of two steady states. The stagnation steady state is the same as if the domestic economy were in autarky, and is characterized by purchasing power parity $Q = S = 1$ and zero net foreign assets $NFA = 0$. Conversely, the full employment steady state has $Y = Y^f$, $\Pi = \bar{\Pi}$, and $(1+i) = \bar{\Pi}/\Pi^* > 1$. Provided $\sigma > 0$ is large enough, this steady state is associated with a depreciated real exchange rate and terms of trade, $Q > 1$ and $S > 1$, and a positive stock of net foreign assets $NFA > 0$.*

Proof. See the appendix. □

Proposition 1 illustrates that a small open economy *can* find itself in a full employment steady state even if the rest of the world is not, and can achieve this without modifying its

domestic inflation target.[4] Intuitively, it can "export the problem", in that it can achieve full employment by weakening its exchange rate. For a high enough trade elasticity, this means that the country exports its excess saving by building up net foreign assets.

To appreciate the role of nominal exchange rate flexibility, note that from UIP condition (7)

$$\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} = (1+i) = \bar{\Pi}/\Pi^* > 1, \tag{21}$$

In this steady state, the nominal exchange rate constantly depreciates at a speed that is determined by the ratio of the domestic inflation target and the negative inflationary drift abroad (see also Corsetti et al. 2016). It follows that

Corollary 1. *The full employment steady state is feasible only if the nominal exchange rate is allowed to constantly depreciate. If domestic monetary policy pursues a fixed exchange rate, only the stagnation steady state exists.*

To dig deeper into the adjustment mechanism, note first that if asset trade is allowed for, real interest rates in the domestic economy are pinned down by their ROW counterpart up to (expected) changes in the real exchange rate

$$(1 + r_t) = (1 + r_t^*)\frac{Q_{t+1}}{Q_t}, \tag{22}$$

where we have combined equations (4) and (6)-(7). In steady state, the real exchange rate must be constant such that $(1 + r) = (1 + r^*)$. As a result, from the perspective of the small domestic economy, the domestic real interest rate is exogenous in steady state and therefore the same in both the employment and stagnation steady state. Furthermore, equilibrium in the asset market is characterized by equation (12)

$$B_t^m = -B_t^y + NFA_t,$$

such that domestic savings (by the middle-aged) equal domestic borrowing (by the young) plus the net foreign asset position. Intuitively, recall that the stagnation steady state results from "excess savings", and that the real interest rate remains "stuck" above its market clearing level, in turn generating the negative output gap. By contrast, as established by our proposition 1, a small open economy can take such excess savings abroad by acquiring assets on foreigners. The proposition makes it clear that, for this to be possible, the trade elasticity must be large enough, and the capital account must be open and in deficit, as the flip-side of current account surpluses. This takes pressure off the domestic real interest rate, creating the conditions for an equilibrium under full employment to emerge.

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[4]As in EMSS, under the conditions stated in the proposition, both steady states are (locally) determinate. If by contrast σ is very low, approximately below $(1 - \omega)/(2 - \omega)$, both steady states are explosive.

3.3 Exporting versus devaluing domestic savings: the possibility of beggar-thyself depreciation

From theory, we know that real exchange rate movements have both substitution and income effects. Real depreciation makes domestically produced goods cheaper, redirecting world demand towards them. For given output, however, it also reduces the international value of domestic production, making domestic residents poorer. With incomplete markets, these income effects tend to be strong, and can become stronger than the substitution effects (see Corsetti et al. (2008b) and Corsetti et al. (2008a)).

Consider a trade elasticity just below (but not far from) the following threshold: $\tilde{\sigma} = 1/(2-\omega)$, a number in between one half and one.[5] A steady state equilibrium with full employment exists, associated with real depreciation. But the rate of depreciation is so large that, valued at international prices, the national income when the economy moves from secular stagnation to full-employment output actually falls. The contraction in income in turn reduces the value of domestic savings, causing the country to become an international debtor in equilibrium. As a result of the adverse terms-of-trade movements, domestic residents work more, bringing the economy to full employment, and cut consumption.

The main lesson is apparent. For a range of low trade elasticities, a country can still escape secular stagnation via depreciation, but the income effects of a "currency war" always prevails over substitution effects: desired savings fall more than the change in the foreign demand for domestic output. With international prices moving against the country, domestic residents need to work more to sustain any given level of consumption, creating a trade-off by which the full-employment steady state may not be welfare improving. A currency war is then beggar thyself.

3.4 A graphical synthesis

Figure 1 summarizes the previous discussion graphically, depicting equilibrium in the domestic asset market for both the case of a high trade elasticity (left side) and a low trade elasticity (right side). In either case, the upper panel plots domestic savings (by the middle-aged, $= B^m$) versus domestic borrowing (by the young, $= -B^y$) against the domestic real interest rate r. By contrast, the lower panel plots both savings and borrowing against the domestic level of production, Y.[6] Remember that both savings and borrowing are denoted in real terms, or more precisely, in terms of domestic consumption.

When the trade elasticity is high, under full employment, domestic savings ($B^{m,full}$) exceed

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[5]See the Appendix for a derivation and discussion.

[6]We assume in the graph that savings are upward sloping in the real interest rate, which holds as long as $\rho > 1$. We do, however, not require this assumption for any of our results.
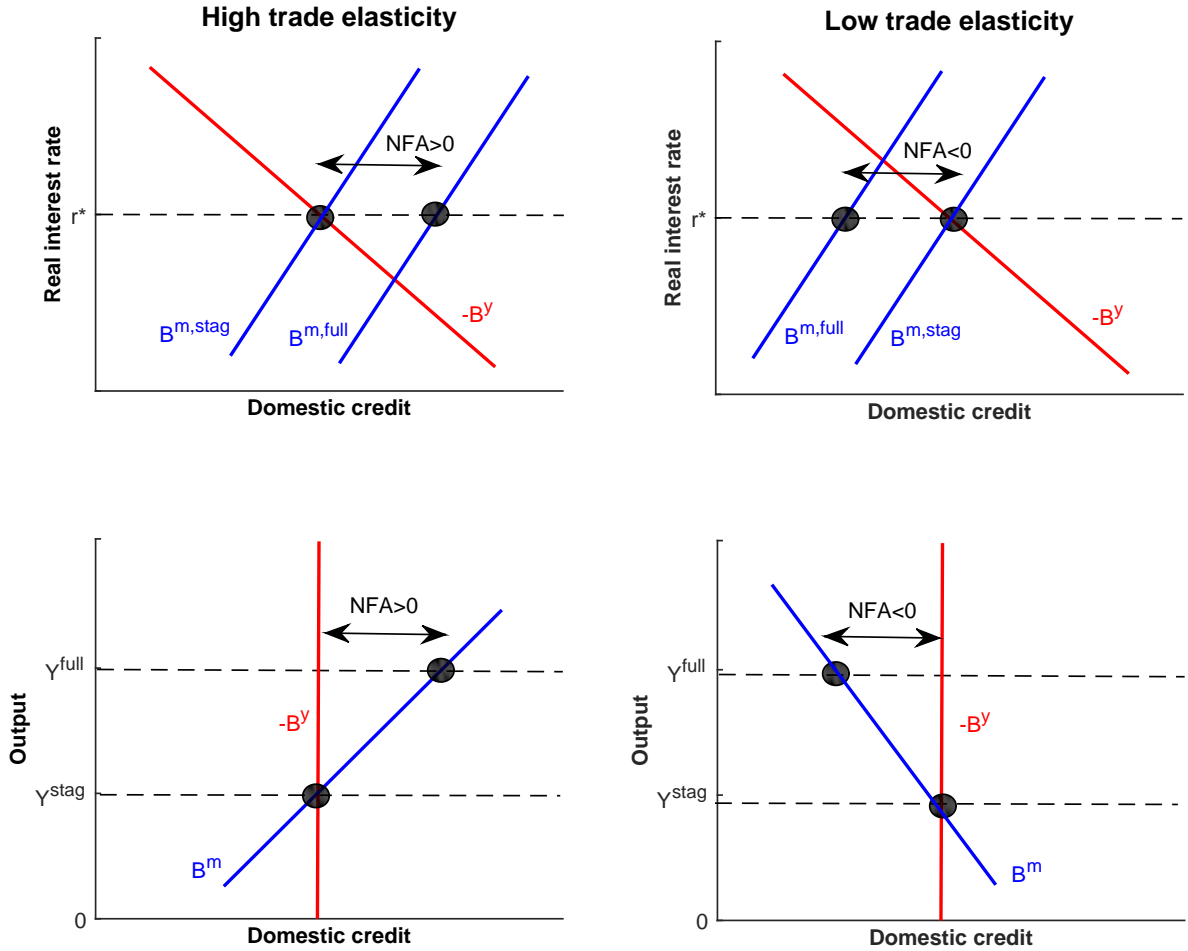
Figure 1: Graphical representation of equilibrium in domestic asset market.

domestic borrowing at the prevailing world real interest rate r^*. If capital outflows are possible, the difference is made up by a positive net foreign asset position. If, however, such outflows are not possible, the excess savings must be "absorbed" by the domestic economy. Given that $r = r^*$ and that hence the level of domestic borrowing is fixed (namely, equal to $D/(1 + r^*)$), this requires a reduction in the level of desired savings.

This brings us to the lower panel which shows that, again for a high level of the trade elasticity, desired savings increase in the level of domestic production. This is because the level of domestic income valued at international prices (equal to $P_H Y/P$, see equation (12)) is positively sloped in domestic production. Thus, a reduction in desired savings requires a reduction in domestic production, and the economy moves from Y^{full} to $Y^{stag} < Y^{full}$. The latter shifts the savings curve to the left in the upper panel ($B^{m,stag}$), and equilibrium in the domestic credit market is restored.

By contrast, when the trade elasticity is low, domestic income hence domestic savings *fall* in the level of domestic production (the B^m curve in the lower right panel is backward bending). This is because, when domestic and imported goods are highly complementary, a higher level of domestic production is absorbed only when its price falls dramatically, such that, valued at international prices, the value of domestic income is actually *reduced*. As a result, as the economy moves from stagnation to full employment, its excess savings are compressed in value by so much, that under full employment the economy finds itself as a *net debtor* vis-à-vis the rest of the world: $B^{m,full}$ moves to the left of $B^{m,stag}$ in the upper right panel of Figure 1.

4   Transition to full employment - how do small open economies escape stagnation?

We have established the existence of a full-employment steady state for the small domestic economy. We now analyze how the domestic economy can escape stagnation by solving explicitly for the transition path to full employment.

4.1   The escape path

Starting from deep recession, we show that, under the monetary policy rule (14), escape requires a large upfront nominal and real depreciation, and a temporary rise in both nominal and real interest rates relative to their previous steady states. In the process, the domestic economy steadily recovers and, depending on the trade elasticity, either runs current account surpluses or current account deficits. The transitions for either case are displayed in Figures 2 and 3 below.[7]

Observe that the nominal exchange rate depreciates upfront, and keeps depreciating more gradually over time. This reflects Corollary 1: for the domestic economy to delink itself from the deflationary drift in the ROW, domestic inflation needs to outpace foreign inflation, implying trend depreciation. In anticipation of this, the nominal interest rate jumps up from UIP condition (7), and comes down again gradually as the speed of nominal depreciation subsides. In the long run, the nominal interest rate it is pinned down by Fisher equation (6), and corresponds to real interest rate $(1 + r^*)$ times the domestic inflation target. The real interest rate and real exchange rate adjust similarly as their nominal counterparts in

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[7]We emphasize that technically, equilibrium in the model is globally indeterminate, in that dynamics can be affected by "sunspot shocks". As in earlier models of inflation targeting under a zero lower bound constraint (for example Benhabib et al. 2001), a change in beliefs can thus trigger transition to the full employment steady state—as well as transition to the stagnation steady state. See Benhabib et al. (2002) for a discussion on how transition to the zero lower bound steady state can be ruled out in a closed economy. See Cochrane (2011) for a general discussion on such "ruling out an equilibrium path". See Mertens and Ravn (2014) for "optimism" versus "pessimism" affecting dynamics under global indeterminacy in a closed-economy New Keynesian model.
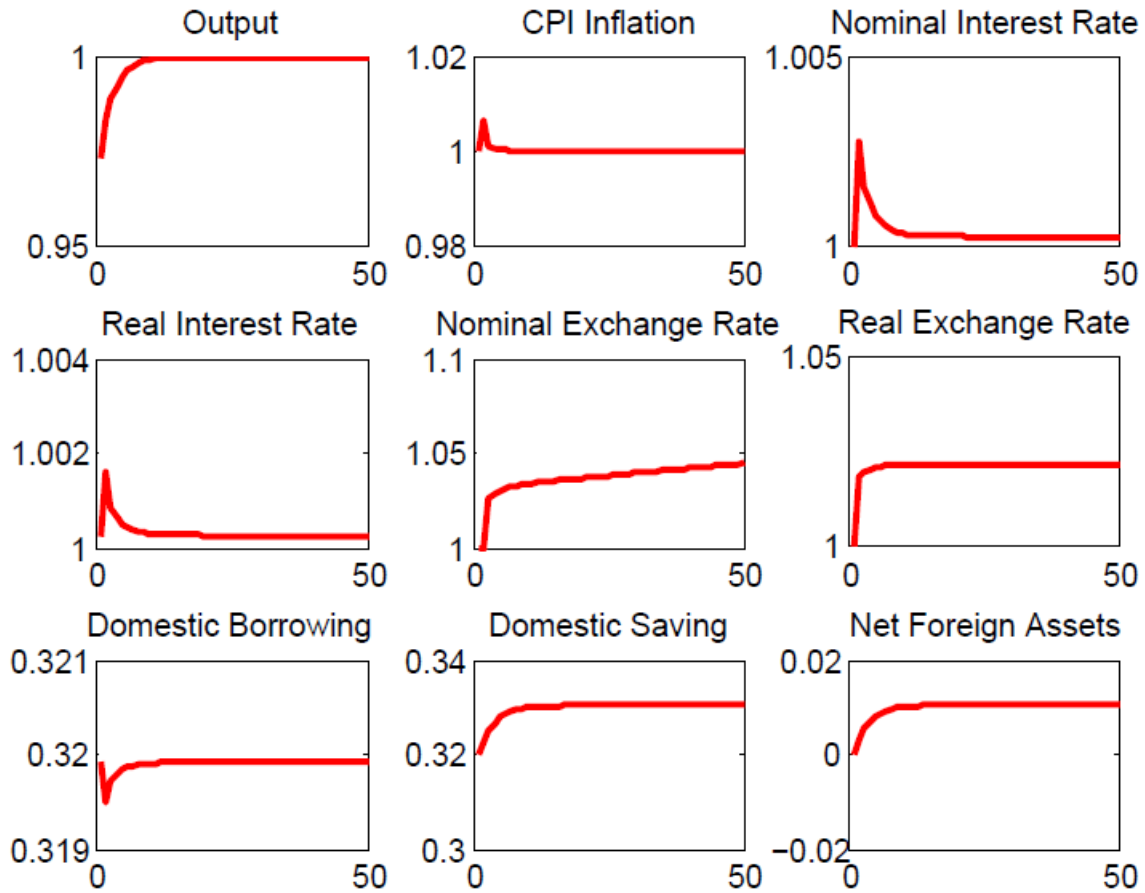
Figure 2: Example transition to full employment: high trade elasticity.

the early stage of recovery. In the long run, however, the real interest rate settles down on its pre-transition value, equation (22), while the real exchange rate remains permanently weakened—reflecting the relative abundance of the domestic good on the world market under domestic full employment. Meanwhile, the country builds up net foreign assets during the recovery in the case of a high trade elasticity (Figure 2), and builds up net foreign debt during the recovery in the case of a low trade elasticity (Figure 3). The lower middle panel echoes the discussion from earlier above: domestic savings rise during the transition to full employment when the trade elasticity is high, but fall when the trade elasticity is low.

The fact that the recovery in this economy is associated with a temporary *rise* in nominal and real interest rates relative to their pre-transition steady states, is obviously at odds with the notion that, in the presence of nominal and financial rigidities, a boost in demand and depreciation requires a fall in interest rates. Here however the rise in nominal interest rates is driven by trend depreciation in the new steady state, which is required to delink the long-run
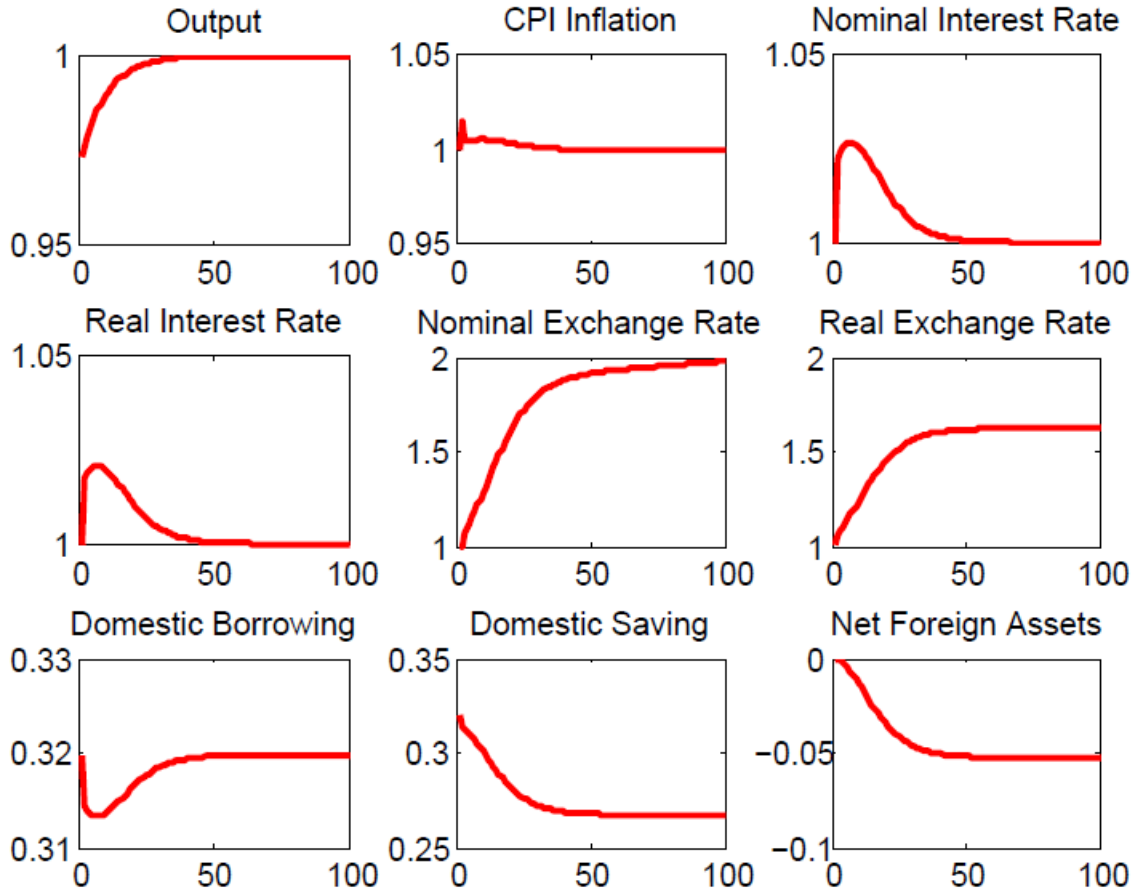
Figure 3: Example transition to full employment: low trade elasticity.

price level in the domestic economy from the deflationary drift in the rest of the world—a result that resonates with the 'Neo-Fisherian' literature.[8] This dynamic adjustment is also reminiscent of Svensson's "Foolproof Method" to escape a liquidity trap in an open economy: what jump-starts the economy is an upfront and persistent weakening of the nominal and real exchange rate (Svensson 2001 and Svensson 2003).

4.2 Valuation effects and macroeconomic dynamics along the escape path

A novel contribution of our paper is a close-up analysis of the dynamics of output and the current account along the transition: Under the conditions spelled out in proposition 1 the economic activity falls upfront; it only recovers gradually as the ROW absorbs the saving surplus. Along this path, the interest rate must increase, to compress domestic demand and facilitate net exports of the appropriate size (the opposite occurring with a low trade

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[8]See Schmitt-Grohe and Uribe (2012) for an example of 'Neo-Fisherianism' in a small open economy model.

elasticity).

The question we discuss in this subsection is how, along the transition, valuation effects from depreciation may affects macroeconomic dynamics and adjustment. We have already seen that, when trade elasticities are low, the large real depreciation in steady state reduces the present discounted value of income flows from domestic production, i.e. cause a fall in domestic wealth. The implications for macroeconomic dynamics are apparent from a comparison of Figures 2 and 3. First, the rate of depreciation will be higher (reflecting lower elasticities). Second, consumption will fall on impact, driven by wealth, and will keep falling to its new steady state level. Third, the country will run a deficit, becoming an international borrower.[9] Which elasticity is relevant for the analysis of small open economies? As is well know, there is little consensus in the literature. By and large, macro time-series estimates tend to yield values on the low side, ranging from as low as .3 to 2. Micro and trade estimates tend to yield much higher values, in the range of 2 to 4 or even higher.[10] There is nonetheless consensus that trade elasticities are lower in the short run than in the long run, prompting several studies to investigate the reasons for this difference (Ruhl (2008), Crucini and Davis (2016)) In light of the debate in the literature, it is not appropriate to rule out the possibility of low elasticities *a priori*. Yet, the empirical and quantitative evidence makes a strong case for reconsidering our results letting elasticities differ in the short and the long run, becoming higher over longer time horizon.

In Figure 4, the elasticity is just above .45 at the beginning of the escape path, and increases gradually to 4 as a function of time. A number of important results emerge. The exchange rate needs to adjust in nominal and real terms much more at the beginning of the transition, so does inflation. The real exchange rate actually overshoots temporarily its value over the transition, driving down the real interest rate. Domestic borrowing temporarily rises together with saving. Most remarkably, the nominal interest rate so remains at the zero lower bound for a number of periods.

A key lesson from allowing for plausible differences in short- and long-run elasticities is that along the escape route, the interest rate in a small open economy may remain at the ELB on impact. It may take some time before the improvement in macroeconomic conditions and

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[9]As explained in the last section of this paper, valuation effects may be so large that the steady state is explosive, and a transition path may not exists under rational expectations. The elasticity is selected to be the smallest for which the steady state is not explosive. Furthermore, for σ very low, the real exchange rate would actually need to appreciate during the transition.

[10]As regards macro studies, Taylor (1993) estimates the value for the U.S. to be 0.39, while Whalley (1984) reports a value of 1.5. For European countries most empirical studies suggest a value below 1. For instance, Anderton et al. (2004) report values between 0.5 and 0.81 for the Euro area. See the comprehensive study on G-7 countries by Hooper, Johnson and Marquez, 2000. As regards micro studies, for instance, Bernard et al. (2003) finds a value as high as 4.
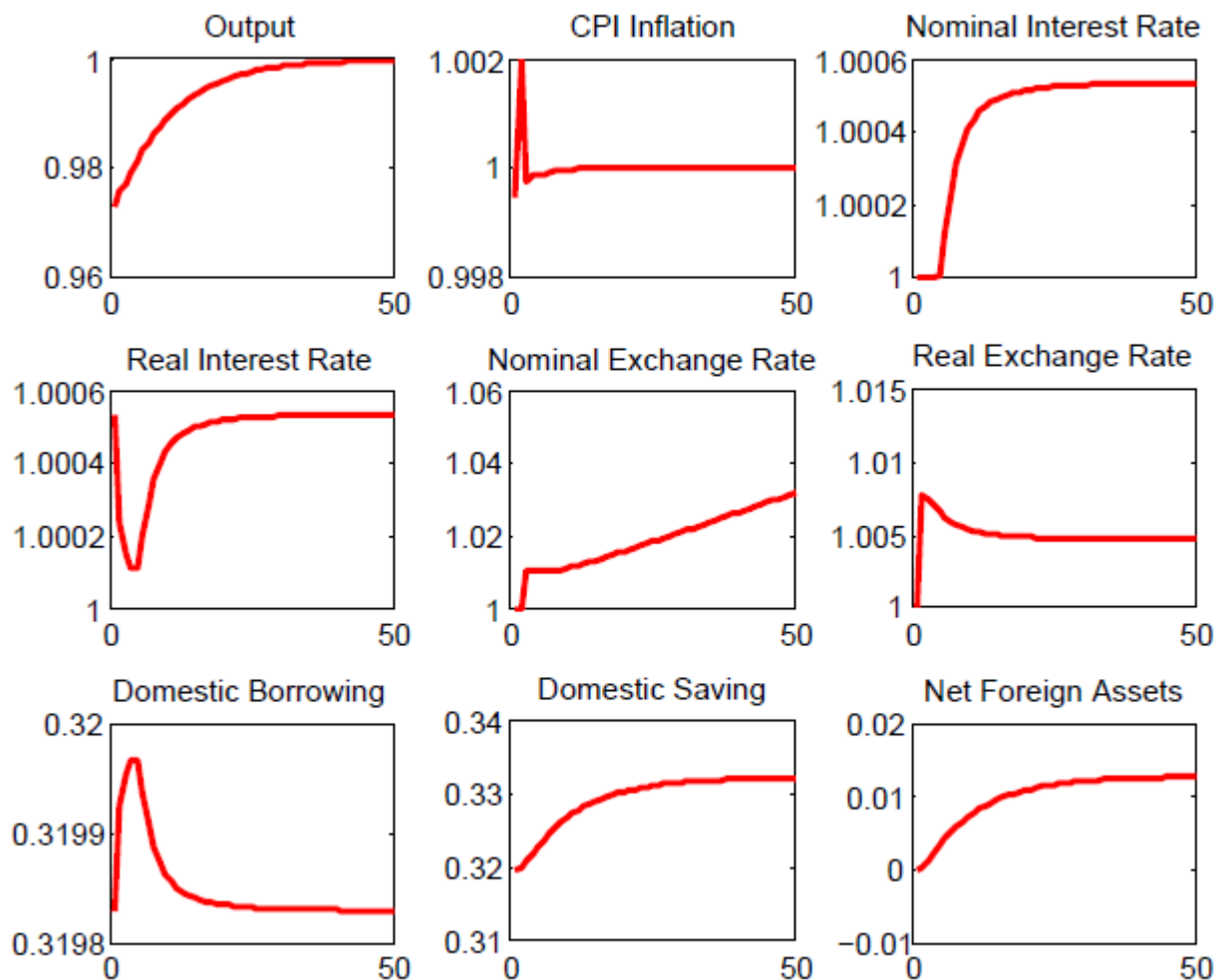
Figure 4: Transition to full employment: low short-run, high long-run trade elasticity.

persistent inflation allows the central bank to return to business as usual. During that period, the economy experiences some exchange rate appreciation, after the initial overshooting.

To be clear: the escape path is still Neo-Fisherian at heart. But strong valuation effects in the short run create a rich and complex dynamic, that may appear (but is not) at odds with the Neo-Fisherian prescription for an increase in the nominal rates driven by high expected inflation.

Finally, observe that, while domestic welfare in the long run is higher at full employment, the income effects from large devaluation exacerbate the transition costs for existing generations. As mentioned in the introduction, escape policies in this case are essentially 'jam tomorrow', potentially raising complex political-economy issues.

5 Adjusting monetary rules

A key result of the secular stagnation literature is that a permanent slump results from real interest rates being "too high" world-wide in steady state, depressing demand and generating negative output gaps. From a different perspective, at the equilibrium real rates, domestic savings cannot be absorbed at full employment, given that there are insufficient savings vehicles in the domestic economy.

In closed economy context, the above is an argument for either lowering the effective lower bound constraint, i.e. set negative policy rates, or increasing the target inflation, in an attempt to enhance the ability of monetary policy to stimulate demand. In this section, we discuss both measures in turn.

5.1 Reducing the effective lower bound (ELB)...

When the ELB is lowered to negative territory, (14) and (15) change to

$$\Pi_{H,t} = \bar{\Pi} \ \ \text{subject to} \ \ i_t \geq -\bar{i}_{\text{ZLB}},$$

or alternatively

$$i_t = -\bar{i}_{\text{ZLB}} \ \ \text{if} \ \ \Pi_{H,t} < \bar{\Pi}.$$

Here, $\bar{i}_{\text{ZLB}} > 0$ denotes the degree of effective relaxation of the zero lower bound constraint.

5.1.1 ...makes secular stagnation worse...

An important result is that resetting the ELB worsens economic stagnation. From the Fisher equations (6)-(5) we have that

$$\Pi = \frac{1 - \bar{i}_{\text{ZLB}}}{1 + r^*} = (1 - \bar{i}_{\text{ZLB}})\Pi^* < \Pi^*, \tag{23}$$

where we again have used that $(1 + r) = (1 + r^*)$ in steady state. That is, as $\bar{i}_{\text{ZLB}} > 0$ and the economy is in the stagnation steady state, the economy must experience deflation for the Fisher equations (both domestically and abroad) to be satisfied. In turn, from Phillips curve (8), a greater rate of deflation domestically widens the domestic output gap

$$Y^f \left(\frac{1 - \gamma/\Pi}{1 - \gamma}\right)^{\frac{\alpha}{1-\alpha}} < Y^f \left(\frac{1 - \gamma/\Pi^*}{1 - \gamma}\right)^{\frac{\alpha}{1-\alpha}},$$

such that as a result, $Y < Y^* < Y^f$, and the domestic recession becomes more severe—in fact, deeper than the recession in ROW.

The dynamic of the domestic economy in response to a ELB adjustment is illustrated by Figure 5, which shows the transition to the new and worse steady state, with even deeper
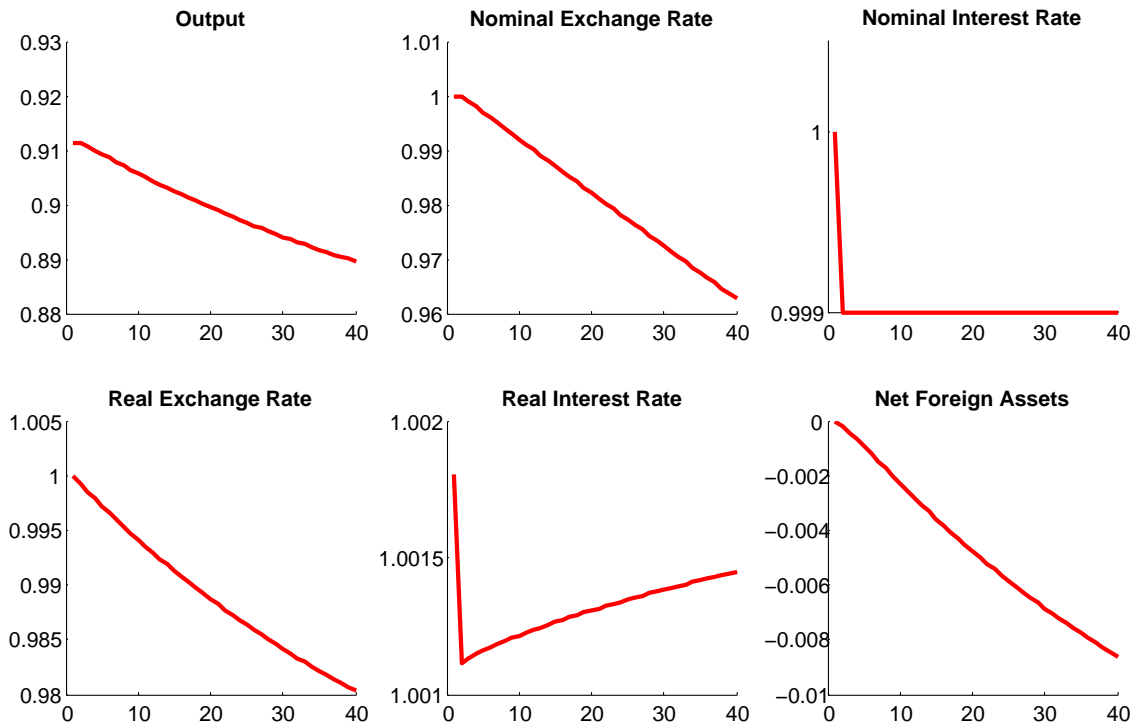
Figure 5: Transition as effective zero lower bound is reduced. Parameters as in Figure 2.

stagnation. Observe that, with the reduction in nominal interest rates to negative values, the nominal exchange rate sets on a path of permanent appreciation, again reflecting the UIP condition (7).[11] Output stagnates, and the real exchange rate appreciates, reflecting the relative abundance of the ROW-produced good relative to the domestic good in the new steady state. As output collapses, domestic savings are reduced, which leads to persistent current account deficits and an accumulation of net foreign debt. Lastly, the real interest rate temporarily falls in anticipation of an appreciation of the real exchange rate, as a result of the UIP condition in real terms (22). Thus, somewhat paradoxically—and in line with our discussion in Section 4—the real interest rate actually *falls* precisely as output collapses to a permanently lower level.

It is worth stressing that a lower ELB implies that the real interest rates falls more upfront, boosting domestic demand and generating a current account deficit. The country imports more foreign saving.

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[11]In the new steady state, the nominal exchange rate appreciates at the speed of the relative rate of deflation in the two countries, which follows from UIP condition (7)

$$1 - \bar{\imath}_{\text{ZLB}} = \frac{\mathcal{E}_{t+1}}{\mathcal{E}_t},$$

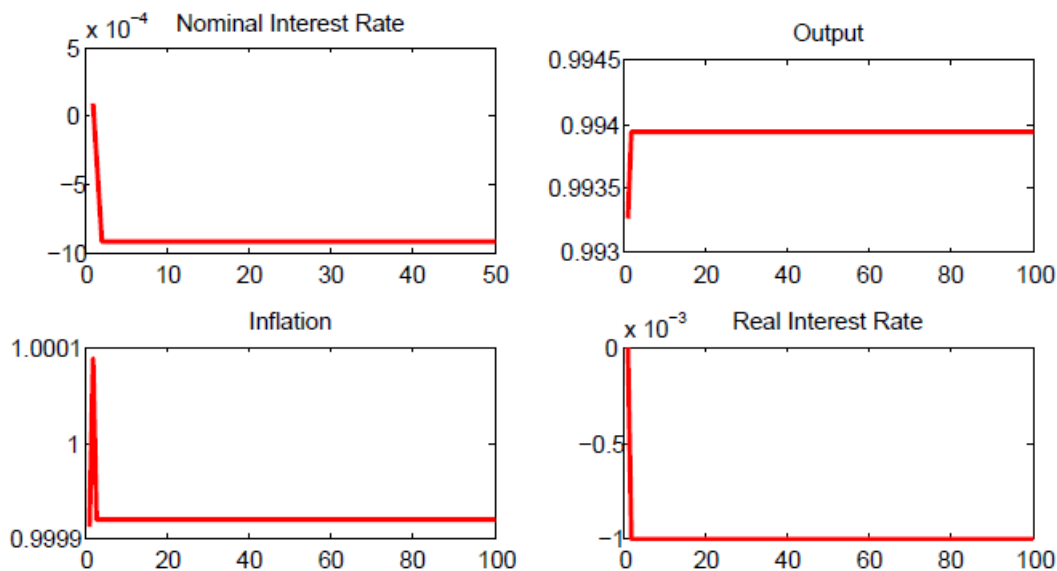combined with equations (17) and (23).

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Figure 6: Transition as effective zero lower bound is reduced in a closed economy

As it turns out, the previous results again are driven by the fact that the domestic economy is open and financially integrated with the rest of the world (recall our discussion from Section 6). To see this, turn back to the case of complete autarky with $\omega = 0$ as in Section 3.1. In this case the domestic stagnation steady state is determined from to (18)-(20), and by setting $i = -\bar{i}_{\text{ZLB}}$. As one can easily verify, in this case lowering the effective lower bound actually raises output, and reduces deflationary pressure, thereby bringing the economy closer to the full-employment equilibrium. Figure 6 exemplifies this result by repeating the experiment from Figure 5, but now assuming that the domestic economy is completely closed. The figure clearly shows that, as a result of the rate cut, output recovers—albeit not to potential—along with a decline in the domestic real interest rate.

As already explained, the divergence between closed and open economy crucially results from the fact that, in the latter, domestic real interest rates are determined in the world capital markets. In a closed economy, by manipulating the domestic *nominal* interest rate, it is instead possible to affect the the domestic *real* interest rates in the long run. In an open, financially integrated economy, by contrast, manipulating nominal rates necessarily translate into deflationary adjustment in the long run, as a result of Fisher equation (6) combined with real interest rate parity.

5.1.2 ...but may help along the transition

It is easy to see that the ELB is irrelevant along the escape transitional dynamics as long as, along the path, the zero lower bound is never a binding constraint. So for sufficiently high trade elasticities, tampering with the ELZ is not useful.

Yet, we have established that, in the realistic case of a difference between short- and long-run elasticities, nominal rate may remain constrained at ELB in the initial phase of the recovery. Once the economy is on the escape path, a reduction in the ELZ allows a faster recovery, shortening the length of time in which monetary policy is constrained.

5.2 Raising the inflation target

To conclude our discussion of monetary policy measures, we shall discuss the implications of permanently raising the domestic inflation target. As explained in Eggertsson and Mehrotra (2014), for the closed economy this policy can be effective to the extent that the inflation target is raised above the negative of the natural real interest rate of the economy. In this case, the full employment steady state necessarily exists—and is characterized by inflation on target, and a strictly positive nominal interest rate. However, the policy by itself does not rule out the stagnation steady state, and is in this sense less effective as a tool for forward guidance than in situations where the duration of the zero lower episode is necessarily finite (Eggertsson and Woodford 2003).

In the context of our small open economy with integrated financial markets, the policy's benefits are even subtler. Precisely, from Section 3.2 we know that two steady states can exist even for a a domestic inflation target that would imply uniqueness of the stagnation steady state if the domestic economy were closed. Yet, as in Eggertsson and Mehrotra (2014), the existence of the two steady states is not altered by a change in the domestic inflation target. In particular, a more elevated target does not stimulate economic activity at the zero lower bound, given that the duration of the ELB spell can in principle be infinite.

What *is* altered is the transition to the full employment steady state along the recovery path in Section 4. The reason is that, along the path shown in Figure 2, domestic policy makers hit their inflation target instantly as the zero lower bound ceases to bind in the period of the lift-off. Thus with a higher inflation target, the recovery would be accompanied by higher levels of inflation. But then, from Phillips curve (8), output recovers more quickly, which in turn is a result of price inflation affecting nominal wage inflation favourably, which in turn relaxes the downward constraint on nominal wages. By repeating the experiment from Figure 2, but under an inflation target which has been raised slightly, we note that output recovers more quickly, and at some point jumps to potential straight away, period where the wage

constraint ceases to bind altogether.[12]

6 Financial policy and the size of the external imbalance

In this section, we elaborate on the idea that the size or even the sign of the current account is sensitive to asset-supply policy. In what follows, we will show that, under the appropriate policies, the transition to full employment does not necessarily require the country to run external surpluses.

Consider policies which could increase domestic asset supply. Specifically, consider the effect of loosening domestic credit conditions by increasing the amount of lending to the young: a larger $D > D^*$. As established in Eggertsson and Mehrotra (2014), in a closed economy context this policy raises the natural real interest rate by increasing borrowing by the young, while at the same time reducing saving by the middle-aged.[13] As a result, the output gap narrows in the stagnation steady state, and the rate of deflation is similarly reduced, such that the policy has an overall favourable effect on the economy.

In an open economy context, the same policy has no effect in steady state: precisely, the policy is neutral in terms of real rates and, under the EMSS specification (with inelastic labor supply), aggregate output. However, it does affect the rate of depreciation and the country's net foreign asset position. In other words, foreigners end up raising their holdings of domestic assets.

More formally, in steady state, the domestic real interest rate is nailed down by the real interest rate in the ROW, from equation (22). Similarly, the rates of deflation in the two countries must by synchronized from the two Fisher equations (6)-(5)

$$\Pi = \frac{1}{1+r} = \frac{1}{1+r^*} = \Pi^*,$$

where we have used that nominal rates are zero in both economies. As a result, from Phillips curve (8), output gaps in the two countries are aligned in steady state, too. From the credit market equilibrium (12), we observe that changes in B^y and B^m, as a result of changes in D, must then be reflected in changes in the country's net foreign asset position.[14] Figure **??** shows this diagrammatically. We note that, in the new steady state once the policy has been

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[12]This occurs when $\Pi_{H,t} > (Y^f/Y_{t-1})^{\frac{1-\alpha}{\alpha}}$, recall equations (8) and (9).

[13]The latter follows from the fact that, if the household accumulates greater debts while young, she has fewer assets to save from when middle-aged.

[14]Again, the divergence between closed and open economy thus results from the fact that in the former, the domestic and ROW real interest rates can differ, because equation (22) is not an equilibrium condition in this case. As a result, domestic macro-prudential policies can push domestic real interest rates in a favourable direction. By way of contrast, this is impossible in an open economy where domestic real interest rates are determined on world capital markets. As we will argue below, a similar result logic implies that attempting to effectively lower the zero lower bound constraint in the domestic economy can only make matters worse.
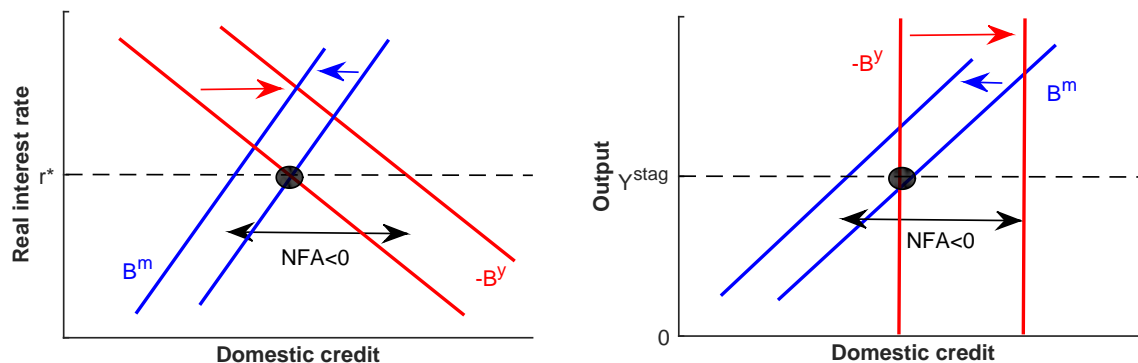
Figure 7: Graphical representation of domestic asset market as D is permanently reduced.

applied, loan demand exceeds savings supply. The gap must be filled by capital inflows and, as a result, current account deficits.

Nonetheless, there are at least two properties of such policy worth stressing. First, even when neutral in an aggregate sense, an increase in assets has distributional effects: it affects relative consumption across generations. From a domestic vantage point, the policy may be worth pursuing for distributional reasons, e.g., to attenuate the costs (of the transition) for the young. Second, by containing eternal surpluses and moderating real depreciation, raising the supply of domestic assets reduces the cross-border negative spillovers from the escape from stagnation. The country does not dump its excess saving in the international markets, so it does not exacerbate the secular stagnation problem at global level. While spillovers from unilateral initiatives of individual small open economies are small, they become relevant if many countries follow the same route. Asset-supply policies thus appear to be a key item in the agenda for a coordinated policy response to secular stagnation.

7   Conclusion

The global decline in equilibrium real interest rates and sub-par economic growth has renewed interest in the hypothesis of 'secular stagnation'. A small open economy exposed to a world which is permanently depressed—negative output gap, less-than-full employment, and nominal interest rates close to their zero bound constraint—faces challenges going beyond conventional prescriptions for optimal policy. This paper establishes this formally in an OLG framework à-la Eggertsson and Mehrotra (2014). We expand on the existing results by investigating new policy experiments in a small open economy framework. The underlying message of the paper is that a small open economy can escape stagnation if financial markets are sufficiently integrated, such that international capital flows are possible. The key feature

of capital flows in our model is that, with plausible trade elasticities, surplus countries attain full employment by using other countries' liabilities as savings vehicles: the domestic country can 'export the problem' and achieve full employment by weakening its exchange rate and building up net foreign assets.

Our analysis bears key lessons for theory and policy. Most notably, it casts the 'neo-mercantilist' motives ascribed to some chronic current-account surplus countries in a new light. In the literature, external surpluses are often thought to be beneficial for either supply-side (Rodrik 2008, Benigno and Fornaro 2014) or precautionary motives. In a global secular stagnation, in contrast, current account surpluses create the conditions for full employment at home, by absorbing the desired saving by domestic residents without output and employment adjustment. Countries may attain full employment by using other countries' liabilities as savings vehicles. In this sense, neo-mercantilism has an 'old Keynesian' rationale. Moreover, in economies with a low trade elasticity, or when the government pursues asset-supply policies, the escape actually takes place together with a contraction in domestic excess saving associated with current account deficits. Despite the accumulation of external debt along the transition path, also in this case nominal and real interest rates need to rise above their previous steady-state values.

Indeed, at the core of the escape from stagnation, is not the mere opportunity for a small open economy to dump its excess saving in the international financial market (or more in general to generate external imbalances taking advantages of foreign demand). Rather, the adjustment mechanism ultimately rests on preventing a steady drop in the rate of domestic inflation driven by the global deflationary drift. This is the core domestic and Neo-Fisherian dimension of the adjustment, which in an open economy requires permanent nominal exchange rate depreciation. In this context, with the real interest rate fixed at world level, attempting to lower the effective zero-bound on nominal domestic rates is generally counterproductive. At the same time, both along the transition and in steady state, the real exchange rate must be sufficiently depreciated to ensure that domestic income and desired savings, as well as external demand, are consistent with convergence to full employment in the long run. This is the external dimension of the adjustment.

These two dimensions interact significantly because real depreciation produces both substitution and income effects, the latter including output valuation effects that may be quite strong—especially when short run trade elasticities are realistically low.

A point that we have not pursued in our analysis is that real depreciation may end up exacerbating domestic financial frictions. In our model, we can shed light on this issue via a small amendment to the baseline specification, that is, by having the borrowing limit faced

by the young generation specified in output units, rather than consumption units. Under this specification, real depreciation makes the constraint more stringent—intuitively, the collateral against which the young can borrow becomes less valuable at international prices. Thus, real depreciation produces a contraction in domestic borrowing, with at least two notable consequences. First, relative to our baseline, welfare from the escape is lower. Second, the fall in domestic borrowing translates into larger capital outflows, as the young absorb less saving by the middle-aged.[15] If real depreciation exacerbates domestic frictions, escape without the accumulation of external surpluses becomes even less likely than predicted by our baseline model, and the possibility of beggar-thy-self depreciation is similarly raised.

While we analyze income effects of depreciation calling attention to trade elasticities, we are fully aware that there are many other possible features of the economy that may reinforce them. A particularly important one is the composition of a country's gross assets and liabilities, going beyond the value of labor endowment/human capital (as we have in our model), to include physical capital and external assets and liabilities. If the small open economy has an initial stock of foreign wealth denominated in the foreign currency, real depreciation along the escape path will create valuation effects that could be adverse (if foreign wealth is negative, i.e. debt) or positive (if foreign wealth is positive, e.g. international reserves), but in all cases will influence consumption and welfare along the escape path and possibly in steady state. The aggregate dynamics and distributional effects across generations will in turn depend on who owns these assets (public vs private), and intergenerational government policy. We leave to future work an exploration of these intriguing directions of research.

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[15]In terms of Figure 1, the $-B^y$ line would shift to the left as the economy moves from stagnation to full employment.

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