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Sudden Stops in Capital Inflows and the Design of Exchange Rate Regimes

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ABSTRACT

A two sector small open economy model developed by Corden (1991, 2002) is used to analyse the impact of sudden stops in capital inflows on an internal and external equilibrium and to explore the merits of disposing of the nominal exchange rate as policy tool in rectifying real exchange rate misalignments. It is shown how the economy's sectoral demand properties determine the extent of recession associated with real exchange rate adjustment that is neither engineered by nominal exchange rate changes nor brought about by a decline in nontraded goods prices. The conclusion is drawn that, when deciding on the design of exchange rate regimes, the structural characteristics of the economy ought to be considered so as to appropriately strengthen its capacity to cope with shocks in the form of negative swings in capital inflows.

JEL classification: F31, F32, F41

Keywords: capital inflows, sudden stops, real exchange rate adjustment, exchange rate regimes

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1 Introduction

Current account deficits do require policymakers' attention if global capital markets become a "cruel master" (Lipschitz et al. (2002)) and expose the economy to sudden stops in capital inflows, thus leading to a change in the equilibrium real exchange rate and rendering the existent external imbalance non-sustainable.[1] Many countries, emerging market economies in particular, have responded to this drying up of foreign financing by moving to more flexible exchange rate regimes (see e.g. Bubula and Ötker-Robe (2002)).

In the following, within the frame of a two sector small open economy model developed by Corden (1991, 2002), the impact of sudden stops in capital inflows on an internal and external equilibrium is analysed and the merits of disposing of the nominal exchange rate as policy tool in rectifying the occurring real exchange rate misalignment, i.e. the divergence between the actual and the equilibrium real exchange rate, are explored. In particular, this simple analytical framework allows us to examine the anatomy of sectoral market disequilibria emanating from a slowing down in capital inflows and to discuss the contribution of the nominal exchange rate in engineering a depreciation of the real exchange rate. It is shown that, in the case of a fixed exchange rate regime and sticky nontraded goods prices, real exchange rate adjustment causes a recession effect, the size of which is determined by the responsiveness of sectoral demand to changes in the real exchange rate and to changes in domestic absorption, respectively.

The paper is organised as follows. In section 2, within the framework of the Corden model, the role of the nominal exchange rate in correcting a real exchange rate misalignment triggered by a negative swing in capital inflows is examined. In

[1] For an extensive analysis of various causes and effects of sudden stops in international capital inflows see e.g. Calvo (1998).

particular, price and quantity effects stemming from real exchange rate adjustment under a flexible exchange rate regime are contrasted with the adjustment under a fixed exchange rate arrangement. In section 3, the impact on the adjustment paths of different degrees of responsiveness of demand for traded and nontraded goods to changes in the real exchange rate and domestic absorption is clarified. Some policy conclusions are derived in section 4.

2 The analytical framework

Our analysis of (i) the emergence of real exchange rate misalignments emanating from a sudden stop in capital inflows and (ii) the necessary changes in prices and quantities so as to bring about a real exchange rate adjustment is carried out within the frame of the Corden (1991, 2002) model of a small open economy with a traded and a nontraded goods sector.

Absorption A is defined as the sum of domestic demand for traded goods T and nontraded goods N:

(1) $$A=D^T+D^N.$$

While consumption of nontraded goods is confined to domestic goods, demand for traded goods pertains to both domestic and foreign goods.

The real exchange rate e is defined as the ratio of traded and nontraded goods prices:

(2) $$e=\frac{P^T}{P^N},$$

with a rising e being a real depreciation and a falling e a real appreciation. Since the economy is small, the law of one price holds for traded goods, so that

(3) $$P^T=EP^{T*},$$

where E stands for the nominal exchange rate, i.e. domestic currency units in terms of one foreign currency unit, and P^{T*} denotes the price of traded goods in foreign currency. Thus, since the domestic price of traded goods is determined by the world market, i.e. fixed externally, the small open economy can alter it only by changing the nominal exchange rate. In contrast, the price of nontraded goods is determined in the home market.[2]

As for the determinants of demand for traded and nontraded goods, respectively, it is assumed that demand for traded goods is an increasing function of absorption, while it declines as the real exchange rate rises:

(4) $D^T = D^T(A,e)$, where $1 \geq \frac{\partial D^T}{\partial A} \geq 0$ and $\frac{\partial D^T}{\partial e} < 0$.

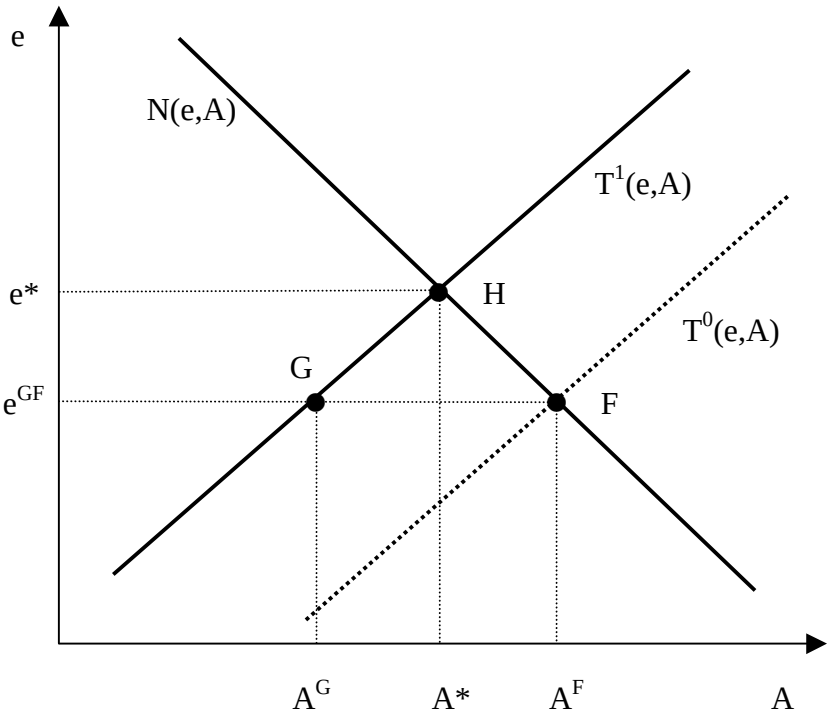
Conversely, demand for nontraded goods is an increasing function of both absorption and the real exchange rate:

(5) $D^N = D^N(A,e)$, where $1 \geq \frac{\partial D^N}{\partial A} \geq 0$ and $\frac{\partial D^N}{\partial e} > 0$.

The following figure illustrates the basic features of the Corden model.

[2] For a more extensive analysis of the nature of this real exchange rate concept see e.g. Claassen (1996).

Figure 1: The Corden model and sudden stops in capital inflows



The T^1 schedule in the (*A*,*e*) plane shows different combinations of absorption and the real exchange rate that yield external equilibrium: demand for traded goods coincides with domestic supply, leading to a balanced current account. The positive slope of the schedule can be explained as follows: Since e.g. an increase in absorption leads to excess demand for traded goods, the real exchange rate needs to rise so that traded goods become (relatively) more expensive and the increase in demand only pertains to the (relatively) cheaper nontraded goods (expenditure-switching effect) -- given the short-run nature of the model, domestically produced output is not price-sensitive --. Therefore, the area below the T^1 schedule shows all combinations of *e* and *A*, which correspond to a real overvaluation and a current account deficit.

Turning to the nontraded goods sector, the N schedule depicts all combinations of absorption and the real exchange rate that ensure internal equilibrium and thus full employment, since demand for nontraded goods is equal to full-employment output.

The N schedule is negatively sloped since e.g. any fall in absorption, which leads to sectoral demand below full-employment output, needs to be accompanied by a rise in the real exchange rate, i.e. a real depreciation, so as to restore sectoral equilibrium.

In point H, i.e. at the intersection of the N and T^1 schedules, both sectors of the small open economy are in balance, with equilibrium absorption being A* and the actual real exchange rate coinciding with the equilibrium one e*.

Following this description of the basic features of the Corden model, we now turn to the examination of the impact on sectoral market equilibria of a sudden stop in capital inflows and the adjustment paths of the real exchange rate. The point of departure is F in figure 1, where the nontraded goods sector is in equilibrium and the traded goods sector is characterised by a current account deficit that is soundly financed by capital inflows. Now, if the small open economy suffers a drying up of capital inflows, the T^0 schedule shifts leftwards to T^1. At the new equilibrium H, the actual real exchange rate e^{GF} is overvalued and the level of absorption A^F depicts a non-sustainable external imbalance (the nontraded goods sector is not affected and remains in equilibrium). Therefore, the sudden stop in capital inflows *KI* leads to an immediate contraction in the current account deficit *CAD* if there is no cushioning by a loss of international reserves *R*:

$$KI \downarrow = CAD \downarrow + \overline{R}$$

The key issue as to whether this adjustment of the current account deficit will affect the internal balance and thus trigger an eventual output loss hinges on the speed of reaction of the real exchange rate: An immediate real depreciation would ensure that the drop in absorption is accommodated by a fall in demand for traded goods only so that the adjustment path would be from F to H along the N schedule, with the nontraded goods sector remaining in equilibrium. However, if nontraded goods prices

are assumed to be rigid downwards in the short and medium run[3], the real exchange rate depreciation can only be brought about by a nominal depreciation. Therefore, if the small open economy has entered into a flexible exchange rate arrangement and disposes of the nominal exchange rate as policy tool, it can quickly rectify the occurring real exchange rate misalignment and thereby avoid potential output losses and recession.

In contrast, in the case of a fixed exchange rate regime, the real exchange rate change cannot be engineered by a change in the nominal exchange rate, so that the adjustment of the current account deficit will take a different route. Assuming homothetic preferences -- i.e. there is, for a given real exchange rate, a linear income-expansion path of traded vis-à-vis nontraded goods -- the fall in absorption emanating from the elimination of the external imbalance will lead to a drop in demand for both traded *and* nontraded goods. This contraction in absorption will thus shift the economy from F to G, where the current account gap is closed, while the nontraded goods sector exhibits actual demand below full-employment output; the divergence between the actual real exchange rate e^{GF} and the equilibrium one e* continues to exist. Depending on the speed of the downward adjustment of nontraded goods prices, the economy will move along the T^1 schedule to H, implying that only demand for nontraded goods rises, so that ultimately the objective of external *and* internal balance is attained and the actual real exchange rate coincides with the equilibrium one. However, if nontraded goods prices were not to decline at all, full-employment output would adjust downwards to the lower level of absorption A^G and, reflecting an

[3] This Keynesian feature of nontraded goods prices appears to be a realistic assumption, given the downward rigidity of nominal wages due e.g. to wage indexation or wage contracts extending over several periods.

adjustment of the equilibrium real exchange rate to the level of the actual real exchange rate, thus trigger a recession effect.[4]

The conclusion that can be drawn from the preceding discussion is that, while the real exchange rate adjustment takes place regardless of the design of the exchange rate regime, the course of adjustment is determined by the availability of the nominal exchange rate as policy tool. If the nominal exchange rate is used to rapidly adjust relative prices to the new equilibrium level, the small open economy can escape recession. However, if the economy in the case of a fixed exchange rate arrangement has to rely on the fall in nontraded goods prices so as to bring about a real depreciation, output losses and unemployment due to the retarded or even lacking adjustment of the actual real exchange rate may not be avoided.[5]

3 The recession effect and its determinants

3.1 Sectoral demand properties

Having discussed the adjustment paths of the actual and the equilibrium real exchange rate under a flexible and a fixed exchange rate regime, we now turn to the factors, which moderate or exacerbate the size of the recession effect that materialises in case real exchange rate adjustment can neither be engineered by changes in the nominal exchange rate nor brought about by a decline in nontraded goods prices.

First, as can be derived from the previous discussion, the extent of output losses depends on the size of the real exchange rate misalignment that stems from the

[4] This result complements Edwards‘ (2002) observations with regard to the recent crisis in Argentina. For a discussion of the costs of real overvaluation in various emerging market economies and the drawbacks associated with pegged exchange rate regimes see Edwards (2001). Further analytical findings and empirical evidence is provided by e.g. Calvo and Reinhart (2000) and Calvo, Izquierdo and Talvi (2002).

[5] Moreover, fixing the nominal exchange rate might even trigger a currency crisis, since the economy might not be in a position to sustain the level of its exchange rate and might be forced to let it go (see e.g. the empirical evidence collected by Siebert (2002) on currency crises emanating from real exchange rate misalignments).

stop in capital inflows: The larger is the deviation of the actual real exchange rate from the equilibrium one, the more pronounced is *ceteris paribus* the ensuing recession.

Second, the slopes of the T and N schedules affect *ceteris paribus*, i.e. for a given real exchange rate misalignment, the extent of the necessary contraction in absorption and output. Therefore, we examine the properties of sectoral demand so as to shed light on the determinants of the slopes of the T and N schedules.

As concerns the traded goods sector, the slope of the T schedule is derived by totally differentiating the implicit function in (4):

$$(6) \qquad dD^T = \frac{\partial D^T}{\partial A} dA + \frac{\partial D^T}{\partial e} de = 0$$

and rearranging the terms as follows:

$$(7) \qquad \left.\frac{de}{dA}\right|_T = -\frac{\frac{\partial D^T}{\partial A}}{\frac{\partial D^T}{\partial e}}, \text{ where } 1 \geq \frac{\partial D^T}{\partial A} \geq 0 \text{ and } \frac{\partial D^T}{\partial e} < 0.$$

Expression (7) shows that the slope of the T schedule is determined by the responsiveness of demand for traded goods to changes in absorption and to changes in the real exchange rate, respectively. In particular, the following results can be obtained:

(i) the lower (higher) is the responsiveness of demand for traded goods to changes in absorption--i.e. the marginal propensity to spend on traded goods is low (high)--, the flatter (steeper) becomes the T schedule; and

(ii) the higher (lower) is the responsiveness of demand for traded goods to changes in the real exchange rate, the flatter (steeper) is the T schedule.

While the slope of the T schedule is usually positive, two extreme cases can be distinguished, depending on the properties of sectoral demand. If demand for traded goods is highly responsive to real exchange rate changes or not responsive at all to changes in absorption, the T schedule is a parallel to the A-axis:

$$\text{(8a)} \qquad \left.\frac{de}{dA}\right|_T = \lim_{\frac{\partial D^T}{\partial e}\to-\infty} -\frac{\frac{\partial D^T}{\partial A}}{\frac{\partial D^T}{\partial e}} = 0\,;$$

$$\text{(8b)} \qquad \left.\frac{de}{dA}\right|_T = -\frac{\frac{\partial D^T}{\partial A}}{\frac{\partial D^T}{\partial e}} = 0 \text{ if } \frac{\partial D^T}{\partial A} = 0\,.$$

On the other hand, if demand for traded goods is not responsive to real exchange rate changes, the T schedule is a parallel to the e-axis:

$$\text{(9)} \qquad \left.\frac{de}{dA}\right|_T = \lim_{\frac{\partial D^T}{\partial e}\to 0} -\frac{\frac{\partial D^T}{\partial A}}{\frac{\partial D^T}{\partial e}} = \infty \text{ (if } \frac{\partial D^T}{\partial A} > 0\text{).}$$

Turning to the nontraded goods sector, total differentiation of (5) yields

$$\text{(10)} \qquad dD^N = \frac{\partial D^N}{\partial A}dA + \frac{\partial D^N}{\partial e}de = 0$$

and thus the slope of the N schedule:

$$\text{(11)} \qquad \left.\frac{de}{dA}\right|_N = -\frac{\frac{\partial D^N}{\partial A}}{\frac{\partial D^N}{\partial e}}\text{, where } 1 \geq \frac{\partial D^N}{\partial A} \geq 0 \text{ and } \frac{\partial D^N}{\partial e} > 0\,.$$

The following features of the N schedule can be derived:

(i) the lower (higher) is the responsiveness of demand for nontraded goods to changes in absorption--i.e. the marginal propensity to spend on nontraded goods is low (high)--, the flatter (steeper) becomes the N schedule; and

(ii) the higher (lower) is the responsiveness of demand for nontraded goods to changes in the real exchange rate, the flatter (steeper) is the N schedule.

While normal demand reactions lead to a negative slope of the N schedule, two extreme cases can be identified. If demand for nontraded goods is highly responsive to real exchange rate changes or not responsive at all to changes in absorption, the N schedule is a parallel to the A-axis:

$$\text{(12a)} \quad \left.\frac{de}{dA}\right|_N = \lim_{\frac{\partial D^N}{\partial e}\to\infty} -\frac{\frac{\partial D^N}{\partial A}}{\frac{\partial D^N}{\partial e}} = 0$$

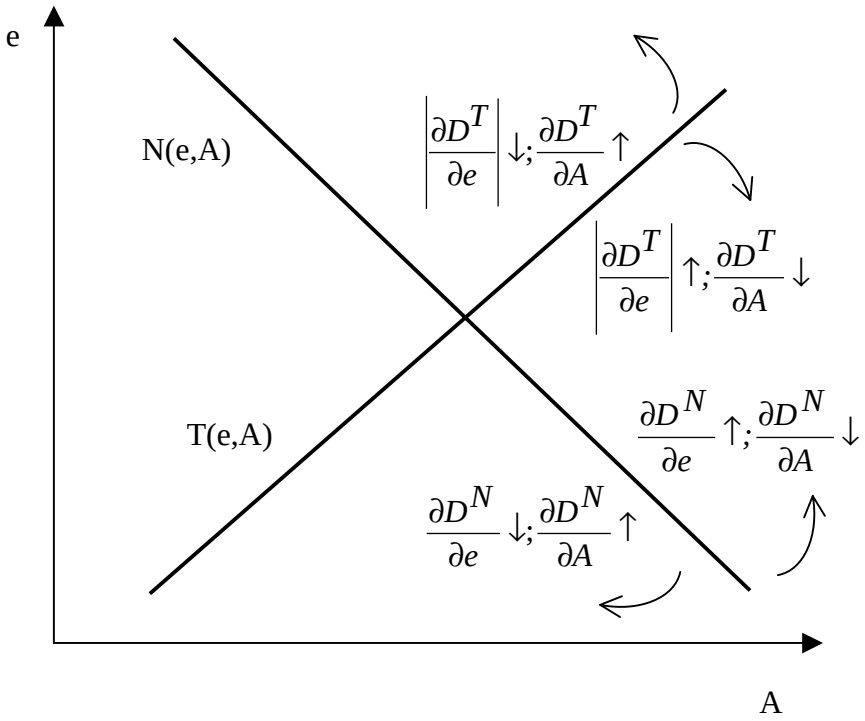
$$\text{(12b)} \quad \left.\frac{de}{dA}\right|_N = -\frac{\frac{\partial D^N}{\partial A}}{\frac{\partial D^N}{\partial e}} = 0 \text{ if } \frac{\partial D^N}{\partial A} = 0\,.$$

If, in contrast, demand for nontraded goods does not exhibit any responsiveness to changes in the real exchange rate, the N schedule is a parallel to the e-axis:

$$\text{(13)} \quad \left.\frac{de}{dA}\right|_N = \lim_{\frac{\partial D^N}{\partial e}\to 0} -\frac{\frac{\partial D^N}{\partial A}}{\frac{\partial D^N}{\partial e}} = -\infty \text{ (if } \frac{\partial D^N}{\partial A} > 0\text{).}$$

The effects of different degrees of sectoral demand responsiveness to changes in absorption and the real exchange rate are summarised in the figure below.

Figure 2: Responsiveness of demand for traded and nontraded goods



3.2 The size of the recession effect

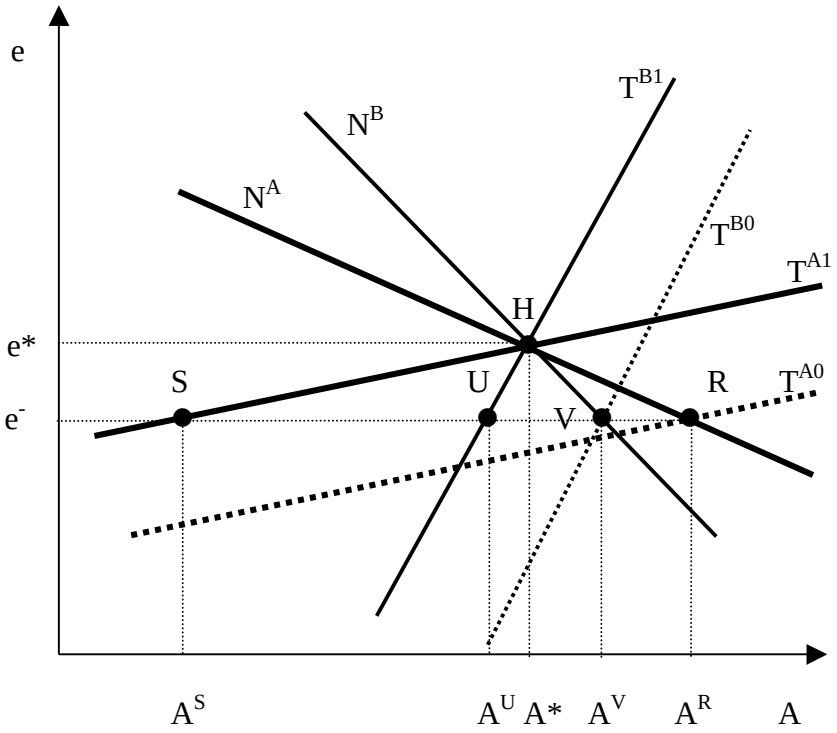
Drawing on the foregoing analysis of the impact of different properties of sectoral demand on the slope of the T and N schedules, we can now distinguish between three different sizes of recession effects, which materialise in the course of real exchange rate adjustment if, in a rigid nontraded goods prices environment, the nominal exchange rate is not available as policy instrument.

- **Case A: The strong recession effect**

If both T and N schedules are fairly flat -- i.e. technically speaking, the economy is characterised by (i) a low marginal propensity to spend on traded goods or a high responsiveness of demand for traded goods to changes in the real exchange rate and (ii) a low marginal propensity to spend on nontraded goods or a high responsiveness of demand for nontraded goods to changes in the real exchange rate --

the costs associated with rectifying the real exchange rate misalignment are high as the recession effect is strong (see figure 3 below).

Figure 3: Large and small recession effects



The point of departure is R on the N^A and T^{A0} schedules, where the small open economy is characterized by an internal balance and a current account deficit that is financed by capital inflows. If the inflow of capital were to stop, point R would become a non-sustainable external imbalance, which would have to be corrected. Assuming a fixed exchange rate regime, domestic absorption would have to contract substantially by (A^R-A^S), leading to situation S, where the traded goods sector is in balance again, while in the nontraded goods sector actual demand is below full-employment output. Since nontraded goods prices do not decline, the economy gets stuck in situation S, with full-employment output adjusting downwards to the lower level of absorption A^S and thus triggering a strong domestic recession.

- **Case B: The weak recession effect**

We next consider a situation, in which the T and N schedules are fairly steep, i.e. (i) the responsiveness of demand for traded goods to changes in absorption is high or the real exchange rate responsiveness of demand for traded goods is low and (ii) the responsiveness of demand for nontraded goods to changes in absorption is high or the real exchange rate responsiveness of demand for nontraded goods is low. Starting again from a situation of internal and external balance (point V), a standstill in capital inflows renders the current account deficit non-sustainable. Under the assumption of a fixed exchange rate regime, the economy would move to U, where the nontraded goods sector is in disequilibrium. Lacking downward flexibility in nontraded goods prices would trigger a contraction in output, which would lead to external *and* internal balance in U. Since we assume an identical real exchange rate misalignment (e^*-e^-) in cases A and B, we can compare the strength of the two recession effects, which materialize under a fixed exchange rate arrangement in a rigid nontraded goods prices environment: it is evident that the size of the recession effect is much more pronounced in case A than in case B: $(A^R-A^S) > (A^V-A^U)$. Therefore, forgoing the option of adjusting the nominal exchange rate is more costly in situation A than in situation B.

- **Case C: No recession effect**

We finally turn to the situation of a horizontal N schedule, which reflects a zero marginal propensity to spend on nontraded goods or an infinite responsiveness of demand for nontraded goods to changes in the real exchange rate. In this case, the expenditure-switching properties of the nominal exchange rate are of no relevance, since the elimination of the current account deficit does not affect the internal balance

and thus does not trigger any real exchange rate misalignment. Therefore, the small open economy could operate a fixed exchange rate regime without renouncing a policy instrument.

In summing up, the following policy lessons can be drawn:

First, nominal exchange rate flexibility is most desirable if the small open economy is characterised by high real exchange rate responsiveness of demand for traded goods or low responsiveness of demand for traded goods to changes in absorption and high real exchange rate responsiveness of demand for nontraded goods or low responsiveness of demand for nontraded goods to changes in absorption.

Second, in the case of high responsiveness of demand for traded goods to changes in absorption or low real exchange rate responsiveness of demand for traded goods and high responsiveness of demand for nontraded goods to changes in absorption or low real exchange rate responsiveness of demand for nontraded goods, the benefits of disposing of a flexible nominal exchange rate in bearing the adjustment of the real exchange rate are rather small.

Third, nominal exchange rate flexibility can be renounced if the economy exhibits either infinite real exchange rate responsiveness of demand for nontraded goods or lacking responsiveness of demand for nontraded goods to changes in absorption.

Table 1 presents an overview of the main findings of the preceding analysis.

Table 1: Sectoral demand properties and recommended exchange rate regime

	$\left\lvert\frac{\partial D^T}{\partial e}\right\rvert$ **high or** $\frac{\partial D^T}{\partial A}$ **low**	$\left\lvert\frac{\partial D^T}{\partial e}\right\rvert$ **low or** $\frac{\partial D^T}{\partial A}$ **high**
$\frac{\partial D^N}{\partial e}$ **high or** $\frac{\partial D^N}{\partial A}$ **low**	**Strong recession effect** $\Rightarrow$ **Flexible exchange rate**	**Not clear cut**
$\frac{\partial D^N}{\partial e}$ **low or** $\frac{\partial D^N}{\partial A}$ **high**	**Not clear cut**	**Weak recession effect** $\Rightarrow$ **Fixed/flexible exchange rate**
$\frac{\partial D^N}{\partial e} \to \infty$ **or** $\frac{\partial D^N}{\partial A} = 0$	**No recession effect** $\Rightarrow$ **Fixed exchange rate**	**No recession effect** $\Rightarrow$ **Fixed exchange rate**

4 Concluding remarks

A drying up of capital inflows, by leading to a non-sustainable current account gap and thus to the emergence of a real exchange rate misalignment, poses a challenge for policymakers since the design of exchange rate regimes determines the costs associated with the required real exchange rate adjustment.

Bearing in mind that changes in the real exchange rate will take place regardless of the nature of the exchange rate regime that the economy has entered into, the analysis within the framework of the Corden model has shown how sectoral demand properties determine the extent of recession arising from real exchange rate adjustment that is neither engineered by nominal exchange rate changes nor brought about by a decline in nontraded goods prices. It has been derived that, in the presence

of price rigidities in the nontraded goods sector, nominal exchange rate flexibility is all the more desirable if the small open economy is characterised by high real exchange rate responsiveness of demand for traded goods or low responsiveness of demand for traded goods to changes in absorption and high real exchange rate responsiveness of demand for nontraded goods or low responsiveness of demand for nontraded goods to changes in absorption. Operating a flexible exchange rate regime under these conditions would strengthen the small open economy's capacity to cope with negative shocks in the form of stopping capital inflows. Conversely, opting in this case for a fixed exchange rate regime would be a sub-optimal course of action, as the adverse shock would not be absorbed by price changes, but would rather translate into considerable recession.

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