Too Much to Lose, or More to Gain? Should Sweden Join the Euro?*

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Abstract

This paper considers the costs and benefits of Sweden joining the European Economic and Monetary Union (EMU). We pay particular attention to the costs of abandoning the krona in terms of a loss of monetary policy independence. For this purpose, we apply a cointegrated VAR framework to examine the degree of monetary independence that the *Sveriges Riksbank* enjoys. Our results suggest that Sweden has in fact relatively little to lose from joining EMU, at least in terms of monetary independence. We complement our analysis by looking into other criteria affecting the cost-benefit calculus of monetary integration, which, by and large, support our positive assessment of Swedish EMU membership.

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I Introduction

The Swedish people in 2003 delivered a resounding rejection of euro membership in a referendum, and the popular perception was that to join the euro would involve relinquishing monetary policy independence to a pan-European body.[1] However, was that necessarily true? Sweden would certainly have handed over monetary sovereignty to the European Central Bank (ECB), but did it actually have any monetary independence to lose? If we define monetary independence as the ability of an economy to set its own interest rates exclusive of outside influence, then this is something that can be tested. In this paper we ask the timely and relevant question: does Sweden have any operational independence for its monetary policy? The answer to this question has serious implications for the cost-benefit calculus of Swedish EMU membership, as the loss of monetary policy independence is widely regarded as the main cost of entering a monetary union.

Unlike Denmark and the UK, both of which negotiated an opt-out clause to the third stage of EMU, Sweden is required by EU law to join the common monetary union and adopt the euro as soon as it fulfils the convergence criteria as laid out in the Maastricht treaty. However, as Sweden did not join the Exchange Rate Mechanism (ERM) of the European Monetary System prior to the creation of EMU, nor ERM II which it needs to be part of to fulfil the Maastricht criterion on exchange rate stability to join EMU, it has *de facto* opted to stay outside the euro area.[2] Unlike other EU members that are obliged to join the euro, Sweden does not stabilise its currency against the euro (Figure 1). Instead, the *Sveriges Riksbank* has followed a policy of inflation targeting with a flexible exchange rate since 1992/1993, which in theory should provide it with full monetary autonomy, a condition we seek to examine.

While Swedish euro membership disappeared from the political agenda and any serious debate about it was more or less muted after the negative outcome of the 2003 referendum, the current global financial crisis has brought back the question of EMU membership. Like in other small open European economies

[1] Jonung and Vlachos (2007, pp. 54–5), who analyse the 2003 rejection of euro membership from a political economy perspective, describe the outcome as follows: "No-voters saw the euro as a threat to national independence, Swedish democracy and the Swedish way of life. They feared that joining the euro meant that decisions of major importance were taken out of the hands of domestic voters and domestic politicians and transferred to Frankfurt and Brussels to be made by policy-makers that were not democratically accountable according to their view."

[2] Sweden has fulfilled all other Maastricht criteria. See European Commission (2008).

Figure 1: The krona to euro exchange rate. Source: Datastream.

— such as Denmark, Iceland and the Central and Eastern European EU members that have not joined the euro yet — the costs and benefits of remaining outside the euro area are now being reassessed in Sweden. Apparently, public opinion in Sweden, as in other euro area outsider countries (with the notable exception of the UK), has been recently turning in favour of joining the euro.[3] By examining the degree of monetary policy independence that the *Sveriges Riksbank* has enjoyed over the past years, we address what is commonly regarded as the main cost of entering a monetary union; if Sweden *de facto* enjoys little or no monetary policy independence, then the costs of abandoning the krona and replacing it with the euro were much smaller than opponents of Sweden's euro membership make believe. While the question of Sweden's monetary independence is at the heart of our analysis, this paper also enters into the broader nature of Sweden's economic relationship with the eurozone to help frame the question of euro membership.

The paper is structured as follows. In Section II we briefly review the previous literature on Swedish EMU membership. In Section III we introduce the econometric methods employed in this paper, followed by an introduction of the data in Section IV. Section V reports the results of the econometric analysis. In Section VI we provide a broader analysis of the costs and benefits of Swedish euro membership and consider possible convergence between Sweden and the eurozone. Section VII concludes.

[3]See http://grahnlaw.blogspot.com/2009/04/swedish-opinion-on-euro-turns.html

II Literature Review

The economics profession has produced a vast amount of output on the costs and benefits of European monetary integration.[4] The amount of research carried out on Swedish EMU membership has been far less extensive; especially after the negative referendum outcome, research has been scant. The Swedish debate has been influenced very much by the report on the consequences of Swedish membership in the monetary union that was prepared by the so-called Calmfors Commission (Calmfors et al., 1997). The Calmfors Commission was appointed by the Swedish government to examine the consequences of Swedish membership in the monetary union ahead of the *Riksdag*'s (the Swedish parliament) decision in 1997 on whether or not Sweden should join EMU. The Commission argued that entering EMU would bring about small efficiency gains for the Swedish economy due to reduced transaction costs and exchange rate uncertainty on the one hand and stronger competition on the other. The Commission contrasted these benefits with potentially adverse effects that large Sweden-specific disturbances could have if these were not responded to adequately by an independent monetary and exchange rate policy. While large idiosyncratic shocks would remain the exception rather than the rule, the Commission maintained that an independent monetary policy would be an insurance for the occurrence of such extreme events and that "the potential stabilisation policy cost of relinquishing monetary policy independence may be considerable" (Calmfors et al., 1997, p. 314). It consequently argued that Sweden should not immediately join EMU upon its creation in 1999, but rather at some later stage when the experience with EMU as well as Sweden's outsider status could be evaluated.[5]

A second government commission published a report in 2002, the year before the referendum (SOU, 2002*b*, p. 1), where it highlighted again that "[m]embership in the monetary union will mean a change in the stabilisation policy regime because domestic monetary policy will disappear as an instrument to stabilise the economy. Instead, Sweden will participate in a common European monetary and exchange rate policy. The opportunity to use interest rate changes to counteract macroeconomic shocks that specifically affect the Swedish economy will then be lost."[6]

[4]For an overview see, for instance, Emerson et al. (1992) and De Grauwe (2007) and the works cited therein.

[5]It is noteworthy that the *Riksbank* took a stand in favour of EMU membership when asked by the government to respond to the Calmfors report.

[6]A summary of the report is avalaible in English under SOU (2002*a*).

In a recent contribution Söderström (2008) noted that more than a decade after the Calmfors report was released some of its original arguments seem to speak more strongly in favour of Swedish EMU membership, whereas other arguments speak more strongly against. Regarding the former, Söderström concludes that the gains of economic integration induced by EMU, such as increases in trade and financial integration, appear to be greater than expected by Calmfors *et al.*[7] Furthermore, Söderström shows that the Swedish business cycle has been closely correlated with the economies of the euro area since the mid-1990s, suggesting that common shocks have been an important driving force of business cycles across Europe. Moreover, he points out that there have been no large country-specific disturbances to the Swedish economy, which would have yielded substantial gains from an independent monetary policy. Söderström (2008) comes to no clear-cut conclusion about whether or not participation in EMU would be advantageous for Sweden, but suggests that the current financial crisis might deliver interesting insights into the cost-benefit analysis surrounding Swedish membership.

In this context, a recent paper by Buiter (2008) provides arguments in favour of Swedish EMU entry. Although Buiter's analysis is concerned exclusively with the question of the United Kingdom's EMU membership, his financial stability arguments apply also to Sweden – maybe even more than to the UK. Buiter argues that, without eurozone membership, the UK is more vulnerable to a triple financial crisis, namely a banking, currency and sovereign debt crisis. According to Buiter, the UK belongs to a group of countries characterised by the "inconsistent quartet": (1) a small country with (2) a large internationally exposed banking sector, (3) a currency that is not a global reserve currency and (4) limited fiscal capacity relative to the possible size of the banking sector solvency gap. All characteristics of this inconsistent quartet certainly apply to Sweden as well, exposing it to potentially damaging vulnerabilities.[8] As Buiter points out, joining EMU would immediately eliminate the third pillar of the quartet, and maybe even provide some relief as regards the fourth pillar of the quartet by reducing liquidity risk premia.[9]

[7]For recent studies on trade effects of the euro see Baldwin (2006) and Flam and Nordström (2007). In the early 2000s, Rose (2001) estimated that in case of adopting the euro, Sweden's trade with the euro area would rise by over fifty percent.

[8]The heavy exposure of Swedish banks in Eastern Europe (and particularly in the crisis-hit Baltic states) has led to growing concerns about a sharp rise in loan losses for Sweden's main banks, which has prompted the *Riksbank* in 2009 to activate a swap agreement with the ECB to ensure it has enough currency reserves to guarantee stability of its banking sector.

[9]For a detailed theoretical analysis of the costs and benefits of the UK (or any other small open European economy) joining EMU see Buiter (2000).

In an assessment of the performance of EMU and an analysis of whether Denmark, Sweden and the UK should join the eurozone, Flam et al. (2008) argue that given that the Swedish central bank has closely followed the ECB's monetary policy, Sweden's macroeconomic performace would probably have been quite similar to its actual performance if it had joined EMU in 1999. In the assessment of Flam et al., the main difference for Sweden would have been that its nominal effective – and therefore real – exchange rate would have been more stable, and that trade with the eurozone would have increased substantially. Flam et al. (2008, p. 17) come to the conclusion that "[t]he benefit of an independent monetary policy has [...] been small during the past ten years, and should hence decrease further with increasing economic integration."

Other recent work addressing the question of Swedish euro membership either directly or indirectly has been carried out by Pesaran et al. (2007) and Ferreira-Lopes (2008).[10] Pesaran et al. (2007) use a *Global VAR* model to estimate effects of a hypothetical entry of the UK and Swedish economies to the euro area. For Sweden their model suggests a likely increase in both output and prices, which leads them to conclude that no unambiguous welfare conclusions are possible for Sweden.

Söderström flags up foreign exchange shocks as a key source of macroeconomic instability for Sweden, to some extent resonating with Buiter, indicating that the exchange rate has to a large extent destabilised – rather than stabilised – the Swedish economy. This suggests that for a small open economy like Sweden, there are additional costs to maintaining a currency that is not a global reserve currency in terms of the shocks that affect it.

Ferreira-Lopes and Söderström adopt a different empirical approach to that taken in this paper; our approach might be described as econometric-theory-centric economic modelling while their approach would better be described as economic-theory-centric economic modelling. Our terminology is merely for convenience; other terms used to describe these schools of modelling are reduced-form and structural-form modelling. It is our belief that both approaches have great value to add to debate on economic policy. Economic-theory-centric modelling, by modelling at the structural level, explicitly models the preferences of

[10]Several other recent contributions concerned with Swedish EMU membership are in fact more about supposedly deficient structures of EMU, such as the Stability and Growth Pact (cf. Jespersen, 2004), about a lack of democratic legitimacy of the ECB's monetary policy making (Forder, 2004) or about the ECB's monetary strategy and inflation performance (Vaubel, 2004) than about economic conditions for Swedish euro entry.

economic agents and can enable analysis that is robust to the Lucas (1976) critique, in that it will account for the impact of policy actions on agent preferences. Furthermore, such economic-theory-centric modelling also allows counter-factual analysis, by allowing the modeller to simulate a model where a policy is enacted, and one in which it is not. This is something an econometric-theory-centric modelling strategy cannot do, because it is based on observational data.

This does not, however, render econometric-theory-centric modelling useless in light of the Lucas critique. If econometric models can be shown to exhibit super exogeneity (Engle et al., 1983), so that parameter estimates in the econometric model are invariant to known historical policy interventions, then the estimates can be seen as reliable for policy analysis. If an econometric model, motivated by economic theories, can be found that satisfies the assumptions placed on it (notably Normality of the error terms), and also exhibits super exogeneity, then this constitutes an equally useful tool for economic policy making as an economic-theory-centric model. This modelling methodology is perhaps best explained and examined in Hendry (1995) and embodied in the general-to-specific, LSE approach to econometrics. The disadvantage of econometric-centric modelling is when the assumptions listed above fail, in particular super-exogeneity in the policy sphere. Furthermore, it is reduced-form modelling in its nature, and even if super exogeneity holds, it may not be that structural relationships relating to individual agent preferences can be identified. The advantage however is that it is not wedded to any particular economic theory, and by its agnosticism, can be a powerful tool for testing between economic theories.

On the other hand, economic-centric econometric modelling is inextricably wedded to the theory being proposed, and as such any estimation method is also constrained by this. This can cause problems, not least from the possibility of omitted variable bias, meaning that econometric results are often not quite what the theorist is seeking for his or her theory. Less formal or strict estimation methods are often employed in economic-centric modelling, on the basis that models are necessarily false and hence will be rejected by data. These models nonetheless allow the counter-factual policy analysis described above, but their less strict estimation raises questions about their applicability: Although the policy analyses possible are attractive and insightful, it is possible they are based on false assumptions and hence are themselves false.

For example, Ferreira-Lopes attempts to conclude about monetary union benefits based on monetary policy independence that does not necessarily exist, and ignores the imperfect nature of foreign exchange markets so powerfully alluded to by Buiter.

Thus, neither school of modelling can claim to be able to offer unambiguously better and more practical solutions, but each adds a different dimension to the discussion of the Swedish question thus far. Buiter's lucid analysis is descriptive, and the work of Ferreira-Lopes and Söderström invoke economic theory in the form of DSGE models to investigate the problem. We, along with Pesaran et al. (2007), bring the tools of econometrics to the board. Econometric methods, when appropriately employed, provide an important angle: that of what the data are revealing. The model is able to indicate, but not prove, the existence of many assertions about the nature of the relationship between Sweden and the eurozone that are often taken on assumption, in particular the assumption of independence of policy. As such we argue our paper provides a powerful contribution to the important and timely question of whether Sweden should adopt the euro.

III Methodology

Recently, in Reade and Volz (2009*a*) and Reade and Volz (2009*b*) we investigate monetary policy independence using the cointegrated vector-autoregressive (VAR) methodology. In these papers we consider the dependence economies in regions exhibit on both regionally dominant economies, and internationally influential economies. Specifically, we investigate whether cointegrating vectors, or steady-state relationships, exist between economies, and consider which economies adjust, and which remain exogenous. We find little evidence of monetary policy independence for countries other than the US, Japan and the eurozone (or Germany within Europe, pre-EMU). In Reade and Volz (2009*a*) the ability of the cointegration framework to discriminate between cases of monetary policy dependence and independence was emphasised by using the counter-example of the UK. While cointegrating relationships are found between all countries that later became members of EMU, with Germany being the dominant player, no cointegrating relationship was found between the UK and Germany despite the UK's involvement in the ERM.

As with our earlier papers, we conduct our analysis using the cointegrated VAR methodology to inves-

tigate the degree of monetary policy independence that the *Sveriges Riksbank* enjoys. In particular, we consider a two-country pairing, that of Sweden and the eurozone. This somewhat mimics our paper on pre-EMU Europe, where we considered combinations of countries with Germany. This pre-EMU analysis builds on Edison and MacDonald (2003), and is similar to the earlier-mentioned Global VAR model of Pesaran et al. (2007), albeit on a smaller, more focussed, scale. The Global VAR, as its name suggests, builds a model linking industries and economies together in one entity. In Pesaran et al. a counterfactual exercise is employed to ask what would have happened had Sweden joined the euro in 1999. Our emphasis is on the question of whether Sweden should join the euro now, and not what might have happened had it joined at some point in the past, and hence we report estimations purely on historical data to investigate this.

The majority of empirical investigations of monetary policy independence model interest rates in isolation, even though classical interest rate parity conditions involve exchange rates. One exception to this is Fratianni and von Hagen (1990), who add in domestic inflation and growth as exogenous variables into a VAR model of the first differences of interest rates when investigating German monetary dominance in the pre-euro EMS.[11] We follow in this trend of modelling only interest rates because if a sensible and reasonably well-specified econometric model can be found for interest rates in isolation then the so-called 'sectoral general-to-specific' property of cointegration applies. This theory states that if the information set is enlarged (to include exchange rates) then the same cointegrating vectors found in the smaller system will also be found in the larger system, can be invoked to support the analysis.[12] If a well-specified model is found, this is evidence suggesting that other important effects in a different context (such as purchasing power parity) have been successfully "partialled" out of the analysis, in that their effect, while important, will not affect the parameters of the case of interest.

The cointegrated VAR methodology builds on the cointegration framework of Engle and Granger (1987) for modelling non-stationary time series, extending it into multivariate models. If two time series are individually non-stationary, and if some linear combination of them is stationary, then these two time series are said to be cointegrated. From an economic standpoint it is theoretically implausible that interest rates

[11] For a review of empirical studies in this field see Reade and Volz (2009*b*).
[12] For more on this property, see Ericsson et al. (1994) and Juselius (2007).

can be non-stationary because this would imply that the variance of interest rates would be increasing over time to infinity. Nonetheless, worldwide interest rates since the early 1970s do not satisfy the assumption of a constant mean and variance. Such analysis brings into question the important matter of sample length; a longer sample size will usually reveal more mean reversion, since the longer the time period, the more time for a series to revert to its true mean level. Given that over sample sizes of over thirty years it is very difficult to maintain that interest rates have stationary means and variances, this leaves us with somewhat of a quandry: do we take the more appropriate statistical representation of interest rates, or do we revert to what economic theory implies? It is often the case that a statistical approximation of non-stationarity is more appropriate and less harmful than obeying an theoretical economic regularity. This is particularly the case with non-stationary time series; failing to account for near non-stationarity (if indeed that is the best characterisation of interest rates) may result in inaccurate inference, and possibly spurious significance of results. Thus we treat both interest rates as non-stationary.[13]

Furthermore, given the analysis of Hendry and Clements (2001), it seems very likely that even stationary cointegrating relationships may have shifted over a time period the length of that considered here, with different exchange rate regimes being employed at different points. The existence of stationary cointegrating vectors in the multivariate framework of Johansen (1995) is based on the correlation between such linear combinations of the data levels and the more stationary first differences of the data. If structural breaks have occurred then it is unlikely that any such correlation would exist. Thus if we do find a significant correlation in the data, this is suggestive that despite all possible structural change and other impediments to econometric analysis, some long-run steady state relationship does exist in the data.

The multivariate approach also allows each series in the system to be modelled, hence avoids any *a priori* assumptions about exogeneity of variables, and direction of causality. This is especially helpful in the context of monetary policy independence. While it is theoretically implausible that the eurozone might rely on Sweden for interest rate setting, it is still preferable that we do not rule out this possibility at the outset; it emphasises the credibility of the modelling strategy if clear patterns such as this are upheld by

[13] ADF unit root testing is unable to reject the null hypothesis of stationarity in both time series.

the model. Furthermore, the multivariate context allows a much richer modelling of the dynamics of the variables under consideration, and allows more than one cointegrating vector to exist.[14]

Turning to specifics, we consider a bivariate system with data vector $\mathbf{X}_t$, given by:

$$\mathbf{X}_t = \begin{pmatrix} r \\ r^* \end{pmatrix}_t . \tag{1}$$

The domestic interest rate (here the Swedish one) is denoted r_t while the foreign interest rate, here the eurozone rate, is denoted by r_i^*. These two series form a vector autoregression:

$$\mathbf{X}_t = \Pi_0 + \Pi_1 t + \sum_{i=1}^{K} \Pi_i \mathbf{X}_{t-i} + \mathbf{u}_t, \ \mathbf{u}_t \sim \mathsf{N}\left(0, \sigma^2\right). \tag{2}$$

Here, $\mathbf{X}_t$ is a $p \times T$ data matrix, while Π_i are $p \times p$ coefficient matrices. The Π_0 and Π_1 matrices refer to deterministic terms: a constant and a trend term, which are allowed to exist within this framework, and can be restricted to zero if insignificant. If the data are non-stationary, so $\mathbf{X}_t \sim \mathsf{I}(1)$, then in order for (2) to be balanced (given the stationarity assumption on $\mathbf{u}_t$), it must be rearranged into equilibrium-correction form:

$$\Delta \mathbf{X}_t = \Pi^* \mathbf{X}_{t-1}^* + \sum_{i=1}^{K-1} \Gamma_i \Delta \mathbf{X}_{t-i} + \mathbf{u}_t, \tag{3}$$

where $\mathbf{X}_{t-1}^* = (\mathbf{X}_{t-1}, 1, t)'$, $\Pi^* = (\Pi, \Pi_0, \Pi_1)$, $\Pi = \sum_{i=1}^{K} \Pi_i - I$, and $\Gamma_i = -\sum_{j=i+1}^{K} \Pi_j$. We have banded together the coefficients for the lagged regressors and the deterministic terms, for ease of exposition. Further, if $\mathbf{X}_t \sim \mathsf{I}(1)$, then given that $\mathbf{u}_t \sim \mathsf{I}(0)$ and $\Delta \mathbf{X}_t \sim \mathsf{I}(0)$ then Π must be of reduced rank for (3) to be balanced. If Π is of reduced rank then there exist $p \times r$ matrices α and β such that $\Pi = \alpha\beta'$, and (3) becomes:[15]

$$\Delta \mathbf{X}_t = \alpha \tilde{\beta}' \mathbf{X}_{t-1}^* + \sum_{k=1}^{K-1} \Gamma_i \Delta \mathbf{X}_{t-k} + \mathbf{u}_t, \tag{4}$$

where $\tilde{\beta} = (\beta, \beta_0, \beta_1)'$ and $\mathbf{X}_{t-1}^* = (\mathbf{X}_{t-1}, 1, t)$. The $\tilde{\beta}' \mathbf{X}_{t-1}^*$ terms are cointegrating vectors, the stationary relationships between non-stationary variables, or steady-state relationships. In the interest rate context, they are combinations of interest rates that individually are non-stationary, but together are stationary, with the cointegrating vector being an interest-rate parity relationship.

[14] Of course, given we model just two series in this context, this latter advantage is not particularly relevant.

[15] With the appropriate similar transformations of the constant and trend terms between the cointegrating space and the data differences, $\Pi_0 = \alpha\beta_0 + \gamma_0$ and $\Pi_1 = \alpha\beta_1 + \gamma_1$. Because a trend in first differences implies an implausible quadratic trend, we restrict $\gamma_1 = 0$. We also restrict the constant to only lie within the cointegrating space, hence $\gamma_0 = 0$.

If the Π matrix is of rank one, so that one cointegrating vector exists, then β' is of dimension $1 \times p$ and hence $\tilde{\beta}'$ is $1 \times p+2$ including the constant and trend, and we might write $\tilde{\beta}'\mathbf{X}^*_{t-1}$ as:

$$\tilde{\beta}'\mathbf{X}^*_{t-1} = \begin{pmatrix} \beta_2 & \beta_3 & \beta_0 & \beta_1 \end{pmatrix} \begin{pmatrix} r_t \\ r^*_t \\ 1 \\ t \end{pmatrix} = \beta_2 r_t + \beta_3 r^*_t + \beta_0 + \beta_1 t. \tag{5}$$

If we find rank one, we will likely find some relationship between the two interest rates, which is evidence of monetary policy dependence between the two economies.

The α coefficients also allow extra insight into the economic dynamics taking place in the data, as they dictate whether a variable adjusts to a particular cointegrating vector, and the speed of that adjustment, if any is found. It may be expected that a large or dominant economy, such as the eurozone, would not adjust to this cointegrating vector, as it might be expected to exert monetary policy independence; so if we assume r^* to be the larger economy, then one would expect $\alpha_2 = 0$. The smaller economy may be expected to adjust, so $\alpha_1 \neq 0$. Furthermore, α_1 describes how much of any disequilibrium is corrected each period, as $\alpha = \Delta\mathbf{X}_t/(\beta'\mathbf{X}_{t-1})$, hence (ceteris paribus) a speed of adjustment can be calculated; the smaller is this coefficient, the more independent is a country in setting its monetary policy, as it devotes less of its attention to correcting to what other interest rates are doing. As such, the α matrix is very informative about the nature of monetary policy independence. An economy not adjusting to a cointegrating vector in which it appears is said to "drive" the system: the level of the interest rate in that economy is not constrained by the cointegrating relationship, but instead dictates what level that cointegrating relationship takes. At this point we should emphasise that cointegrating vectors describe equilibrium combinations of economic variables, and hence there could be high interest rate equilibrium combinations as well as lower interest rate equilibrium combinations.

One potential concern might be that if we find a cointegrating vector, it must be that at least one of the two economies will adjust, otherwise the cointegrating vector would not be found (it is found by considering the eigenvalues, which are the squared correlations between the first differences $\Delta\vec{X}_t$ and the linear combinations of levels, $\beta' X_t$). Hence for Sweden to not adjust, we would require the implausible situation where the eurozone adjusts. Given this, we would expect Swedish monetary policy independence

to be manifested in a lack of cointegration between the two series. If it happens that they do move together as time series, then economics and common sense dictates it must be the eurozone influencing Sweden and not vice versa; thankfully also we can find the direction of this relationship out in the data without imposing economic structure *a priori* using the cointegrated VAR framework.

As will become evident in the next section on data selection, as well as in Section VI where we examine various other financial and real economic variables, many patterns of convergence exist between Sweden and the eurozone. We hence add a time trend term into our model that is able to capture convergence. In the face of convergence between Sweden and the eurozone it would be somewhat nonsensical to estimate a model which is unable to capture that convergence. Although the model assumes that rate at which Sweden or the eurozone adjusts to any cointegrating relationship remains constant throughout the sample, the trend term allows any cointegrating vector to reflect a gradually tighter and tighter relationship between interest rates. Naturally, such a model will be of marginal use for forecasting longer horizons, since a linear time trend at some point will begin to imply divergence, which is implausible. However, the main intended purpose of this model is not to forecast but instead to understand more the historical co-dependence between Sweden and the eurozone block of European economies.[16]

IV Data

From the policy interest rates of the ECB and the *Sveriges Riksbank* plotted in Figure 2, initially after 1999, the eurozone rate appears to lead the Swedish rate, and although that gap closes up to 2009 and the current global recession, it is clear the eurozone still leads the Swedish rate, simply the lag is less between the two.

For our estimations, we use daily interbank interest rates due to their relevance for monetary policymaking and their availability and variation at high frequency. To the extent that markets factor in anticipated monetary policy movements before they happen, then interbank rates are a good reflection of monetary policy. Furthermore, if the setting of the interest rate at which banks operate in a particular economy reflect the monetary needs of that economy, then that country can be said to have monetary policy independence. If

[16] Of course, this model could be used for forecasting: Simply we do not do that in this paper. In terms of whether a model such as this *should* be used for forecasting, Hendry and Clements (2001) give a number of reasons why this model may be less appropriate, particularly over shorter forecast horizons.

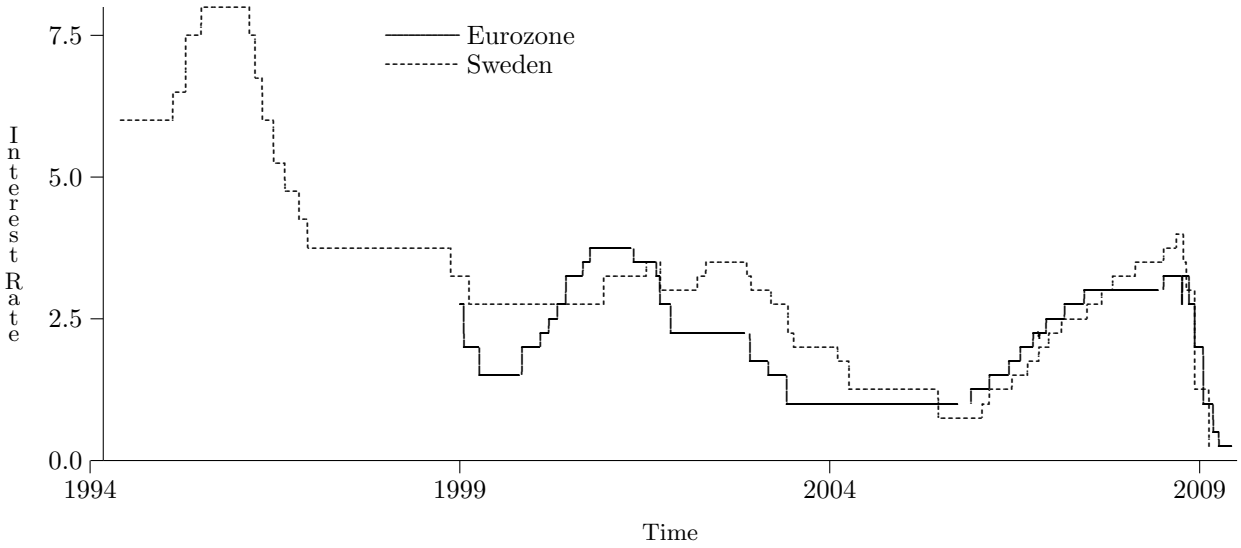

Figure 2: Central bank policy rates (*Riksbank* repo rate, ECB refinancing rate). Source: Datastream.

instead the rate at which banks are able to lend is dictated by other influences, such as the economic events in other economies, then clearly this economy exhibits little if any independence in practical monetary policymaking. Hence interbank interest rates provide an effect means for investigating monetary policy independence.

Our data are three-month interbank interest rates sampled at a daily frequency for Sweden (the Stockholm Interbank Offered Rate, STIBOR) and the eurozone (the European Interbank Offered Rate, EURIBOR). We begin estimation in 1987; pre-euro, the rate was simply calculated for banks in what became the euro area, and post 2001 Greece is included in this calculation. The data begin on 1 January 1987 and our last observation is drawn on 19 June 2009, giving 5,794 observations. Our dataset includes a number of periods of structural instability, notably the Swedish banking crisis of 1992, the structural break of the introduction of the euro in 1999, and the current financial crisis. It is our belief that the credibility of econometric analysis is not enhanced by the judicial use of data via the selection of convenient sub-samples of the available sample. Hence we estimate over the entire time period for which daily data are available for Sweden and the eurozone.

An important point here is that the euro only came into being part-way through our sample; one might thus be inclined to wonder whether it would make more sense for our analysis if we only considered the

post-euro portion of our data? With daily observations, we have many observations, and hence cutting the sample to just post-1999 would still provide well over a thousand observations. A crucial distinction however must be made between enlarging a dataset by raising the frequency of observations, and by increasing the time frame. We are considering movements between macroeconomic variables over the business cycle, and as such, when only considering 10 years of data, increasing the frequency will not produce more economic cycles in which to observe the co-movements between the data series.[17] Cointegration, like stationarity, is better observed over longer time periods, particularly when macroeconomic variables are under scrutiny, and as such it is likely that over a shorter time period there are less corrections to the equilibrium in order for that equilibrium to be effectively discovered. Reflecting this, we carried out the cointegration analysis included in this paper over just the post-1999 data period, and found results extremely similar to those reported in the paper; the only notable difference was that the cointegration discovered was slightly weaker. The main reason for this can be found from considering the actual cointegrating vector found over the entire data period, plotted in Figure 7; over the longer horizon it is quite clear that the equilibrium relationship exists, as there are many corrections to it. But if one takes a smaller segment of that relationship, such as that since 1999, then many of these equilibrium corrections are lost and the equilibrium relationship that can be found is weaker. It should be emphasised that this is a time series statistical feature and not an economic feature: Cointegration is a stationarity concept and can only be found if these is sufficient data to display the reversions to mean. Hence it will not necessarily be found as strongly over shorter time horizons, and as such taking both time periods in isolation (pre- and post-EMU) results in weaker cointegration.[18]

The two series are plotted in Figure 3. There appears to be clear co-movement between the series, and arguably some convergence also. In the late 1980s and early 1990s there is a marked difference between the two series, with Sweden's interest rates markedly higher throughout. The 1992 ERM crisis and associated attempts to defend the value of the currency have a huge effect on Swedish interest rates. Apart from a bulge 1996, post 1992 the two interest rates appear to move much more closely together, with periods in the

[17] Although, *ceteris paribus*, it will increase the precision with which effects in the time period are measured.

[18] The highest eigenvalue, which can be taken as a measure of the strength of cointegration, in the entire sample is 0.009, while it was 0.013 pre-EMU and 0.006 post-EMU. Sweden's α coefficient, hence measuring Sweden's level of independence, was 0.003 post-EMU, 0.009 pre-EMU and 0.007 overall, with all three coefficients strongly significant.

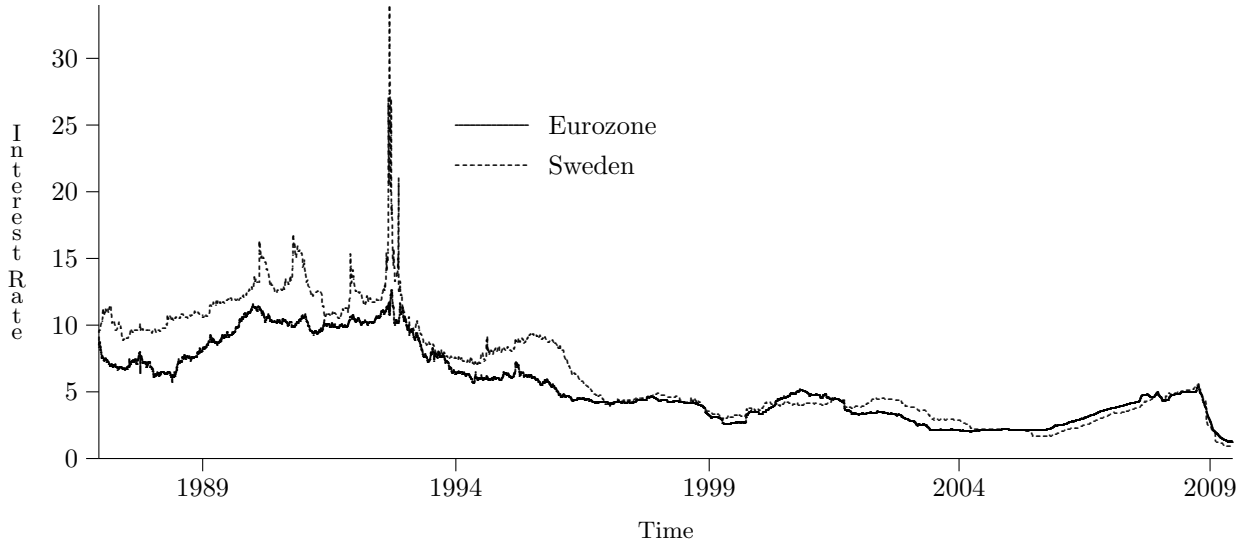

Figure 3: Interbank interest rates for the eurozone and Sweden, 1/1/1987–6/19/2009. Source: Datastream.

early part of the 21st century where the Swedish interest rate is below that of the eurozone. The effect of the recent financial crisis is evident in the sharp fall in interest rates at the end of 2008.

We use data at a daily frequency which provides plenty of observations, but also potentially adds noise to our dataset, and will likely produce fat-tailed residual distributions due to ARCH effects. An important question is whether there exists particularly much variation between observations at such a high frequency. Figure 4 plots the interest rate series over four shorter time periods to give some idea of whether the plot in Figure 3 hides the variation (or lack of it) in the series because the scale is so large. These four plots show that even in the more recent time periods there is considerable variation in the interest rate series, albeit on a smaller scale to earlier in the sample. However, such heteroskedastic effects, while interesting and warranting future investigation, do not induce bias in coefficient estimates, nor do they affect the rank test outcome in the cointegrated VAR (Nielsen and Rahbek, 2000).

V Results

We estimate the model with six lags (days) of both variables, and we include 46 impulse dummy variables to cope with outliers. The majority of these outliers are to cope with the 1992 ERM crisis, as can be seen in Figure 5, which plots the two interest rates with the dummy variables added plotted directly below,

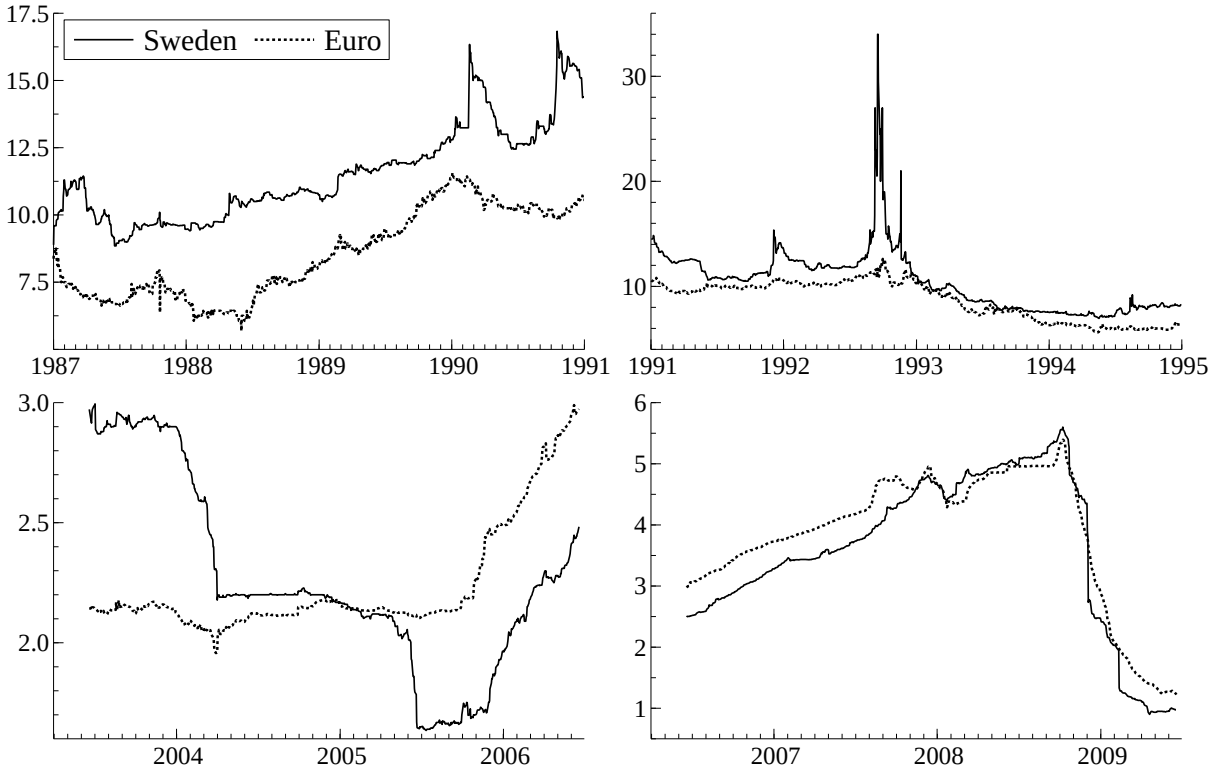

Figure 4: Interest rates broken into four smaller time periods (note different scales on vertical axes in each case). Source: Datastream.

corresponding to particular observations.[19] Concern may be raised that by using dummy variables to cope with perhaps the most noteworthy historical event specific to our sample, we are choosing to omit, or ignore that information. Dummy variables are used to model outlier events, events that plausibly belong to a different distribution to that of the rest of our data series. Undoubtedly there is information in the financial crisis of note for our estimation purposes, and it should be emphasised that as our data is daily we by no means eliminate all observations corresponding to the crisis, and hence plausibly we retain all the relevant information for our purposes. It is well known from the ARCH literature (e.g. Engle, 1995) that at times of volatility high frequency financial data series will display greater noise thus arguably some different

[19]It should be emphasised here that the asymptotic impact of entering such dummies given the dynamics of the VAR system have been extensively studied by, amongst others, Johansen et al. (2000). Furthermore, much research has been devoted to the issue of using impulse dummies for outliers in recent years (e.g. Hendry et al., 2008) and the main implications of that literature is that the inclusion of irrelevant dummies is harmless, but not including dummies for outliers can distort inference. As such, we are confident about our use of such dummy variables.

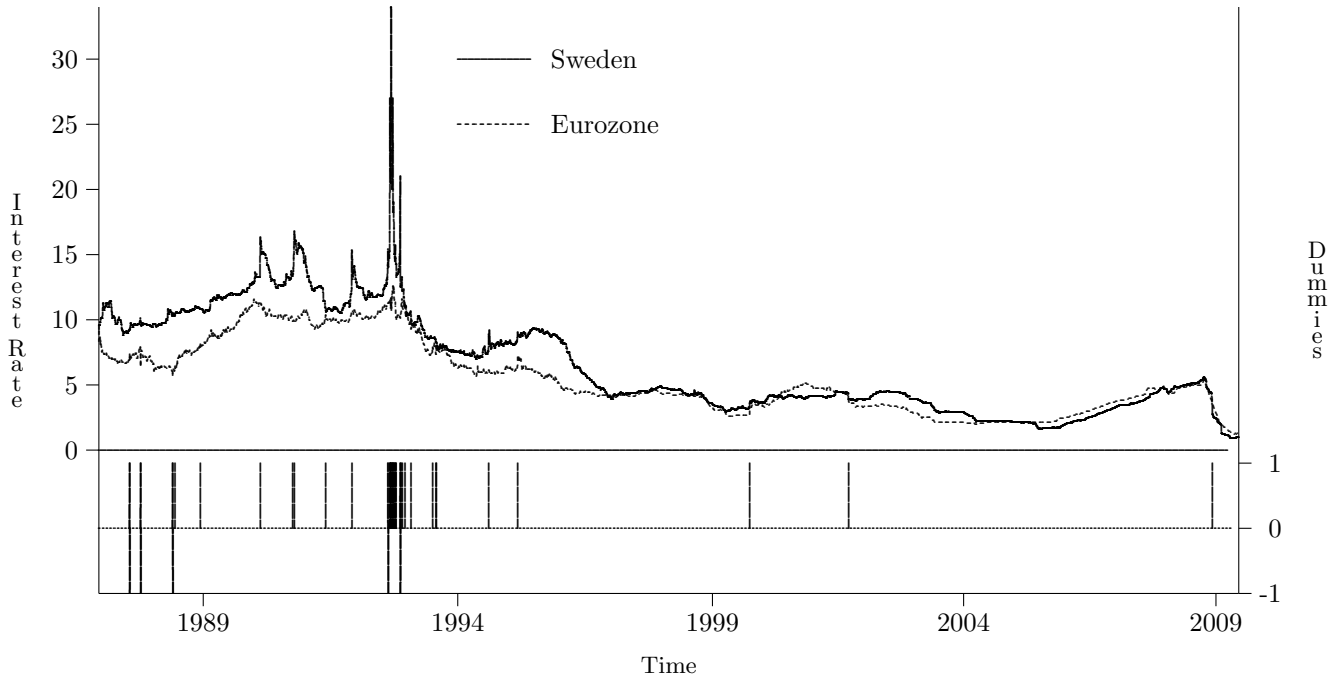

Figure 5: Plot of eurozone and Swedish interbank interest rates with impulse dummies also plotted. Source: Datastream.

distribution of very high variance and unknown mean, and we argue that we are removing this noise from our data as opposed to omitting all information relevant or not from this notable historical incident. By omitting such noisy observations we are able to better uncover the true movements in the data series which might otherwise be dwarfed by the volatility in interest rates surrounding the crisis. With the addition of these dummy variables, which produces a total number of parameters in our model of 124, a model is arrived at which satisfies the requirements for a model to produce an accurately sized rank test, and a model which represents the data effectively.[20]

The model exhibits non-Normal residuals due to the fat-tailed characteristic of high-frequency financial data, as usually modelled using ARCH-type models. Because ARCH effects do not adversely impact the rank test, and because the residuals in the model, despite being non-Normal, are symmetric, we choose to proceed. As a result of such high frequency data, we also note signs of autocorrelation in our residuals. This autocorrelation was independent of lag length, hence we retained a lag length of six. Additionally, the

[20]By stating our model represents the data effectively we state that all statistical evidence points towards our model yielding an accurately sized rank test and unbiased parameter estimates. Whether the data represent the underlying economic reality is another matter, but in the case of interest rates there is little scope for measurement error, and the correspondence between interbank interest rates and monetary policy rates has already been discussed.

Rank	Eigenvalue	Log-Likelihood	Test statistic	P-value
0		16428.5	55.38	0.00 **
1	0.00887	16454.3	3.78	0.77
2	0.00065	16456.2		

Table 1: Trace test outcome for various rank possibilities. * denotes a test rejection at the 10% significance level, ** denotes a rejection at the 5% significance level. Source: Datastream.

rank test outcome is very conclusive at rank 1, as can be ascertained from Table 1, and hence we are not worried about any possible problems with testing that this autocorrelation might induce (Juselius, 2007). It is only in marginal test decisions where size distortions in testing are present that decisions may be affected, but thankfully as our decision is clear in favour of rank one, we can be confident despite the autocorrelation in our residuals. From Table 1, the null hypothesis of rank zero is heavily rejected with a test statistic of 55.38, but the null hypothesis of rank 1, to which we proceed when following the Johansen (1995) procedure, is not rejected and has a p-value of 77%, suggesting a very clear conclusion in favour of a rank of one. Many alternative rank testing procedures have been proposed to cope with poor size and power properties in the trace test, not least the Bartlett corrections of Johansen (2002).[21] However again given our test outcome is very conclusive, it is unlikely that any size distortions in the trace test could have affected the test enough to alter this particular implied outcome.

The restrictions imposed allow for a (1,-1) relationship between the eurozone and Sweden, and also restrict the eurozone's adjustment coefficient in the alpha matrix to zero. The Swedish adjustment coefficient has a t-statistic of around 7, hence is very significant. Thus the eurozone can be seen to be driving the system. These over-identifying restrictions are tested using a likelihood ratio test, and are accepted with a test statistic of 1.23, which has a p-value of 54.2%. The resulting system is, where r_t is the domestic (Swedish) interest rate, and r_t^* is the foreign (eurozone) interest rate:

$$\begin{pmatrix} r \\ r^* \end{pmatrix} = \begin{pmatrix} \underset{(0.001)}{-0.0072} \\ 0 \end{pmatrix} \begin{pmatrix} r - r^* - \underset{(0.271)}{2.343} + \underset{(0.00008)}{0.0006}\, t \end{pmatrix}. \tag{6}$$

Sweden's adjustment coefficient is low at 0.007, but it is of the right sign, and it should be emphasised that

[21] The Bartlett corrections are most necessary in the case of I(2), or near-I(2) data. As it is clear that our data are not I(2) from a brief consideration of the data plot (I(2) data tend to be very smooth, something which interbank interest rates are not), then we are confident in not using a Bartlett correction.

we are considering daily data. The half life of any deviation from equilibrium is about 100 days, hence about a third of a year. The clear implication of this is that Sweden follows the eurozone in its interest rate setting. Its monetary policy may have the illusion of independence due to standing outside the eurozone, yet its decisions are severely hampered by the need to follow the movements of interest rates in the eurozone.

The time trend term is also small, at 0.0006, but again we are considering daily data, and additionally it is of the right sign; if we consider that the cointegrating vector term is effectively equal to an I(0) error term, say ϵ_t, then we can write:

$$r - r^* = \underset{(0.271)}{2.343} - \underset{(0.00008)}{0.0006}\, t + \epsilon_t, \tag{7}$$

and hence the difference between the two interest rates is decreasing over time. Multiplying the coefficient 0.0006 by the number of observations in our sample, 5,794, suggests that the difference between the two rates has shrunk by 348 basis points since 1987. This appears to tally with the divergence in interest rates of around three percentage points in the early part of the sample compared to the end, from Figure 3.

The cointegrating vector itself is plotted in Figure 7, and it can be seen that apart from the drastic departure from equilibrium around the 1992 financial crisis, the vector is very close to equilibrium. The vector is certainly stationary: it crosses the zero line on many occasions as a result of the long sample size, showing the value of using as many observations as possible. As with macroeconomic movements, often the departures from equilibrium are quite sustained over economic cycles, and as such had data from only 1999 onwards been used, many equilibrium correction movements would have been omitted from the dataset, explaining the weaker cointegration result found over that reduced time period. Estimating only over the post-euro period is a very simple recursive test; more detailed recursive analysis reveals minor instabilities around the 1992 financial crisis, also induced by the relatively few observations in the recursive sample at that point. Estimating just the post-1992 period, the rank one test outcome remains strong, and although there are slight differences in the nature of the cointegrating relationship, the conclusion of Sweden's dependence on the eurozone remains. Given the discussion of the need for a long sample in terms of time horizon and not frequency of observations, a recursive analysis is somewhat less useful here, given that the two variables display little evidence of structural breaks despite the change in exchange rate regime in 1992. Despite the

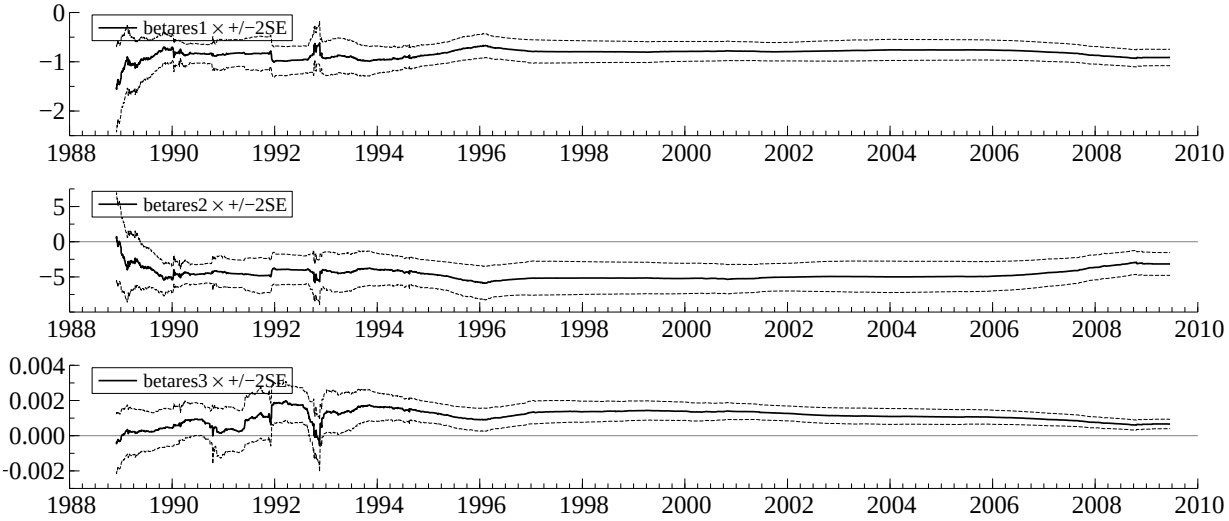

Figure 6: Resursive plots of the three parameters in the cointegrating vector: The coefficient on the eurozone interest rate, on the constant and on the time trend.

noted disadvantages of recursive analysis in this context, it does provide an important contribution to our understanding of the Swedish situation. As such, recursive estimates for the coefficient on the eurozone interest rate (which we successfully restrict to one in the reported analysis), the constant and the time trend are reported in Figure 6. There is a noticeable blip for the 1992 crisis, although part of the instability before 1992 is caused by a lack of observations rather than any inherent instability, necessarily. Since the early-1990s the plots have been remarkably smooth and stable. Even with the 1992 blip however it is clear that the level of the coefficients emerging prior to the crisis remains afterwards: The parameters in our model appear robust to this large and extraordinary economic even that took place. Parameter stability from recursive analysis is used by Christensen and Nielsen (2009) to argue that their model is robust to the Lucas Critique, and in the terminology of our earlier discussion, their model satisfies super exogeneity. We can thus apply the same test to our model and conclude that our parameters are invariant to extraordinary events such as the 1992 financial crisis, and hence relevant to use when considering economic policy analysis.

Considering robustness a little more, it is beneficial to check that our results are driven by the signals in the data, and not the noise — daily data, while potentially introducing precision via more observations, may also

introduce more noise. Financial markets are renown for their autoregressive conditional heteroskedasticity; volatility one day breeds volatility the next day. Thus it makes some sense to also aggregate our data to the weekly and monthly frequencies. If the results are the same then we can be confident that the estimates we have at the daily frequency represent the signals transmitted in the data, and not the noise present. At both the weekly and monthly levels, the rank one hypothesis is again found to be most appropriate via testing, and the restrictions imposed on the daily model are accepted with a p-value of 73.5% at the weekly level, and 39.8% at the monthly level. The constant coefficient remains similar in the cointegrating vector, while the time trend is affected by the data frequency, as is the rate at which the Swedish interbank rate corrects disequilibrium. Both however are consistent with the daily model with the time trend coefficient again implying that the two interbank rates have converged from a difference of around 3.5 percentage points over the sample period, and the Swedish adjustment coefficients implying roughly similar lengths of times for which Swedish rates could depart from the equilibrium relationship of nearly a hundred days.

Reflecting on this outcome, it may be that Sweden and the eurozone are reacting to the same shocks, and hence our identification of policy dependence is over-stated. Hence, it may be that while data and hence econometrics pick up a relationship, it actually reflects independent responses to the same shocks. This may be so, but in reacting to a macroeconomic shock, the eurozone is systematically taking the lead, and Sweden following; this we feel is evidence suggestive of a lack of policy independence. It is worth emphasising that the methodology employed here is able to identify countries that plausibly exhibit monetary policy independence; in Reade and Volz (2009*a*) the UK is found to display independence as a cointegrating relationship did not exist between it and Germany, pre-euro, while *all* of today's members of EMU exhibited a clear dependence on Germany's monetary policy. We should also reiterate that it is the joint finding of a cointegrating relationship, adjustment by a dependent economy and non-adjustment by an independent economy that yields a monetary policy dependence conclusion. Cointegration is to be expected due to the correlation between interest rates within Europe and other capitalist economies, but it is the adjustment to this cointegration that marks out the cointegrated VAR methodology as insightful in this context. It would be more difficult to conclude in favour of Swedish policy dependence if the eurozone also adjusted to the

cointegrating relationship found, since in that case the eurozone would not drive the relationship, but some other combination of persistent shocks, what are often called common trends. Hence were Sweden able to react to its idiosyncratic shocks first and foremost, it would do so, and this would be uncovered in the data, as was done, for example, in the case of the UK. However, the implication is that, in fact, while Sweden suffered idiosyncratic shocks that did not affect the rest of the eurozone, it did not respond to these, or if it did, it had a very temporary period of time in which it was able to respond differently. The example of the brief period in 1992 of the *Riksbank*'s repo rate at 500% to defend Sweden's membership in the EMS is indicative of this. While it will never be possible to conclusively prove dependence based on econometric data, it seems quite implausible that Sweden came to monetary policy decisions by looking independently at the macroeconomic events in Europe and not taking into consideration the policy movements at the ECB.[22] Our econometric results simply reflect this reality and yield further evidence to bring to bear.

Of course, it is always very tempting to try to read as much as possible into one's result, and rely too heavily on them. The evidence presented here is not suggesting that Sweden waited 100 days and then decided to do exactly what the eurozone had done 100 days previously. It is saying that there was a tendency over the 22-year period observed for Sweden and the eurozone's interest rates to move in line with each other, and for the eurozone to lead where that relationship went, with Sweden following. The equilibrium estimated, our cointegrating vector, was rarely, if ever fully observed, yet the data reveal that this was a plausible relationship to which the data were constantly moving towards, subject to frequent common and idiosyncratic macroeconomic shocks. Our results do not necessarily suggest that should Sweden join the eurozone it would have a painless journey, since it has been following the eurozone over the years. However, these results do point towards a reassessment of the idea often put forward that Sweden would be relinquishing monetary policy independence if it joined the euro.

[22] Where, again, the changes in interbank rates are taken to represent monetary policy movements.

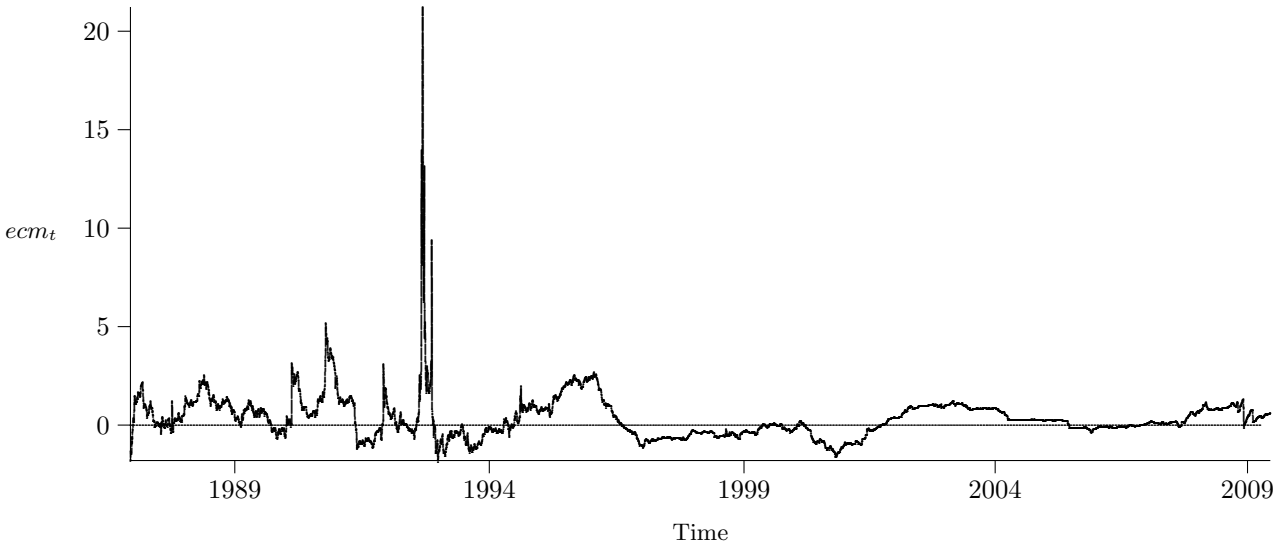

Figure 7: Plot of cointegrating vector between eurozone and Swedish interbank interest rates with constant and time dummy. Lags and deterministic terms not included in estimation of this term. Source: Datastream.

VI Convergence, More Generally?

The finding of monetary policy dependence in our econometric results suggest that the costs of joining the euro are lower for Sweden than widely thought. If in fact Swedish monetary policy is simply following the eurozone, this implies it has no independence currently anyway, and thus to join the euro, instead of depriving Sweden of policy independence, would instead give her a say in the determination of European monetary policy by granting the governor of the *Sveriges Riksbank* a seat on the ECB's governing council. However, there is reason for caution against concluding too heavily in favour of Swedish euro adoption on the back of a monetary policy independence argument alone. Policy independence is one important part of the argument for or against an economy joining a currency area, but it is certainly not the only one. In this Section, we hence aim to provide a broader picture of convergence between Sweden and the eurozone, mimicking to some extent the recent analysis of Söderström and Flam *et al.*

Going back to the deliberations of Mundell (1961), business cycle synchronisation is usually deemed the most important factor in whether or not an economy ought to enter into monetary union. The more synchronised business cycles of the different countries or regions of the common currency area are, the less the need for an independent monetary policy will be, because the common monetary policy will suit all countries

or regions reasonably well. Because business cycles are endogenous, as they are influenced, among others, by trade and financial integration, which in turn are affected by the very process of monetary integration (Frankel and Rose, 1998), a simple *ex ante* analysis is usually not sufficient to make qualified judgements of a country's suitability for membership in a monetary union. However, given that the degree of Sweden's integration with the eurozone is already very high (e.g. Flam et al., 2008) and that the business cycles of Sweden and the eurozone have become more synchronised with rising degrees of economic integration, as will be discussed below, we refrain from conducting an in-depth analysis of the likely effects on the Swedish economy of trade and financial integration with the eurozone (which would be enough work for an entirely new paper). Instead, we restrict ourselves here to a look into the historic evolution of selected Swedish and eurozone business cylces indicators and a comparison of Sweden's performance with those of other countries inside and outside of the eurozone.

Table 2 displays selected business cycle indicators for Sweden and the eurozone, as well as for a number of other European countries, both euro members and outsiders.[23] The upper panel presents data on nominal GDP growth, which shows that the correlation of the Swedish and eurozone business cycle has increased after the creation of EMU, a period in which Sweden had on average higher growth rates than the eurozone.[24] The Swedish and eurozone time series of nominal GDP growth is plotted in Figure 8, which also appears to suggest increased alignment of Sweden and the eurozone: the disparities between the two economies have reduced significantly after 2002, with the growth profiles in the Great Recession being almost identical. Table 2 also reveals that while the correlation of the Swedish business cycle with the eurozone is not as high as of EMU members France, Italy, Spain and Finland, it is actually higher than the correlation of the German business cycle with the eurozone.

The second panel of Table 2 presents data on unemployment, which has been lower in Sweden than in any other European country presented in the table, except for Denmark and Norway, post-1999. The correlation of Swedish unemployment with the eurozone has actually declined since 1999, but it does not differ very

[23] The data source is Datastream.

[24] Flam *et al.* (2008) and Söderström (2008), for instance, also note that differences in business cycles have become much smaller since the early 1990s for both euro and non-euro countries.

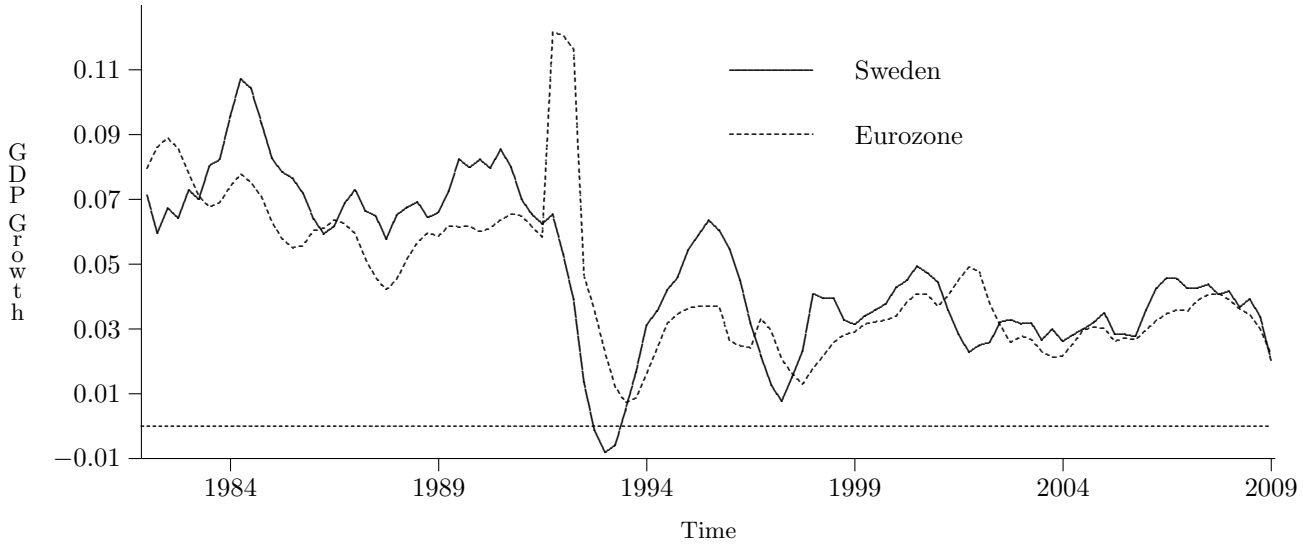

Figure 8: GDP growth. Source: Datastream.

much from those of big euro member countries like Germany and Spain. What is more important, in any case, is that the generally low level of unemployment in Sweden and its relatively flexible labour markets increase the Swedish economy's ability to respond to possible adverse shocks, providing it with an important adjustment mechanism if symmetries were to arise within the monetary union (cf. Flam *et al.*).

Going back to Fleming (1971), the convergence of CPI inflation rates has been regarded as a precondition for joining a currency area since this is a long-term condition for balanced national accounts within that area. Swedish inflation has been lower on average than in the eurozone, which means that the competitive position of Swedish exporters would have strengthened within the monetary union over the past decade, had Sweden joined.[25] In this respect Sweden would have encountered no problems stemming from EMU membership.[26] At the same time, given that Sweden has already managed to implement a credible monetary policy framework that has delivered a low rate of inflation, Sweden would not gain much from entering monetary union the way that countries with a weak track record of inflation have (the tying-one's-hands argument as developed by Giavazzi and Pagano (1988)).

[25]For historical inflation rates see Table 2.

[26]In any case, one should note that the time-inconsistency argument, which was brought forward by, amongst others, Kydland and Prescott (1977), reverses the order between what can be regarded as precondition and what can be seen as the desired outcome of monetary integration. As an application of the Lucas critique (Lucas, 1976), inflation convergence can be considered as an intended result of monetary integration between countries with different historical inflation histories. From this perspective the Maastricht criterion on inflation convergence is dispensable.

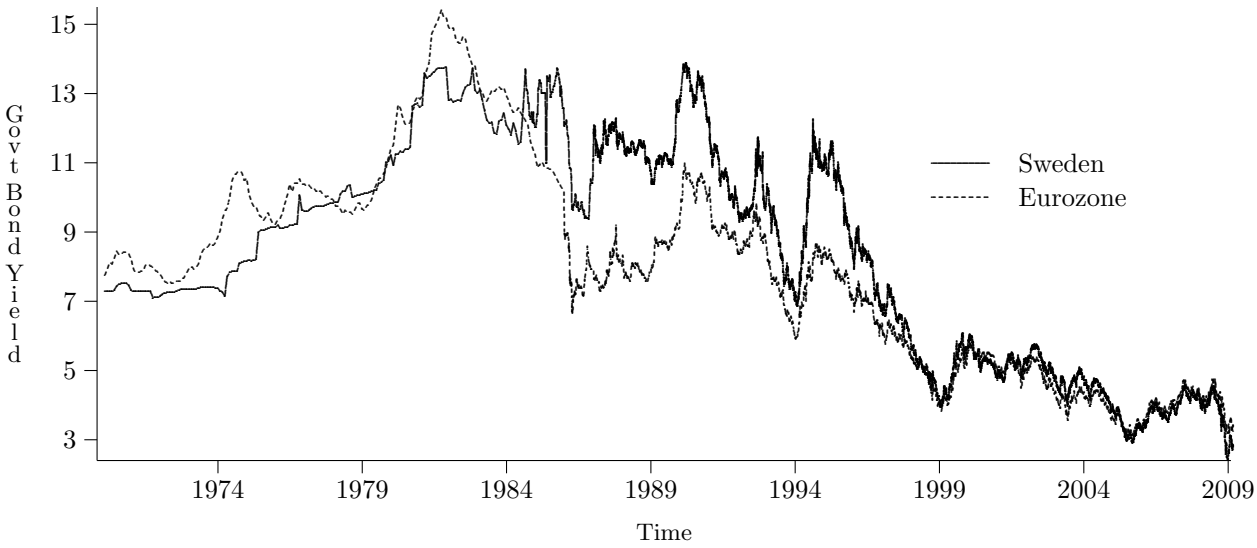

Figure 9: Swedish and eurozone 10-year government bond yields. Source: Datastream.

Turning to long-term interest rates, which are presented in the lower panel of Table 2, we see that the difference in the yields of ten-year government bonds has been very small between Sweden and the eurozone, both before and after creation of EMU. Figure 9, which plots the 10-year government bond yields for the eurozone and Sweden, shows clearly that yields have been converging on each other and that they have been closely aligned since at least the beginning of the decade. With long-term rates being arguably more important drivers of aggregate demand than short-term nominal rates for both the eurozone and Sweden, the convergence that has taken place suggests that there would in effect be little change at all if Sweden were to join the euro.

Regarding the external value of the krona, Figure 1 already showed that the krona has been reasonably stable against the euro, with the krona/euro exchange rate remaining around nine for most of the time, with only a recent slump of the krona to around eleven at the end of 2008 as a consequence of the financial crisis. Looking at the euro's and krona's movement against the dollar (Figure 10, standardised), we can see that both have moved in tandem over the past decade, reflecting the close movement of the Swedish and eurozone economies. Again, this suggests that EMU entry would not be disruptive, given that Swedish interest rates and exchange rate movements have been closely aligned to the eurozone over a long period of time.

Summing up, the analysis of his Section has shown than many important macroeconomic variables for

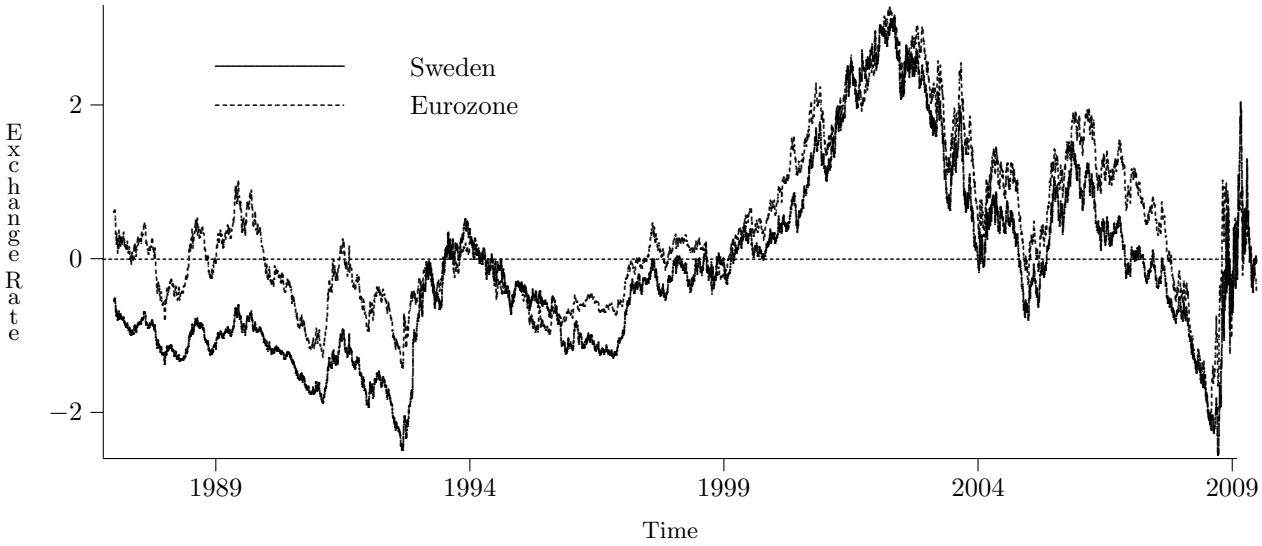

Figure 10: Swedish and eurozone US dollar exchange rates, standardised. Source: Datastream.

Sweden and the eurozone have converged over the years, giving a rather positive outlook on Sweden's EMU membership.

VII Conclusions

This paper enters into the debate on Swedish euro adoption re-ignited by the global economic crisis that has left many smaller open economies particularly vulnerable. In our analysis we focus on what is commonly regarded as the main cost of entering a monetary union: the loss of monetary policy independence. Using a cointegrated VAR model, we investigate the degree of monetary independence that the *Sveriges Riksbank* has had in steering Swedish money market rates. We find a clear cointegration relationship between eurozone and Swedish rates. The relationship is driven by the former, with the Swedish rate following the eurozone's rate with some lag. Even when Sweden experienced a severe banking crisis in the early 1990s – a huge idiosyncratic shock – Sweden remained in tow with Europe. While the *Riksbank* significantly deviated from continental monetary policies when it briefly raised its repo rate to 500 percent (!) in September 1992 to prevent further capital outflows and (unsuccessfully) defend the krona exchange rate and Swedish membership in the EMS, it quickly returned to European levels, even though Sweden exited the EMS and the Swedish economy struggled severely and unemployment soared in the years ensuing the banking crisis. We

regard this as a reassuring example that we are allowing in our analysis for both common and idiosyncratic shocks, but that for Sweden, the common shocks, and following Europe, dictated monetary movements more than Sweden's own issues.

The intention of our analysis is not to deny the fact that, by staying outside of EMU, Sweden would retain the possibility to deviate from the ECB's policy or use its exchange rate as an adjustment mechanism in times of crisis. But our investigations covers a period of more than two decades and suggest that in practice the *Riksbank* has made little if no use of this opportunity. Critics of EMU have correctly argued that the problems that Greece has experienced as a result of a steady loss of competitiveness within the eurozone could be eased by a devaluation — if it still had the drachma instead of the euro — in a much less painful fashion than the adjustment Greece is facing now with real wage cuts and fiscal tightening. The Greek troubles are an argument against EMU membership for countries that are likely to experience a loss of competitiveness against austere EMU core countries like Germany, the Netherlands and Austria. This type of argument would not appear to apply to Sweden however because, as discussed earlier, Sweden would have actually experienced real depreciation and gained competitiveness within EMU had it joined, since its inflation has been lower on average than eurozone inflation. The case for a Greek exit of EMU does not necessarily contradict the case for a Swedish entry.

Overall, our deliberations suggest that the *Riksbank*, despite staying outside of the eurosystem and pursuing an inflation targeting framework with a flexible exchange rate that should theoretically leave it full monetary policy autonomy, is *de facto* not master in its own house. Rather, we argue that Sweden is lulled by some kind of monetary independence delusion. By joining the euro, Sweden would give up monetary sovereignty, but the cost in terms of a loss of monetary policy autonomy would be negligible. We hence consider the argument made by the Calmfors Commission and others that through EMU membership Sweden would "no longer have the opportunity to pursue an independent monetary policy" (Calmfors et al., 1997, p. 312) and hence might face serious consequences for stabilisation-policy as flawed as it largely blends out reality. The cost of ceding monetary sovereignty would arguably be outweighed by Sweden gaining a seat in the ECB's governing council, where the governor of the *Riksbank* would have a say in formulating

the common European monetary policy stance. Instead of being a passive bystander to the ECB's interest rate decisions, the *Riksbank* could play an integral part in European monetary policy making.[27]

We complement our analysis on Swedish monetary independence by assessing the convergence of other real and financial variables of the Swedish and eurozone economies. Given the tight integration and convergence of the Swedish economy with the eurozone, we see little argument why Sweden should abstain from adopting the euro. (In our analysis we do not consider purely political considerations about Sweden's relation with and role within the EU which need to be taken seriously but where we do not consider ourselves in the position to comment on.) In contrast, we believe that staying outside of the eurozone implies forgone benefits that Sweden, a small open economy with a sizable and internationally exposed financial sector, would enjoy from adopting an international currency. As pointed out by Buiter (2008), being part of a monetary union that features a global reserve currency holds significant benefits for financial market stability, a point which has been demonstrated in the recent financial market upheavals. While Sweden did not have to defend its exchange rate by raising interest rates in the midst of the financial crisis like Denmark, which is part of ERM II and which has been shadowing the ECB's monetary policy almost one-to-one (which makes the Danish decision to stay outside ERM somewhat nonsensical), it had to activate swap arrangements with the ECB to secure euro liquidity for its internationally operating banks. We hence believe that the answer to the question of whether Sweden should join the euro that we posed in this article's heading should be answered with a qualified "yes".

[27] Heikensten (2003, p. 3), then governor of the Riksbank, concedes that Sweden's influence in European economic policy making, even beyond monetary policy, has "declined considerably" because of Sweden's decision to remain outside of EMU.

			Sweden	Eurozone	France	Germany	Italy	Spain	UK	Denmark	Finland	Norway
GDP growth	Mean	pre	0.019	0.023	0.021	0.024	0.020	0.030	3.013	0.025	0.025	0.033
		post	0.026	0.019	0.019	0.015	0.010	0.035	0.024	0.015	0.029	0.024
	SD	pre	0.023	0.010	0.014	0.019	0.016	0.022	19.659	0.020	0.034	0.026
		post	0.024	0.017	0.014	0.012	0.019	0.010	0.016	0.020	0.024	0.020
	Corr	pre	0.785	1.000	0.887	0.778	0.774	0.430	0.137	0.174	0.759	0.410
		post	0.869	1.000	0.947	0.676	0.940	0.913	0.863	0.842	0.928	0.401
Unemployment rate	Mean	pre	5.196	10.390	9.921	8.180	9.549	16.240	9.007	6.843	10.533	5.358
		post	6.110	8.304	8.852	8.654	8.158	10.602	5.238	4.533	8.427	3.500
	SD	pre	3.225	0.249	1.186	0.977	1.263	2.025	1.686	1.422	5.142	1.108
		post	0.940	0.574	0.623	1.123	1.377	1.939	0.480	0.729	1.120	0.690
	Corr	pre	0.895	1.000	0.804	0.086	-0.550	0.687	0.514	0.435	0.627	0.551
		post	0.467	1.000	0.880	0.483	0.546	0.463	0.051	0.798	0.645	0.597
Inflation rate	Mean	pre	5.834	1.602	5.723	3.315	7.542	8.946	6.611	5.706	6.372	5.574
		post	1.522	2.136	1.718	1.920	2.316	3.099	2.680	2.200	1.842	2.126
	SD	pre	3.551	0.499	4.128	2.023	6.050	5.575	5.341	3.809	4.429	3.392
		post	1.116	0.669	0.719	0.783	0.580	0.972	1.208	0.711	1.223	1.269
	Corr	pre	0.231	1.000	0.753	0.070	0.509	0.758	-0.575	0.501	-0.453	-0.475
		post	0.720	1.000	0.925	0.357	0.825	0.856	0.587	0.470	0.545	0.295
Long-run interest rates	Mean	pre	9.675	9.653	7.585	6.857	10.399	12.329	9.750	9.397	8.246	9.523
		post	4.447	4.436	4.363	4.243	4.596	4.438	4.784	4.477	4.408	5.045
	SD	pre	2.320	2.210	1.636	1.318	2.889	3.370	2.737	2.557	2.418	2.829
		post	0.794	0.621	0.630	0.641	0.619	0.672	0.457	0.719	0.674	0.988
	Corr	pre	0.929	1.000	0.959	0.969	0.943	0.937	0.787	0.899	0.962	0.705
		post	0.873	1.000	0.989	0.951	0.989	0.998	0.710	0.970	0.995	0.906

Table 2: Descriptive statistics for a range of macroeconomic indicators for a number of European nations. SD stands for standard deviation; Corr stands for correlation with the eurozone; pre stands for the pre-EMU period (for most countries January 1983 - December 1998); post stands for the period January 1999 - May 2009. Data source: Datastream.

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