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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.

JEL Classification: E52, E58, F41, F42, C32.
Keywords: Swedish EMU membership, Monetary policy independence, European monetary integration, Cointegrated VAR method.

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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. 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, 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."

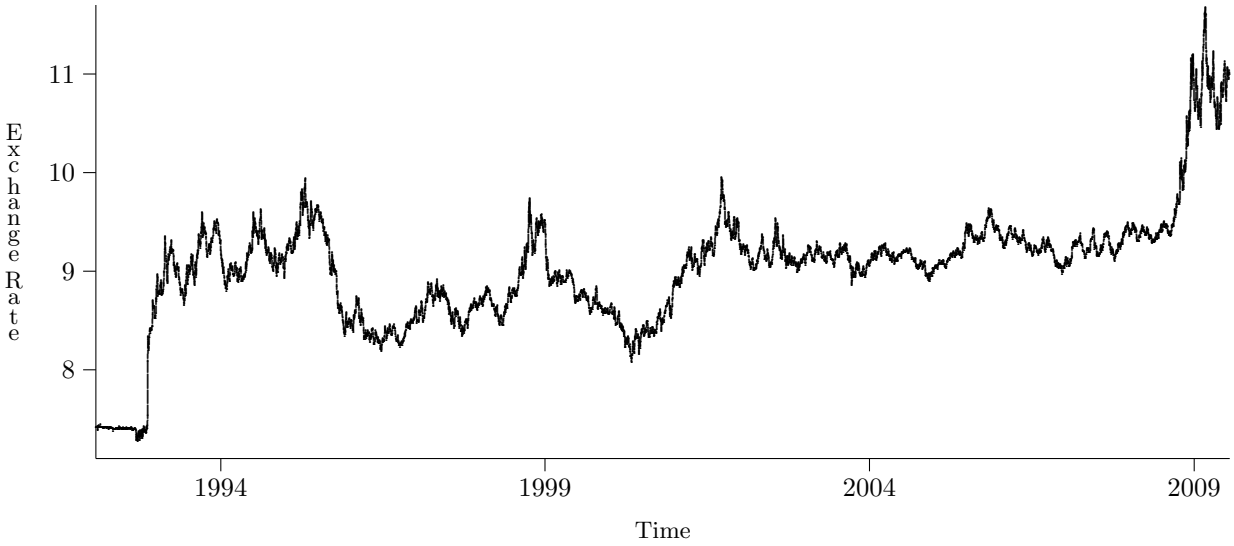

Figure 1: The krona to euro exchange rate. Source: Datastream.

— 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.[2] 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.

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

II What Has Been Done Before on Swedish EMU Membership

The economics profession has produced a vast amount of output on the costs and benefits of European monetary integration.[3] 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 idiosynchratic 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.

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."[4]

[3] For an overview see, for instance, Emerson et al. (1992) and De Grauwe (2007) and the works cited therin.
[4] 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.*[5] 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.[6] Söderström (2008) comes to no clear-cut conclusion about whether or not participation in EMU would be advantagous 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 compelling 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.[7] As Buiter points

[5]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.

[6]Söderström actually contradicts his own findings of strong correlations of the Swedish business cycle with the economies of the eurozone with supplementary analysis that he produces using a DSGE model, which suggests that country-specific shocks are an important source of Swedish business cycle fluctuations. Given the very clear results of the actual data on the Swedish and euro area business cycle, we consider these more reliable that the results of a DSGE model. As a sidenote one might mention that recent research by Enders et al. (2009), which is also based on a calibrated DSGE model, suggests that the government of a country joining the euro can expect booms and recessions to occur with similar frequency and strength as before, but to be more synchronised with the other members of the currency union. We will have a brief look at the Swedish and eurozone business cycles in Section VI

[7]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

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.[8]

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).[9] 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.

Ferreira-Lopes (2008) adopts a DSGE approach to investigating welfare questions associated with euro adoption, notably that of losing monetary policy flexibility. Compared to the research conducted by Buiter (2008), this type of analysis seems a little simplistic. First, no consideration of the benefit of belonging to a globally important currency is allowed, and secondly the adverse and disruptive influence of open financial markets with regard currency fluctuations is not included. Perhaps more importantly however, her analysis relies entirely on the assumption that Sweden still retains monetary policy flexibility, or independence, to carry out policy movements to counteract idiosyncratic shocks to its economy. This is what we test in this paper.

swap agreement with the ECB to ensure it has enough currency reserves to guarantee stability of its banking sector.

[8]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).

[9]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.

Söderström's DSGE model 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.

Notwithstanding the results of Ferreira-Lopes and Söderström, we wonder about the explanatory power of their analyses. Both Ferreira-Lopes and Söderström base their analysis on calibrated DSGE models as opposed to conventional estimated regression outputs. Their DSGE models are not estimated on actual data, and are stationary, constant parameter representations of a deeply non-stationary and complicated economy. These types of models raise concerns on a number of levels; Hildenbrand (1994, 1998) has emphasised the heterogeneity of agents, something that the entire microeconometrics literature bears testament to, while Stiglitz (2003) has pointed out that asymmetric information can induce many Keynesian-type effects usually absent from DSGE models, and Aghion et al. (2002) *inter alia* have led the rebellion against model-based, or rational, expectations. These models may impose structure on the economy, hence allowing a welfare analysis, but the welfare is that of the rational agent conducting his day-to-day activities in complete and perfect markets. Importantly, any conclusions developed in these models entirely rely on the types of assumptions made, and the types of arguments considered. For example, Ferreira-Lopes attempts to conclude about monetary union benefits on the basis of a monetary policy independence that does not necessarily exist, and ignores the imperfect nature of foreign exchange markets so powerfully alluded to in Buiter. We do not doubt that DSGE-type models have contributed greatly to the understanding of macroeconomic dynamics, and in particular what can generate them; however, in the context of a deeply empirical question such as Swedish euro entry, we have reservations about their use.

Of course, econometrics cannot necessarily claim to be able to offer better solutions, but adds another 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. In this paper we attempt as best we can to fit an econometric model to an important dataset describing Swedish and European monetary policy movements. 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. As such we argue our paper provides a powerful contribution to the important and timely question of whether Sweden should adopt the euro.

III How We Go About It

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 Europe (or Germany within Europe). 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 EMU members, in which Germany was 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 investigate 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. This is a very ambitious endeavour given all the possible structural changes over the period in question had Sweden joined the euro. 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 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.[10] We follow in this ilk, 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, notably 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.[11] 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 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 in 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

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

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.[12]

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 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.[13]

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

[12] ADF unit root testing is unable to reject the null hypothesis of stationarity in both time series.
[13] Of course, given we model just two series in this context, this latter advantage is not particularly relevant.

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:[14]

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

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.

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.

[14] 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 $\gamma_0 = 0$.

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. A country not adjusting to a cointegrating vector in which it appears is said to 'drive' the system: the level that the country's interest rate is at is not constrained by the cointegrating relationship, but in fact dictates what level that cointegrating relationship takes.

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 rate at which Sweden or the eurozone

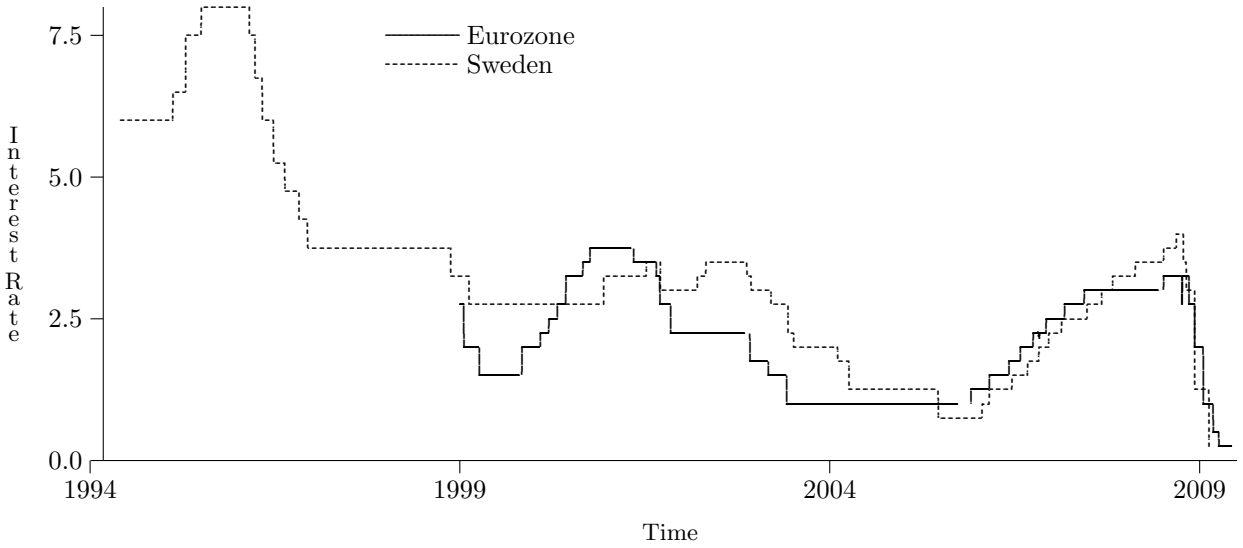

Figure 2: Central bank deposit rates. Source: Datastream.

adjusts to any cointegrating relationship remains constant throughout the sample, the trend term allows that 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 unlikely. However, the purpose of this model is not to forecast.

IV What Data We Use

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 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 daily interbank interest rates 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.[15] 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 weaker. The main reason for this can be found from considering the actual cointegrating vector found over the entire data

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

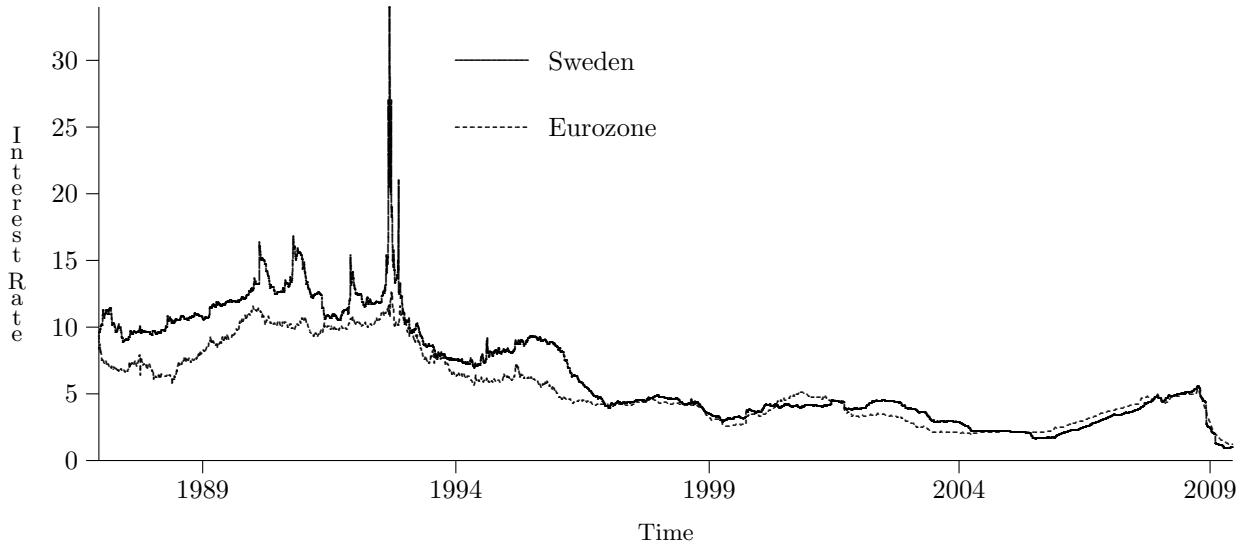

Figure 3: Interbank interest rates for the eurozone and Sweden, 1/1/1987–6/19/2009. Source: Datastream.

period, plotted in Figure 6; 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.

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 Swedish banking crisis has a huge effect on Swedish interest rates, and coinciding with the ERM instability affecting the eurozone around 1992, there is a more muted effect on eurozone interest rates. Apart from a bulge 1996, post 1992 the two interest rates appear to move much more closely together, with periods in the 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

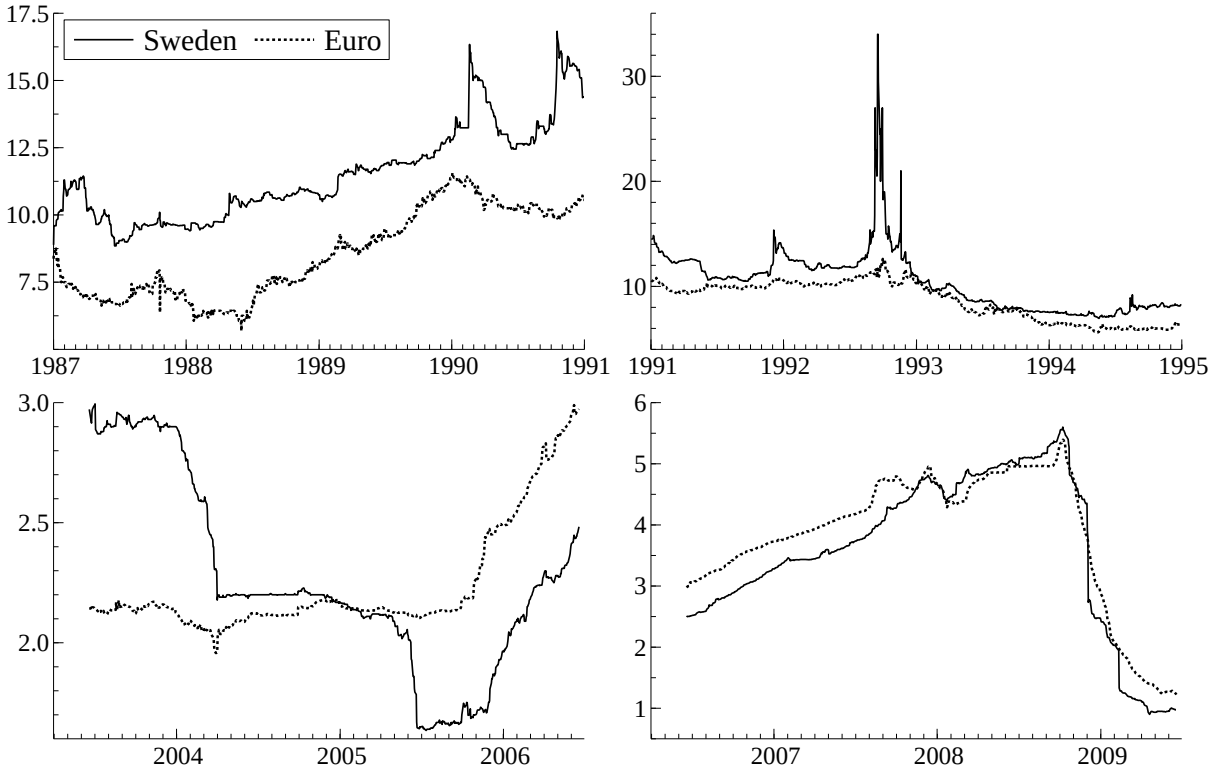

Figure 4: Interest rates broken into four smaller time periods. Source: Datastream.

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 What We Find

We estimate the model with six lags 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 Sweden banking crisis, as can be seen in Figure 5, which plots the two interest rates with the dummy variables added plotted directly below,

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.

corresponding to particular observations.[16] 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 which does not suffer from a wrongly sized rank test, and a model which represents the data effectively. 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 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). 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.

[16]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.

The restrictions imposed allow for a (1,-1) relationship between the eurozone and Sweden, and furthermore we can restrict the eurozone's adjustment coefficient in the alpha matrix to zero, while 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 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 0.00006, 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:

$$r - r^* = \underset{(0.27)}{2.43} - \underset{(0.00008)}{0.0006}\, t + \epsilon_t, \tag{7}$$

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 6, 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 slight 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.

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. This may be so, but in their reaction to a macroeconomic shock, the eurozone is clearly taking the lead, and Sweden appears forced to follow, limiting its independence. It is worth emphasising that the methodology

employed here is able to distinguish between countries that 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. 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 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 was unable to respond to these, or if it was, 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 central bank interest rates at 500% is indicative of this.

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 (or its predecessors) 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 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.

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 would instead of depriving Sweden of policy independence 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

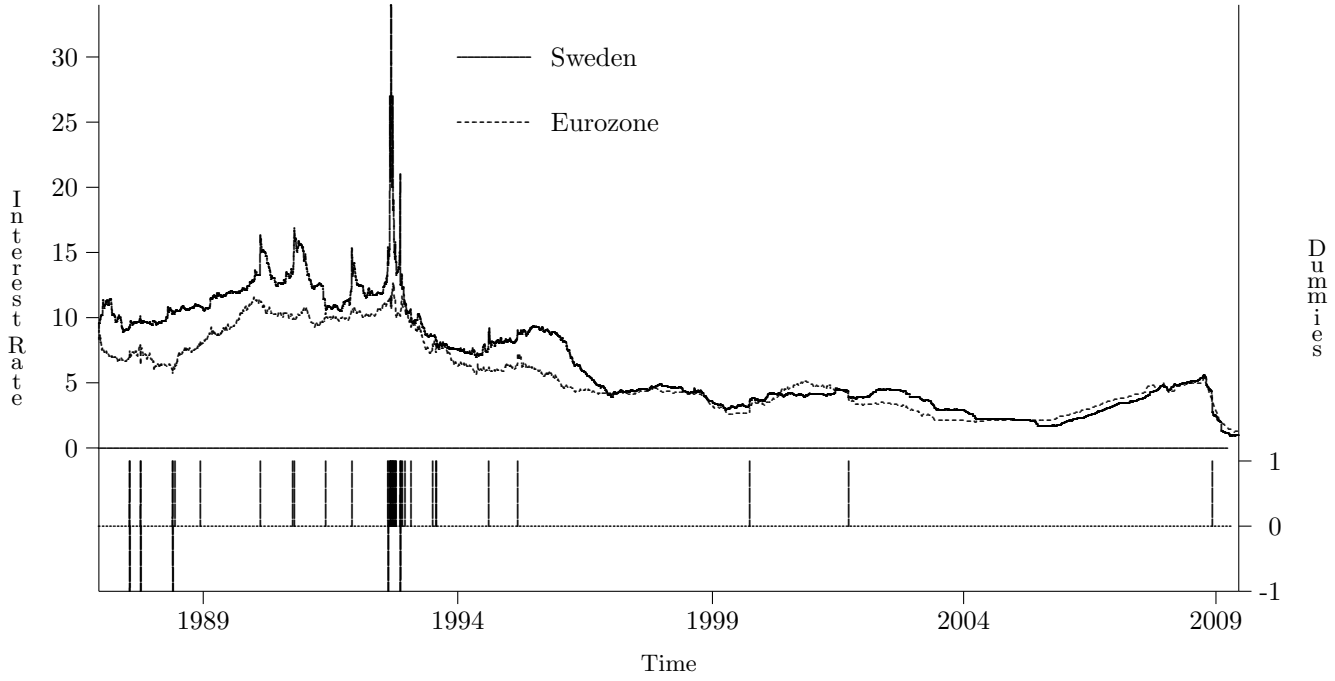

Figure 5: Plot of eurozone and Swedish interest rates with impulse dummies also plotted. Source: Datastream.

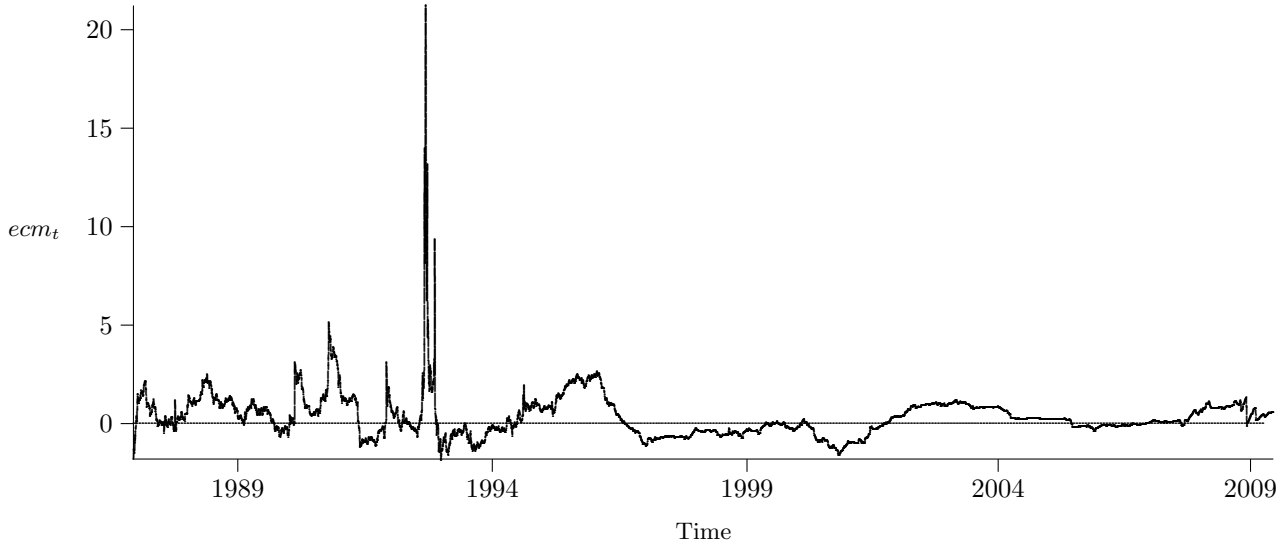

Figure 6: Plot of cointegrating vector between eurozone and Swedish interest rates with constant and time dummy. Lags and deterministic terms not included in estimation of this term. Source: Datastream.

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 cylce indicators for Sweden and the eurozone, as well as for a number of other European countries, both euro members and outsiders. 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.[17] The Swedish and eurozone time series of nominal GDP growth is plotted in Figure 7, which also appears to

[17]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.

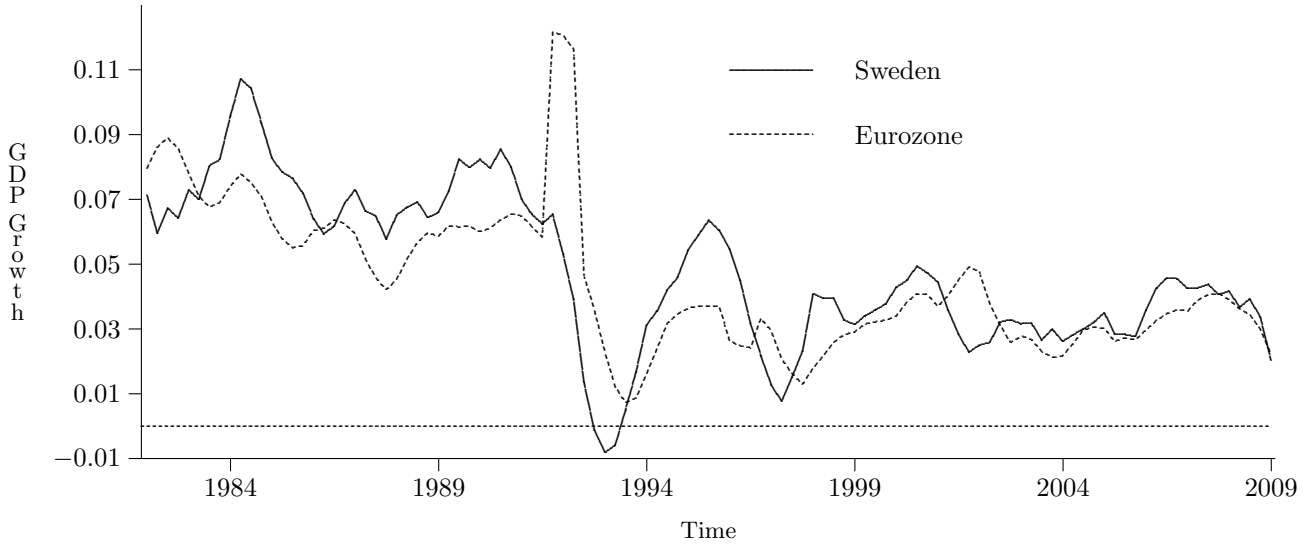

Figure 7: GDP growth. Source: Datastream.

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 current downturn 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 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 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

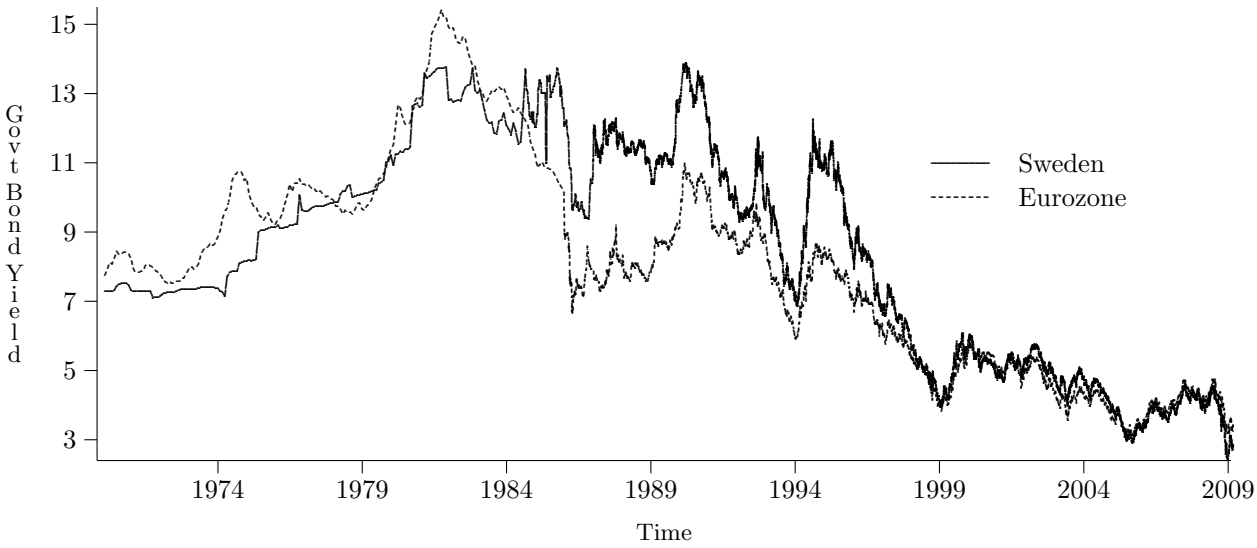

Figure 8: Swedish and eurozone 10-year government bond yields. Source: Datastream.

joined. In this respect Sweden would have encountered no problems stemming from EMU membership.[18] 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)).

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 8, 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.

[18] In any case, one should note that the time-inconsistency argument, which was brought forward by Lucas (1976), 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, 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.

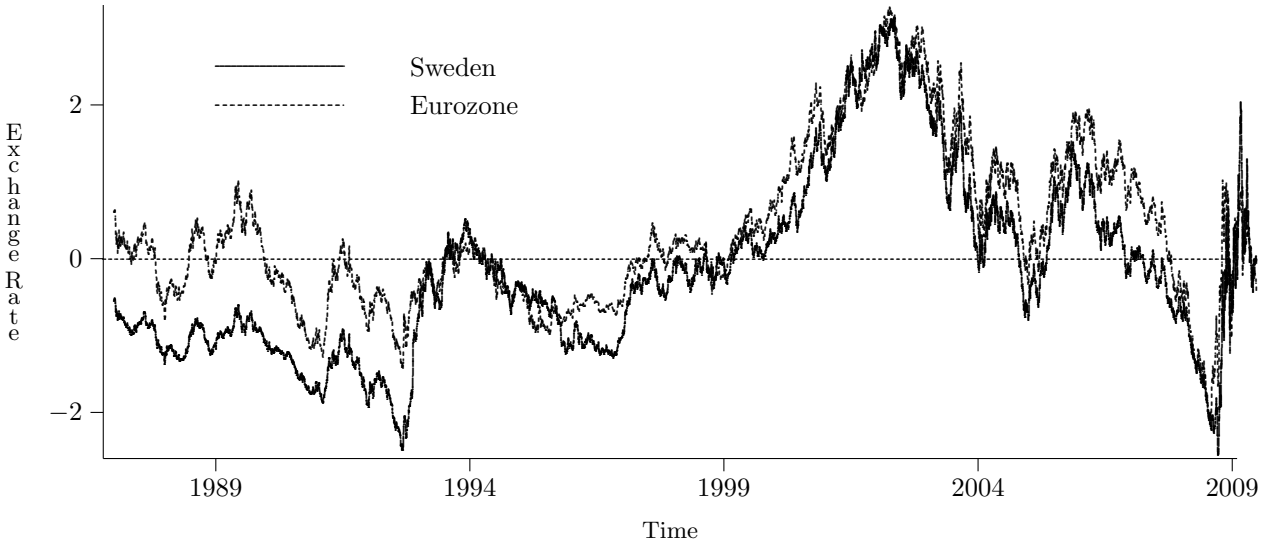

Figure 9: Swedish and eurozone US dollar exchange rates, standardised. Source: Datastream.

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 9, 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 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.

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.

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 arguments 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 an unqualified "yes".

			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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