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Finnish and Swedish Business Cycles in a Global Context*

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Abstract

This paper examines the characteristics of business cycles in and across Sweden and Finland during the postwar period. We find that output fluctuations in Sweden and Finland are highly correlated to two measures of the international business cycle, a European and a non-European common business cycle component. The Swedish but not the Finnish business cycle becomes more synchronized to the European business cycle over time whereas the Finnish but not the Swedish business cycle becomes more synchronized to the non-European business cycle. We also find that country-specific business cycles in Finland and Sweden are highly synchronized only during the 1990's.

JEL CLASSIFICATION: E32, F41

KEYWORDS: Finnish and Swedish business cycles; World business cycle; European business cycle; symmetry and comovement of cycles.

1 INTRODUCTION

Europe has now taken the final step in the formation of EMU but Finland was the only Nordic country that joined EMU on schedule in 1999 whereas the government of Sweden decided in Spring 1997 that it would not be among the first group of EU countries forming monetary union.¹ In Sweden there is a widespread fear among policy makers that the Swedish business cycle is not synchronized with the “European business cycle” such that

*I have received valuable comments from Michael Bordo, Lars Jonung, Lars-Erik Öller, seminar participants at the workshop “The Crisis of the 1990s” held at the Stockholm School of Economics on June 18, 2000, the Swedish Riksbank, and the workshop “Economic Aspects of European Integration” held at Mölle on May 15–18, 2001.

¹In Denmark, the voters had earlier decided not to join the single currency area, while those in Norway decided to remain outside EU.

the cost of giving up an independent monetary policy is quite high. In Finland, however, there seems to be no such fears. These fears, however, seem at odds with the emergence of a stronger international business cycle after the abandonment of the Bretton Woods system in 1973. This view is supported, for example, by recent evidence in Artis and Zhang (1997, 1999).² In their earlier paper, Artis and Zhang (1997), they find that world business cycles became more group specific after 1979, with the German business cycle linking countries participating in the ERM system whereas countries outside had weaker cyclical ties to Germany. In their latter paper, Artis and Zhang (1999), they show that business cycles in ERM countries have become more synchronized to the German business cycle and less synchronized with the US business cycle.

Examining the historical record of international business cycles, Bergman, Bordo and Jonung (1998) find that business cycles have become more synchronized as measured by the contemporaneous correlation of business cycles in a large set of countries.³ Their evidence suggests that interrelationships between countries under different monetary regimes reflect the growth and interdependence of markets and changing patterns of economic performance. They also find that business cycles in core EU countries are very high during the post-Bretton Woods period that most likely demonstrates the establishment of the common European market.

Lumsdaine and Prasad (1999) also find that business cycles fluctuations become more synchronized during the post-Bretton Woods period. As opposed to most studies, they estimate common business cycle components to decompose domestic economic fluctuations into a common “world” and a country-specific business cycle. This decomposition is based on a time-varying weights method. They find evidence of both a “world” and a “European” common business cycle and that the correlation between these common cycles and domestic business cycles is stronger during the post-Bretton Woods period compared to the earlier Bretton Woods era.

The purpose of this paper is to examine the characteristics of business cycle fluctuations within and across Sweden and Finland. These two countries are small in relation to the main European countries but have chosen to follow two different ways in their integration with Europe. To examine the interaction between business cycles across these two Nordic countries and their relationship to the international business cycle, we present estimates of two common business cycle components (the European and the non-European business cycle) based on monthly observations of industrial production from 16 countries. There are several ways to construct or estimate a common business cycle component, unobservable component models (i.e., Bergman, Gerlach and Jonung (1992) and Gregory, Head and Raynauld (1997)), common trends and common cycles models (i.e., Engel and Kozicki (1993)), or dynamic factor models (i.e., Norrbin and Schlagenhauf (1996)). The main disadvantage with these methods is that they require additional identifying restrictions or assumptions to identify a common business cycle component.

²However, Baxter and Stockman (1989) found no evidence supporting this view. Their evidence instead suggested that business cycles have become more country-specific during the post-war period.

³See Backus and Kehoe (1992) and Basu and Taylor (1999) for similar studies.

We will follow the approach suggested by Lumsdaine and Prasad (1999) where the decomposition is not dependent on identifying restrictions and where the weights used when constructing the common component are allowed to vary over time. This method, thus, allows for a country's business cycle to strongly influence the world business cycle during certain periods but not influence the common business cycle during other periods.

This paper extends the existing literature on international business cycles in several directions. First, we apply the Baxter and King (1999) bandpass filter to extract all variations of industrial production at business cycle frequencies, frequencies between 1.5 and eight years.⁴ Lumsdaine and Prasad (1999) use growth rates of industrial production. Second, we apply the time-varying weights methodology recently suggested by Lumsdaine and Prasad (1999) to estimate the common component, representing common shocks, of business cycles in our sample of countries. Third, we extract the external influence on domestic business cycles in Sweden and Finland, allowing us to examine the properties of country-specific business cycles in these two countries.

The paper is organized in the following manner. In section 2 we describe the method used to extract the business cycle component from the data and how we construct the common component of industrial production in our sample of countries. Section 3 contains the empirical analysis. First, we examine the influence of the two estimated common business cycle components on domestic economic fluctuations. Second, we study changes in the co-movement of domestic and international business cycles. Finally, we examine the relationship between Swedish and Finnish business cycles where the external influences from international business cycles have been extracted from the domestic business cycle. Section 4 summarizes the main findings.

2 METHODOLOGY

2.1 DATA

The data set consists of monthly observations on industrial production for 16 OECD countries, Austria, Belgium, Canada, Finland, France, Germany, Greece, Italy, Japan, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom and the United States. We employ industrial production as the business cycle measure rather than real GDP since it is available monthly. The sample period is 1961:1 to 1997:12, a total of 444 observations. The data are taken from IFS CD-Rom except industrial production for Portugal taken from OECD Main Economic Indicators.

2.2 MEASURING DOMESTIC BUSINESS CYCLES

Prior to our empirical analysis we must extract the cyclical component from the macroeconomic time series, i.e., the natural logarithm of industrial production. Recently, Baxter and King (1999) have developed a bandpass filter that isolates cyclical components

⁴This definition of the business cycle was suggested by Burns and Mitchell (1946). Stock and Watson (1999) use the same definition in their study of the US business cycle.

of economic time series. Their filter can be applied to extract fluctuations at certain frequencies in our data. In particular, we isolate cyclical components of the data with durations conforming to the Burns–Mitchell definition of the business cycle.⁵ We use a 36–order two–sided filter following Baxter and King (1999) to extract all fluctuations at frequencies between 18 and 96 months (1.5 year and eight years) from the logarithm of industrial production in each country. When applying this filter, we lose observations at both ends of our sample. We use forecasts and backcasts based on a twelfth order univariate autoregressive model to add these observations to the sample prior to applying the bandpass filter. This same method is used by Stock and Watson (1999) who examine US business cycles.

2.3 MEASURING THE INTERNATIONAL BUSINESS CYCLE

To estimate the common international business cycle component, we apply the method suggested by Lumsdaine and Prasad (1999). This method is based on the observation that large countries have low business cycle volatility whereas small countries have large volatility. Furthermore, large countries should be less influenced by the international business cycle as compared to small economies. This argument suggests that the following GARCH(1,1) model for the domestic industrial production could be used to construct time–varying weights

$$\begin{aligned} y_{it} &= c_i + \varepsilon_{it} & \varepsilon_{it} \mid I_{t-1} &\sim N(0, h_{it}) \\ h_{it} &= w_i + \alpha \varepsilon_{it-1}^2 + \beta h_{it-1} \end{aligned} \quad (1)$$

where y_{it} is the bandpass filtered component of the logarithm of industrial production in country i , c and $w > 0$ are constants, I_{t-1} is the information set available at time $t-1$, and the parameters in the equation for the conditional variance, α and β , are constrained to be greater than zero and are assumed to satisfy $\alpha + \beta < 1$. The GARCH(1,1) model above is estimated for each country independently. The estimate of the conditional variance h_{it} can then be used to construct the weights

$$W_{it} = \frac{(h_{it+1})^{-1/2}}{\sum_{i=1}^n (h_{it+1})^{-1/2}} \quad (2)$$

such that the common component can be constructed using

$$z_t = \sum_{i=1}^n W_{it} y_{it} \quad (3)$$

Applying this method, we construct two measures of the international business cycle, one common European business cycle and one non–European business cycle.⁶ In equations

⁵They define business cycles as recurrent, but not strict periodic, fluctuations in economic activity with a duration usually between one and ten years, the average length varying over time.

⁶The bandpass filtered industrial production series are very persistent implying that the stationarity restriction that $\alpha + \beta < 1$ is violated quite frequently. When estimating the GARCH(1,1) models, we im-

(2) and (3), we let $n = 13$ when constructing the common European business cycle component, z_t^{EU} , in industrial production in the 13 European countries. Similarly, $n = 3$ when constructing the common non-European business cycle component, z_t^{NEU} .

3 EMPIRICAL WORK

3.1 ESTIMATES OF THE INTERNATIONAL BUSINESS CYCLE

In Figure 1, we show plots of the Swedish and the Finnish business cycle and the two estimated international business cycles. Corresponding graphs for the other countries in our sample are shown in Appendix A. In the first column we plot the Finnish and the Swedish business cycles together with the estimated common EU business cycle whereas the second column shows their relationship to the estimated common non-EU business cycle. Looking first at the two graphs in the left column of Figure 1, we find a much stronger relationship between the European business cycle and the two Nordic business cycles, in particular for the Swedish business cycle. Judging from these two graphs, it seems to be the case that the Swedish economy is much more synchronized to the EU cycle than Finnish economy is.

In the second column of Figure 1, plotting the estimated EU business cycle together with the Finnish and Swedish business cycle, we note that the severe recessions in the non-EU countries Canada, Japan and the US in 1974 and 1983 did not cause corresponding deep recessions in Finland and Sweden. The first oil price shock in the early 70's causing recessions in the world economy did not affect the two Nordic countries as much as it affected the non-EU countries. Furthermore, the sharp expansion during the latter part of the 60's also tended to increase production but in Finland, in particular the expansion halted after a year. Finally, the downturn in early 1970 came earlier in the world economy than in both Finland and Sweden.

Table 1 reports the factor loadings for Sweden and Finland, i.e., a measure of how important the two international business cycles are for domestic cyclical fluctuations. To estimate these factor loadings, we set up a SUR system with sixteen equations using the domestic business cycle as the dependent variable and a constant and the two international business cycles as independent variables. We also split the sample into four sub-samples, the 60's, 70's, 80's and the 90's allowing us to infer whether the external influences change over time. The estimated equation for country i is, thus, given by

$$y_{it} = \beta_{i0} + \beta_{i1}d_1z_t^{EU} + \beta_{i2}d_2z_t^{EU} + \beta_{i3}d_3z_t^{EU} + \beta_{i4}d_4z_t^{EU} + \beta_{i5}d_1z_t^{NEU} + \beta_{i6}d_2z_t^{NEU} + \beta_{i7}d_3z_t^{NEU} + \beta_{i8}d_4z_t^{NEU} + \varepsilon_{it} \quad (4)$$

pose the restriction when necessary. We have also computed the common component using IGARCH(1,1) models and compared to the standard GARCH(1,1) model. The empirical results below are unaffected when using the IGARCH model. Furthermore, to allow for potential asymmetries in the business cycle, we have also compared our baseline results with results based on EGARCH(1,1) and TGARCH(1,1) models. The asymmetry parameters are very seldom statistically significantly different from zero and none of the results below change when using these models to construct the common components.

where the dummy variables are defined in the following way; d_j is equal to one for subsample j and zero otherwise. Note also that the size of the factor loadings, β_{ij} , only can be used to determine the relative importance of international business cycles across countries i .

From the estimates shown in Table 1, we find that economic fluctuations within Finland have become more dependent on the non-European business cycle over time, a result also evident in Figure 1. During the 60's and the 70's, the parameter associated with the non-EU business cycle is negative and significantly different from zero at the 10 percent level but positive during the 80's and during the 90's. The external influence from the European business cycle has decreased over time and is not statistically significant at conventional significance levels during the 90's. Comparing this pattern to the Swedish development, we note that they are quite similar although economic fluctuations in Sweden is more dependent on the European business cycle than in Finland. We have performed standard F-tests of the hypothesis that the factor loadings are constant across different subsamples and that the factor loadings for the non-European and the European business cycles are equal. These hypotheses can always be rejected at conventional significance levels for both Finland and Sweden.

The external influence during our sample period is also quite high. The R^2 's indicate that more than 50 percent of the total variance of Finnish and Swedish business cycles can be explained by the two measures of international business cycles. Thus, a substantial component of domestic cyclical fluctuations in industrial production is explained by external factors.

These empirical results are similar to what we find for the other European countries in our sample. For Belgium and the Netherlands, two other small open European economies, we find that the European influence is strong and relatively constant over time while the correlation to the non-European business cycle turns negative during the 90's. This suggests that the non-EU business cycle is negatively correlated to the domestic Belgian and Dutch business cycles during this period. The evidence, thus, suggests that business cycles in these two countries become less synchronized to the non-European business cycle over time. The absolute values of the parameters associated to the common European business cycle are also higher for these two countries compared to Finland and Sweden during the 90's. Similar results hold for other European countries as well, except for the UK where the European influence decreases while the non-European influence increases during the 90's. These results support earlier findings in Artis and Zhang (1999) where they find that European business cycles become more synchronization to the German business cycle and less dependent on the US business cycle over time.

For the three non-EU countries, Canada, Japan and the US, we find that the influence from the non-European business cycle increases over time in Canada and the US but decreases over time for Japan. It seems to be the case that the Japanese business cycle is more synchronized to the European business cycle than to economic fluctuations in Canada and the US.

When comparing the R^2 :s reported in Table 1 for the other countries in our sample,

we find that Greece and Belgium are the not so dependent on the international business cycles whereas the G7-countries are much more dependent than other countries in our sample.

3.2 CO-MOVEMENTS OF INTERNATIONAL BUSINESS CYCLES

In this subsection we examine the co-movements of bandpass filtered industrial production in Finland and Sweden and the constructed international business cycles. We retain the sub-sample division used in the previous section. Table 2 reports cross-correlations of output in Sweden and Finland and the two measures of the international business cycle. Specifically, we measure the co-movement between Finnish (Swedish) bandpass filtered industrial production, y_t , and the j -months lead of the international business cycles, x_{t+j} . A large correlation coefficient at lag zero, $j = 0$, indicates that the two measures are contemporaneously correlated. If we find a large coefficient at $j = 1$, for example, this indicates that the variable tends to lead Swedish (or Finnish) output by one month. In other words, this measure is leading the Swedish business cycle. The columns for each country in Table 2 show the cross-correlation of y_t and x_{t+j} where $j = -6, \dots, 6$.

A major impression from this table is that both Finnish and Swedish business cycles are highly correlated to the two measures of international fluctuations in industrial production. The results in Table 2 confirm the evidence in Table 1. The correlation between the Finnish and the European business cycle was rising from the 60's to the 80's, but then fell sharply during the 90's while the non-European contemporaneous correlation is increasing over time. Swedish business cycles become more and more synchronized with the international business cycles, in particular when comparing the point estimates for the 70's and the 90's. Comparing the point estimates of the correlations between Swedish and the international business cycles, we find that they are slightly higher for the non-European business cycle during the 90's. Table 2 also reveals that Swedish and Finnish business cycles are highly synchronized and that this synchronization increases over time.

Looking more closely at the empirical results, we find that the leads and lags relationship between cyclical components of industrial production in Sweden and Finland, and the international business cycles are not stable over time. The European business cycle is leading the Finnish business cycle during the 80's but lagging during earlier periods. For Sweden we find that the European business cycle is leading only during the 80's and the 90's. The non-European business cycle is leading both the Finnish and the Swedish cycles during the 80's. By contrast, we also find that the leads and lags relationship between output fluctuations in Sweden and Finland remain fairly stable over time. The Swedish business cycle is leading the Finnish during the 60's, 70's and 90's.

These results may reflect the weaker economic ties between the Finnish economy and European economies during the first three decades. In Table 3, we show trade (exports plus imports) by trade partner in percent for selected years. From this table we note that the EU is the most important trade partner for both Finland and Sweden. However, we also find that both Finnish and Swedish trade with EU decreases over time, from 62 percent in 1965 to 55 percent in 1999 and from 63 percent to 57 percent, respectively. Thus,

trade with non-EU countries tends to increase for both countries. It is also noteworthy that Swedish-Finnish trade is relatively more important for Finland than for Sweden. Finnish trade with Sweden became increasingly important during the 60's and 70's. After 1980, the shares fell from 17 percent in 1975 to 10 percent in 1999.

Our results in Table 1 suggest that linkages between countries have become more prevalent within Europe during recent years. It has been suggested in the literature that this reflects the increased integration of Europe, see for instance Bergman and Hutchison (1998) and Frankel and Rose (1997). This is a thought-provoking hypothesis as it would imply that the Swedish and, in particular, the Finnish economies should become more dependent on (or similar to) the rest of Europe. To find an answer to this question, we may examine the record of the small European countries included in our sample of countries.

Looking at the cross-correlation pattern for the longstanding EU members Belgium, Netherlands and Luxembourg as well as Austria we find that business cycles in these countries are highly correlated to the European business cycle.⁷ We also find that the correlation with the non-European cycle tend to decrease over time since the 70's. The contemporaneous correlation coefficients fall from around 0.8 in the 70's to around 0.3 during the 90's. A similar pattern is found for other small European countries and for Germany and France. These results support earlier findings that business cycles within Europe becomes more synchronized over time.

3.3 CO-MOVEMENTS OF COUNTRY-SPECIFIC BUSINESS CYCLES IN SWEDEN AND FINLAND

In Table 4 we report cross-correlations between Swedish and Finnish country-specific business cycles. To construct these measures, we extract the external influences on the Swedish and Finnish economies, i.e., we extract the residuals from the SUR regressions reported in Table 1. The residuals from this regression equation then represent the country-specific component of Swedish (or Finnish) output fluctuations. Therefore, any correlation between country-specific business cycles reflects common co-movements not shared by all countries. For example, if Swedish and Finnish business cycles are correlated, it can be interpreted as common output fluctuations in these two countries not included in the estimated world business cycle.

Table 4 reveals that Swedish and Finnish business cycles are highly synchronized during the 90's and that the Swedish business cycle is leading the Finnish. Looking at the other three decades, we note that the contemporaneous correlation is quite low, between 0 and 0.3. One explanation to the large contemporaneous correlation during the 90's is that both countries experienced banking and financial crises during the beginning of this period which led to similar fluctuations of output. Figure 2 plots the two country-specific business cycle components in these two countries. The common behavior of business cycles during the most recent decade is clearly visible. It is also interesting to compare

⁷These results are not shown here for brevity but they are available upon request from the author.

this graph with Figure 1 where we plot the Swedish and Finnish business cycles together with the European and non-European business cycles. From this graph, we note that the two major crises led to very different business cycle behavior and that although the international business cycle went down toward the mid-90's, causing a downturn in both Sweden and Finland, economic conditions in the beginning of the 90's in these two countries magnified the downturn. In addition, the causes of these crises were also quite similar, bank crises, rising unemployment and restructuring economy. This may reflect the very strong co-movements of the Swedish and the Finnish economies during the 90's, see Table 4.

4 SUMMARY

This paper has examined business cycle fluctuations in Finland and Sweden and their relationship to the international business cycle. The empirical evidence suggests that Finnish and Swedish business cycles are highly synchronized, in particular during the 90's. In addition, the international business cycle exerts a strong influence on economic fluctuations in these two countries. We construct both a EU and a non-EU international business cycle applying a recent method allowing for time-varying weights when extracting the common component of bandpass filtered industrial production allowing us to distinguish between European and non-European influences. Our evidence suggests that Swedish business cycles become more synchronized to both measures over time whereas the Finnish business cycles become more dependent on non-European external influences than European during the 90's. Extracting the common international business cycle component from the domestic business cycle, reveals that output fluctuations within Finland and Sweden are highly synchronized during the most recent decade where the Swedish country-specific business cycle is leading the Finnish.

This evidence cannot explain the reluctance of the Swedish government to fully join the integration of Europe and joining the EMU. Our evidence does suggest that Swedish business cycles are synchronized to output fluctuations of several EMU countries (Netherlands, Finland and Spain) as well as European countries that at this point have not entered EMU (United Kingdom). We also find that the synchronization with the European business cycle as well as with the non-European business cycle tends to increase after the 70's. This pattern is not significantly different from long-standing EU and EMU countries, for example Belgium and the Netherlands. Similarly, the willingness of the Finnish government to join EU and EMU cannot be explained by our empirical evidence since the Finnish business cycle tends to be less synchronized to the European business cycle and that it is decreasingly synchronized during the 90's. Our evidence also suggests that the Finnish business cycle tends to be more synchronized to the non-European business cycle, in particular during the 90's.

Our interpretation of these contradictory empirical results is that joining EMU may be justifiable *ex post* but not necessarily have to be justifiable *ex ante*. The Finnish government may anticipate that Finland will become more synchronized to the rest of

Europe as a result of increased integration. Such conclusion is consistent with earlier arguments put forward by Frenkel and Rose (1997) and Bergman and Hutchison (1998).

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Table 1: SUR estimates of the influence of international business cycles, equation (4).

	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	R^2
Finland	1.295 (0.206)	2.457 (0.275)	1.032 (0.294)	-0.262 (0.199)	-0.312 (0.186)	-0.900 (0.164)	0.234 (0.110)	2.790 (0.253)	0.508
Sweden	1.319 (0.151)	3.521 (0.202)	0.734 (0.216)	0.675 (0.146)	0.236 (0.136)	-1.760 (0.120)	0.559 (0.081)	1.724 (0.185)	0.686
Austria	1.841 (0.116)	1.617 (0.156)	1.863 (0.166)	2.032 (0.113)	-0.342 (0.105)	-0.212 (0.093)	-0.056 (0.063)	-0.915 (0.143)	0.776
Belgium	0.862 (0.197)	1.009 (0.263)	1.600 (0.281)	1.340 (0.190)	0.527 (0.177)	0.179 (0.156)	-0.126 (0.106)	-0.335 (0.241)	0.470
France	1.527 (0.125)	0.774 (0.167)	0.871 (0.179)	1.377 (0.121)	-0.005 (0.113)	0.487 (0.100)	0.013 (0.067)	0.025 (0.154)	0.743
Germany	2.906 (0.134)	0.649 (0.179)	1.550 (0.192)	2.170 (0.130)	0.122 (0.121)	0.408 (0.107)	0.020 (0.072)	-1.194 (0.165)	0.777
Greece	1.485 (0.192)	-0.516 (0.257)	1.839 (0.274)	0.772 (0.186)	-0.701 (0.173)	1.044 (0.153)	-0.107 (0.103)	-0.241 (0.236)	0.469
Italy	-1.687 (0.192)	2.417 (0.257)	1.982 (0.275)	1.350 (0.186)	1.056 (0.173)	-0.407 (0.153)	0.074 (0.103)	-0.046 (0.236)	0.628
Luxembourg	2.962 (0.239)	2.486 (0.320)	1.908 (0.342)	1.448 (0.231)	0.340 (0.216)	0.338 (0.190)	0.748 (0.128)	-0.270 (0.294)	0.753
Netherlands	1.442 (0.118)	1.823 (0.158)	1.234 (0.169)	1.224 (0.114)	0.140 (0.107)	-0.348 (0.094)	0.134 (0.063)	-0.917 (0.145)	0.714
Portugal	2.052 (0.222)	0.096 (0.297)	1.301 (0.317)	2.466 (0.215)	-0.203 (0.200)	0.957 (0.177)	-0.758 (0.119)	-1.131 (0.273)	0.571
Spain	1.175 (0.160)	0.615 (0.214)	0.674 (0.229)	1.742 (0.155)	0.330 (0.144)	0.457 (0.127)	0.020 (0.086)	0.368 (0.197)	0.633
United Kingdom	1.212 (0.178)	0.572 (0.237)	1.052 (0.254)	-0.121 (0.172)	0.712 (0.160)	0.503 (0.141)	-0.091 (0.095)	1.192 (0.218)	0.531
Canada	0.508 (0.121)	0.354 (0.161)	-0.143 (0.173)	-0.754 (0.117)	0.865 (0.109)	0.618 (0.096)	1.635 (0.065)	2.186 (0.148)	0.844
Japan	-0.021 (0.242)	0.741 (0.322)	0.834 (0.345)	1.297 (0.233)	0.784 (0.218)	0.960 (0.192)	0.639 (0.130)	0.076 (0.296)	0.597
US	-0.382 (0.113)	-1.476 (0.151)	-0.476 (0.161)	-0.454 (0.109)	1.466 (0.102)	2.023 (0.090)	1.147 (0.061)	1.361 (0.139)	0.858

Notes: Standard errors are shown in parenthesis below each estimate.

Table 2: Cross-correlations of international business cycles with Swedish and Finnish business cycles.

		Cross-correlations with domestic output $\text{corr}(x_t, y_{t+k})$												
		Finland												
Sample		$k = -6$	$k = -5$	$k = -4$	$k = -3$	$k = -2$	$k = -1$	$k = 0$	$k = 1$	$k = 2$	$k = 3$	$k = 4$	$k = 5$	$k = 6$
ZEU	1961:1-1997:12	0.480 (0.085)	0.514 (0.081)	0.542 (0.074)	0.562 (0.074)	0.574 (0.072)	0.577 (0.072)	0.569 (0.073)	0.552 (0.077)	0.526 (0.084)	0.493 (0.091)	0.456 (0.099)	0.417 (0.106)	0.377 (0.112)
	1961:1-1969:12	0.636 (0.130)	0.626 (0.133)	0.616 (0.134)	0.608 (0.131)	0.601 (0.125)	0.591 (0.119)	0.572 (0.118)	0.534 (0.125)	0.478 (0.136)	0.404 (0.151)	0.316 (0.168)	0.217 (0.185)	0.111 (0.200)
	1970:1-1979:12	0.652 (0.102)	0.678 (0.092)	0.694 (0.082)	0.698 (0.074)	0.688 (0.070)	0.666 (0.073)	0.631 (0.086)	0.583 (0.107)	0.528 (0.131)	0.468 (0.154)	0.406 (0.175)	0.342 (0.192)	0.278 (0.206)
	1980:1-1989:12	0.606 (0.094)	0.660 (0.090)	0.708 (0.085)	0.746 (0.081)	0.768 (0.078)	0.772 (0.076)	0.759 (0.077)	0.747 (0.078)	0.725 (0.079)	0.692 (0.084)	0.650 (0.093)	0.601 (0.104)	0.549 (0.117)
	1990:1-1997:12	-0.066 (0.174)	0.034 (0.179)	0.130 (0.182)	0.218 (0.186)	0.298 (0.189)	0.368 (0.192)	0.430 (0.195)	0.468 (0.200)	0.499 (0.204)	0.523 (0.207)	0.542 (0.206)	0.558 (0.202)	0.573 (0.194)
ZNEU	1961:1-1997:12	0.555 (0.062)	0.556 (0.059)	0.550 (0.057)	0.538 (0.055)	0.520 (0.055)	0.496 (0.059)	0.469 (0.067)	0.437 (0.078)	0.401 (0.089)	0.361 (0.101)	0.318 (0.111)	0.271 (0.118)	0.222 (0.123)
	1961:1-1969:12	0.277 (0.170)	0.252 (0.173)	0.229 (0.171)	0.209 (0.165)	0.192 (0.161)	0.175 (0.160)	0.153 (0.166)	0.093 (0.181)	0.019 (0.195)	-0.069 (0.207)	-0.165 (0.211)	-0.269 (0.209)	-0.364 (0.199)
	1970:1-1979:12	0.697 (0.091)	0.683 (0.086)	0.657 (0.084)	0.622 (0.086)	0.580 (0.093)	0.533 (0.107)	0.483 (0.125)	0.428 (0.148)	0.372 (0.171)	0.316 (0.192)	0.259 (0.210)	0.200 (0.222)	0.139 (0.229)
	1980:1-1989:12	0.573 (0.109)	0.605 (0.102)	0.631 (0.095)	0.653 (0.090)	0.670 (0.086)	0.682 (0.084)	0.687 (0.084)	0.687 (0.087)	0.678 (0.092)	0.658 (0.099)	0.626 (0.107)	0.581 (0.115)	0.524 (0.123)
	1990:1-1997:12	0.530 (0.141)	0.611 (0.125)	0.673 (0.110)	0.714 (0.096)	0.738 (0.086)	0.749 (0.078)	0.750 (0.075)	0.736 (0.079)	0.715 (0.086)	0.691 (0.094)	0.664 (0.103)	0.635 (0.112)	0.605 (0.121)
		Sweden												
ZEU	1961:1-1997:12	0.506 (0.076)	0.542 (0.072)	0.573 (0.070)	0.597 (0.070)	0.613 (0.073)	0.618 (0.078)	0.613 (0.085)	0.597 (0.092)	0.569 (0.100)	0.531 (0.107)	0.485 (0.112)	0.432 (0.117)	0.375 (0.121)
	1961:1-1969:12	0.619 (0.115)	0.687 (0.105)	0.748 (0.091)	0.800 (0.075)	0.837 (0.059)	0.857 (0.046)	0.856 (0.041)	0.838 (0.044)	0.799 (0.063)	0.746 (0.071)	0.684 (0.071)	0.621 (0.075)	0.557 (0.078)
	1970:1-1979:12	0.565 (0.122)	0.569 (0.117)	0.565 (0.116)	0.551 (0.120)	0.528 (0.127)	0.495 (0.138)	0.453 (0.148)	0.390 (0.161)	0.315 (0.172)	0.229 (0.181)	0.137 (0.187)	0.038 (0.189)	-0.061 (0.188)
	1980:1-1989:12	0.458 (0.111)	0.500 (0.121)	0.547 (0.127)	0.601 (0.123)	0.660 (0.110)	0.720 (0.092)	0.775 (0.084)	0.814 (0.062)	0.840 (0.051)	0.849 (0.044)	0.840 (0.041)	0.819 (0.040)	0.790 (0.042)
	1990:1-1997:12	0.334 (0.158)	0.417 (0.147)	0.496 (0.136)	0.567 (0.126)	0.630 (0.118)	0.684 (0.114)	0.726 (0.113)	0.754 (0.116)	0.769 (0.119)	0.773 (0.123)	0.766 (0.126)	0.748 (0.128)	0.721 (0.128)

Table 2: Continued

		Cross-correlations with domestic output $\left(\text{corr}(x_t, y_{t+k})\right)$													
		Sweden													
Sample		$k = -6$	$k = -5$	$k = -4$	$k = -3$	$k = -2$	$k = -1$	$k = 0$	$k = 1$	$k = 2$	$k = 3$	$k = 4$	$k = 5$	$k = 6$	
ZNEU	1961:1–1997:12	0.527 (0.074)	0.533 (0.075)	0.531 (0.078)	0.523 (0.083)	0.508 (0.090)	0.487 (0.097)	0.459 (0.104)	0.423 (0.111)	0.381 (0.116)	0.333 (0.121)	0.281 (0.125)	0.225 (0.128)	0.166 (0.129)	
	1961:1–1969:12	0.483 (0.130)	0.476 (0.127)	0.466 (0.124)	0.456 (0.119)	0.446 (0.115)	0.436 (0.114)	0.425 (0.115)	0.390 (0.117)	0.350 (0.117)	0.305 (0.111)	0.258 (0.103)	0.209 (0.097)	0.166 (0.099)	
	1970:1–1979:12	0.486 (0.131)	0.460 (0.132)	0.427 (0.136)	0.386 (0.143)	0.338 (0.151)	0.284 (0.158)	0.224 (0.164)	0.148 (0.172)	0.066 (0.177)	0.066 (0.177)	-0.021 (0.180)	-0.111 (0.179)	-0.202 (0.175)	-0.290 (0.168)
	1980:1–1989:12	0.573 (0.113)	0.632 (0.104)	0.687 (0.095)	0.738 (0.086)	0.784 (0.077)	0.821 (0.069)	0.847 (0.061)	0.861 (0.055)	0.861 (0.055)	0.863 (0.051)	0.855 (0.050)	0.837 (0.052)	0.806 (0.060)	0.763 (0.071)
	1990:1–1997:12	0.776 (0.055)	0.820 (0.039)	0.845 (0.029)	0.854 (0.027)	0.851 (0.031)	0.838 (0.039)	0.819 (0.051)	0.790 (0.065)	0.757 (0.080)	0.721 (0.080)	0.683 (0.094)	0.641 (0.108)	0.641 (0.120)	0.595 (0.131)
Finland	1961:1–1997:12	0.645 (0.057)	0.675 (0.053)	0.696 (0.050)	0.705 (0.049)	0.705 (0.049)	0.694 (0.050)	0.675 (0.049)	0.647 (0.058)	0.613 (0.063)	0.574 (0.070)	0.532 (0.077)	0.488 (0.084)	0.441 (0.090)	
	1961:1–1969:12	0.269 (0.155)	0.383 (0.142)	0.468 (0.130)	0.519 (0.121)	0.534 (0.117)	0.522 (0.117)	0.492 (0.123)	0.439 (0.135)	0.391 (0.152)	0.362 (0.168)	0.360 (0.180)	0.388 (0.184)	0.439 (0.179)	
	1970:1–1979:12	0.737 (0.068)	0.741 (0.069)	0.731 (0.073)	0.710 (0.078)	0.683 (0.084)	0.652 (0.092)	0.618 (0.100)	0.576 (0.114)	0.529 (0.129)	0.473 (0.146)	0.407 (0.163)	0.330 (0.179)	0.244 (0.191)	
	1980:1–1989:12	0.397 (0.156)	0.460 (0.145)	0.514 (0.135)	0.563 (0.124)	0.606 (0.114)	0.641 (0.105)	0.668 (0.098)	0.678 (0.098)	0.677 (0.096)	0.664 (0.103)	0.643 (0.113)	0.613 (0.124)	0.577 (0.138)	
	1990:1–1997:12	0.769 (0.060)	0.800 (0.054)	0.826 (0.049)	0.844 (0.044)	0.852 (0.038)	0.847 (0.036)	0.826 (0.042)	0.783 (0.058)	0.722 (0.080)	0.645 (0.105)	0.555 (0.130)	0.455 (0.152)	0.349 (0.169)	

Notes: Standard errors computed using the HAC-delta method are shown in parentheses below each correlation coefficient.

Table 3: Distribution of Finnish and Swedish trade by partner for selected years in percent.

	Finland			Sweden		
	EU-15	Non-EU	Sweden	EU-15	Non-EU	Finland
1965	62	38	10	63	37	4
1970	64	36	16	61	39	6
1975	56	44	17	56	44	6
1980	58	42	14	59	41	7
1985	50	50	13	56	44	6
1990	60	40	14	63	37	6
1999	55	45	10	57	43	5

Source: OECD Statistical Compendium and European Commission (2000).

Table 4: Cross-correlations of the country-specific Finnish business cycle with the Swedish country-specific business cycle.

Sample	Cross-correlations with Swedish country-specific business cycle $\left(\text{corr} \left(x_t, y_{t+k} \right) \right)$												
	k = -6	k = -5	k = -4	k = -3	k = -2	k = -1	k = 0	k = 1	k = 2	k = 3	k = 4	k = 5	k = 6
1961:1-1997:12	0.027 (0.117)	0.053 (0.116)	0.093 (0.116)	0.149 (0.115)	0.221 (0.112)	0.300 (0.107)	0.371 (0.101)	0.398 (0.094)	0.408 (0.086)	0.409 (0.079)	0.403 (0.077)	0.389 (0.080)	0.365 (0.088)
1961:1-1969:12	-0.174 (0.179)	-0.275 (0.170)	-0.337 (0.153)	-0.347 (0.136)	-0.283 (0.128)	-0.164 (0.133)	-0.001 (0.141)	0.117 (0.142)	0.244 (0.139)	0.349 (0.132)	0.418 (0.129)	0.425 (0.139)	0.381 (0.156)
1970:1-1979:12	0.115 (0.172)	0.097 (0.173)	0.084 (0.177)	0.094 (0.182)	0.134 (0.182)	0.203 (0.177)	0.287 (0.169)	0.321 (0.157)	0.358 (0.139)	0.405 (0.120)	0.463 (0.106)	0.525 (0.099)	0.571 (0.098)
1980:1-1989:12	-0.207 (0.126)	-0.154 (0.127)	-0.102 (0.130)	-0.047 (0.132)	0.012 (0.133)	0.074 (0.133)	0.131 (0.135)	0.154 (0.143)	0.155 (0.155)	0.135 (0.168)	0.093 (0.182)	0.035 (0.193)	-0.042 (0.199)
1990:1-1997:12	-0.255 (0.212)	-0.077 (0.215)	0.127 (0.202)	0.336 (0.175)	0.523 (0.141)	0.656 (0.113)	0.712 (0.103)	0.691 (0.110)	0.609 (0.121)	0.491 (0.128)	0.358 (0.130)	0.228 (0.136)	0.113 (0.152)

Notes: Standard errors computed using the HAC-delta method are shown in parentheses below each correlation coefficient.

Figure 1: Finnish and Swedish bandpass filtered industrial production and the estimated international business cycles.

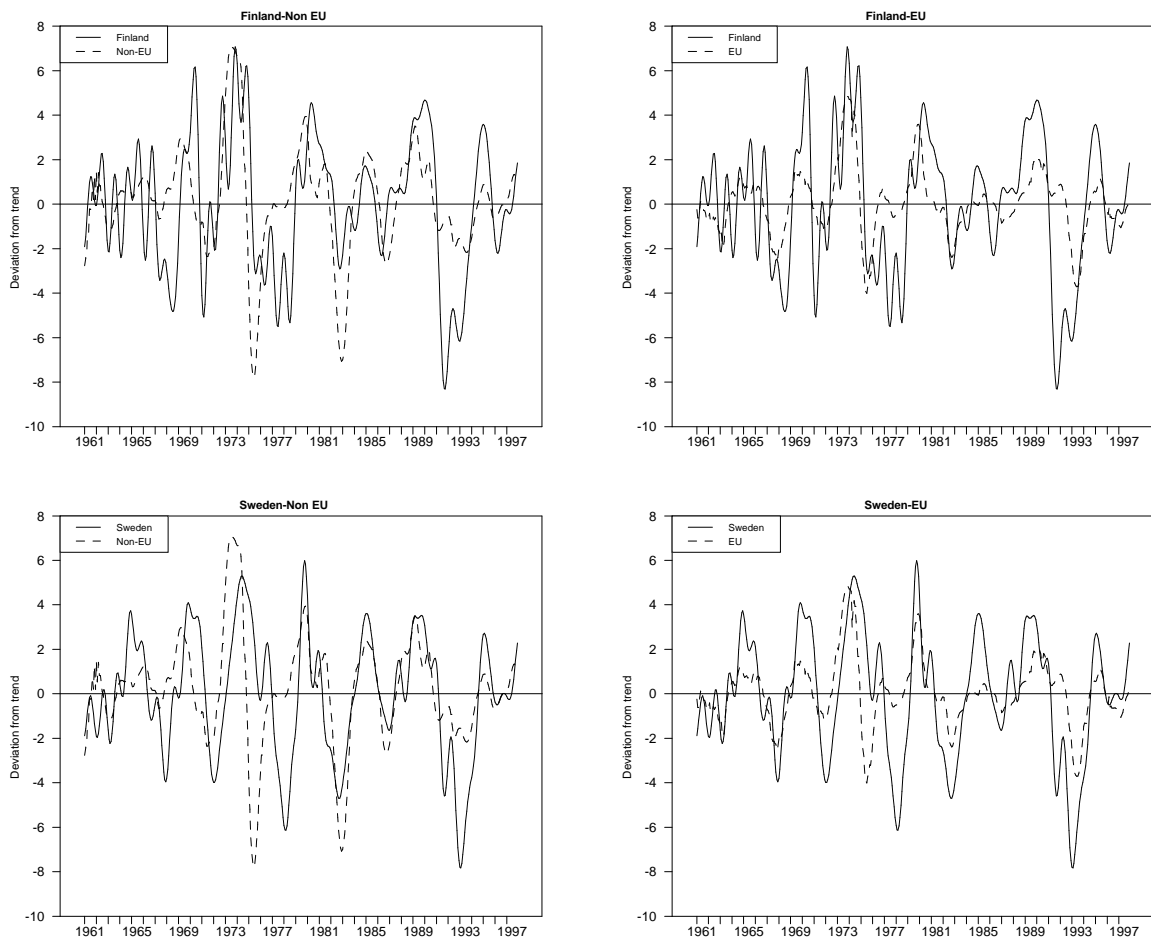
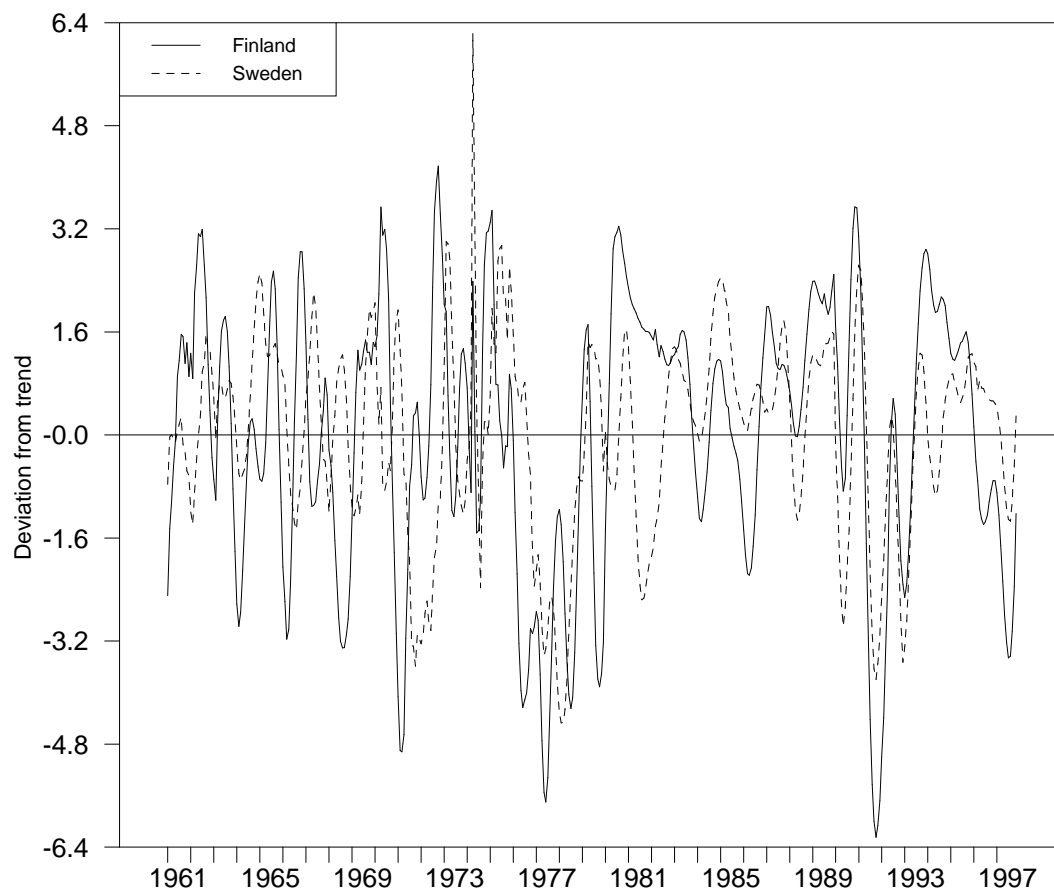


Figure 2: Finnish and Swedish country-specific business cycles.



APPENDIX A: BANDPASS FILTERED INDUSTRIAL PRODUCTION AND THE ESTIMATED INTERNATIONAL BUSINESS CYCLES.

